SOCIO-ECONOMIC STATUS AND NEUROPSYCHOLOGICAL TEST PERFORMANCE IN ZAMBIA

By

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A Dissertation submitted to the University of Zambia in partial fulfilment of the requirements for the Master of Science Degree in Clinical Neuropsychology.

UNIVERSITY OF ZAMBIA

LUSAKA

2011

DECLARATION

I hereby declare that this study report is original and is an outcome of my own effort and that the contents have not been presented elsewhere. The figures, tables, and statistics contained in the report were generated by me except for those whose origin has been acknowledged. The views and opinions expressed in this report do not in any way represent those of the University of Zambia, but my own.

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CERTIFICATE OF APPROVAL

This Dissertation of Owen Katongo Kabanda has been approved as fulfilling the requirements for the award of the Masters of Science Degree in Clinical Neuropsychology by the University of Zambia.

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Examiner	Examiner	Examiner
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ABSTRACT

Introduction

To understand the brain-behaviour relationship, systematic neuropsychological assessments are undertaken using a validated battery of tests to ascertain one's brain integrity and levels of cognitive functioning (Hestad et al., 1998; Kaplan et al., 2001). These tests are however affected by background factors such as age, education, socio-economic status, ethnicity and so on (Strauss et al., 2006). This study was undertaken with the overall aim of investigating the influence of socio-economic status (SES) on people's neuropsychological test performance on the Zambia Neuropsychological test battery.

Specifically, the objectives were to: (1) establish the level to which each of the four SES indices (education, occupation, income, and residence) predict neuropsychological test performance; (2) determine which tests in the Zambia neuropsychological test battery show the most relationship with SES; and (3) establish if there is a significant difference in mean test scores between high and low SES participants on the Zambia neuropsychological test battery.

Design

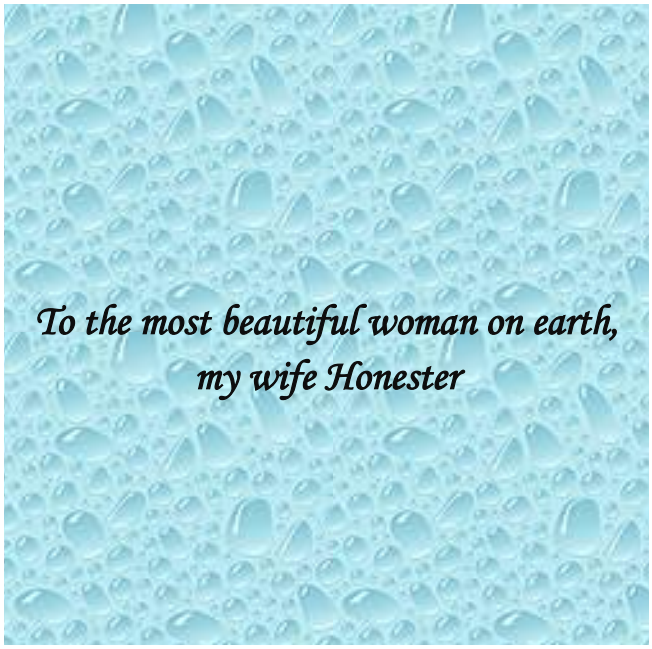
The study was a quantitative one involving 324 participants aged between 18 to 65 years with 5 and more years of education from both rural and urban places in Zambia. After screening, the participants were subjected to a series of neuropsychological tests in the Zambian neuropsychological test battery.

Results

In this study, of the four SES indices, occupation predicted 27% of neuropsychological test performance followed by education (19%). The predictive ability of income and residence were not statistically significant (p>.05). Further, SES had a strongest positive correlation with language fluency tests (r=.46) followed by information processing tests (r=.32), memory tests (r=.24), executive functioning tests (r=.23), motor test (r=.20), and visual episodic memory tests (r=.14). On the overall neuropsychological test performance, high SES participants performed better (mean score=11.11) than their low SES counterparts (mean score= 9.94).

Conclusion

In conclusion, it cannot go without emphasising that the clients' SES should be considered when interpreting test results especially on language fluency and information processing speed tests that are more influenced by SES. Further, standardised norms referenced scores for low and high SES individuals should be used to avoid overdiagnosing or underdiagnosing clients.


To the most beautiful woman on earth,
my wife Honester

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CHAPTER 1

1.0 INTRODUCTION

For a long time, there has been a quest to understand the human brain in regard to its structures, functions, and how it affects the way human beings behave. Researchers and practitioners have developed tools and techniques that allow for better understanding of the brain structures and functions through the use of advanced computer technology and brain scanning techniques (Solso et al., 2008).

To understand the brain-behaviour relationship however, there is need to undertake what is referred to as a neuropsychological assessment. This assessment taps into an individual's higher-order cognitive functioning, including aspects of speed of information processing, attention, memory, language, visiospatial ability, sensory processing, motor ability, executive functioning, learning, and delayed recall (Burke, 2007; Lezak et al., 2004). These systematic evaluations provide a basis on which to understand the level of integrity of the brain and levels of an individual's cognitive functioning (Hestad et al., 1998; Kaplan et al., 2001).

The neuropsychological assessments involve the use of a battery of tests that have been validated (Hestad et al., 1998). As shown in Table 1.1, Zambia's neuropsychological test battery consists of tests of speed of information processing, attention/working memory, abstraction/executive functioning, learning and delayed recall, language, and motor speed (HIV Neurobehavioral Research Centre [HNRC], 2009).

Table 1.1: Zambia Neuropsychological Test Battery

Speed of Information Processing	***Attention/Working Memory***
• WAIS-III Digit Symbol	• Paced Auditory Serial Addition Test
• WAIS-III Symbol Search	• WMS-III Spatial Span
• Trail Making Test Part A	***Language***
Abstraction/Executive Functioning	• Word Sound Fluency
• Wisconsin Card Sorting Test (64-item version)	• Category Fluency (Animals, Action)
• Colour Trails	***Motor***
• Stroop Colour Word Test	• Grooved Pegboard (Dominant and Nondominant)
• Category Tests – computer version	***Screening for Effort***
Learning and Delayed Recall (2 domains)	• Hiscock Memory Test
• Hopkins Verbal Learning Test, Revised-II	**Medical Screening Interview**
• Brief Visuospatial Memory Test – Revised	**Behavioural Notes Summary**
	Academic Skills Questionnaire

Literature shows that just like any other neuropsychological tests, the tests in the Zambia neuropsychological battery are also not immune to the effects of background factors that have the potential to influence an individual's performance on these tests. According to Strauss et al. (2006), these factors include age, education, socio-economic status, language, and gender among others.

To this effect therefore, this study was undertaken with special focus on investigating the influence socio-economic status(SES) has on an individual's performance on the neuropsychological tests. As used in this paper, SES refers to the relative position of a person in a social hierarchy (Green, 1970).

In gathering information on an individual's SES, several approaches have been used including looking at the person's education, income, occupation, residence, and prestige among other variables. Researchers therefore use whatever variable may be convenient. Some researchers have used a single variable like education as a representation of an individual's socio-economic status. Education for instance serves as an antecedent of occupational status which in turn influences an individual's income to a great degree. That is, occupations convert a person's main resource (education) into a person's main reward (income) as follows: Education→Occupation→Income (Ganzeboom et al., 1992; Treiman, 1977).

In the Zambian context in which this study was carried out however, it was envisaged that the sole use of education or income to represent SES would be less encompassing. It is an open secret that in Zambia some people have not acquired much education but have ventured into businesses that give them much money and paradoxically, others have attained higher levels of education with university degrees but these have not translated into high incomes because of high unemployment rates which are as high as 50% (Index Mundi, 2009).

In this study, a Four Factor Index was used taking into consideration Green (1970)'s cautionary advice that any index that purports to measure SES should be comprehensive enough to optimize the prediction of an individual's behaviour. The Four Factor Index that was used in this study comprised Education, Occupation, Income, and Residence.

The logic of this index was that it was more comprehensive when measuring an individual's SES as compared to any one variable when taken separately. Indeed, SES can be measured as a combination of education, income, and occupation (American Psychological Association, 2010). The index used in this study was also premised on assumptions that a differentiated, unequal structure exists in a society, and that combined variables may allow researchers to quickly, reliably, and meaningfully estimate the status position an individual occupies in the society (Hodge & Treman, 1968).

1.1 BACKGROUND AND CONTEXT OF THE PROJECT

This study was carried out in Zambia which is a large sub-Saharan African landlocked country with eight bordering neighbours. The Central Statistics Office reports that by 2011, the preliminary results of the 2010 census of population and housing indicated that the population of Zambia had increased from 9,885,771 in 2000 to 13,046,508 (State House, 2011).

According to Zambia's Central Statistics Office (2009), the country is considerably poor with 51 percent of its population being extremely poor, 14 percent moderately poor and only 36 percent considered as non-poor. With regards to population distribution and residence, many people are in the rural areas whilst the urban population stands at 35 percent of total population (Central Intelligence Agency, 2009).

The country has recorded high unemployment rate at 50 percent of the total population (Central Intelligence Agency, 2009). With high unemployment, low paying jobs and low SES therefore, the national statistics show that approximately 65 percent of the population may well have incomes that are below the basic needs basket which shows the basic expenses for a family of six in a month (Central Statistics Office, 2009). The basic needs basket for Lusaka in the month of September 2009 stood at **K2, 260,680** meaning that when one includes other essential expenses this figure may become very high (The Jesuit Centre for Theological Reflection [JCTR], 2009).

Some of the JCTR (2009)'s comparative figures in table 1.2 below illustrates the comparative amounts of money paid to those who are working in various occupations which posses challenges for them to meet their basic needs.

Table 1.2: 2009 September Take Home Pay for Workers

	Teacher	Nurse	Guard with Security Firm	Secretary in Civil Service	Average Monthly Income in Urban Low-Cost Area	Piece worker on a Farm
Pay Slip	K1,145,300 to K1,631,600	K1,121000 to K2,624,000	K250,000 to K750,000	K635,000 to K1,320,127	K645,326	K5,000 to K15,000 per day

There are a lot of economic activities that Zambians are involved in with a variation in the levels of skill set required. These include professional, semi-skilled, and unskilled labour. These occupations may as well be grouped as 85 percent agriculture, 6 percent industry, and 9 percent services (Central Intelligence Agency, 2009).

The country's literacy levels with regards to people who are aged 15 and over who can read and write English is as high as 80.6% (Central Intelligence Agency, 2009). The paradox however is that even with such high levels of literacy and educational achievements, high unemployment rates and underemployment still pose a great challenge to many people's socio-economic status.

1.2 STATEMENT OF THE PROBLEM

Normative data for neuropsychological tests allow for the individual being tested to be compared against others of the same characteristics (Attix et al., 2008; Kaplan et al., 2001). These standardised norms however, are nonexistent in many developing countries including Zambia.

The lack of appropriate norms for the country has led to the use of borrowed norms and tests which when used on the local population end up not reflecting the true test performance of individuals in these countries (Mulenga et al., 2001). A study was conducted involving 45 literate schoolchildren aged 9 and 11 years from urban Zambia. The core and expanded tests on the neurodevelopmental psychological assessment for children (NEPSY) were administered to the children. Their performance was scored according to age-equivalent norms for children in the United States of America. In their analysis, they found that when they compared the Zambian children's results against the United State's normative average, both Zambian age groups in the study performed poorer in the domains of language, attention and executive functions. It was concluded that when interpreting test scores, there is need to take into account cultural, language, and personal demographic information (Mulenga et al., 2001).

Another example of this challenge is the study done in South Africa. In their study, Skuy et al. (2001) investigated the performance of urban African high school students on a neuropsychological test battery. A group of 100 Soweto students in Grades 8–12, and a second group of 152 sixth grade Soweto students aged 13–15 years, scored significantly lower on most of the measures than their American counterparts. In their conclusion highlighted the need for using norms and approaches which are appropriate to a given population when interpreting and addressing neuropsychological test performance.

Worth pointing out is that practitioners need to have appropriate scores for low and high SES patients for reference when interpreting test results in order to avoid overdiagnosing or underdiagnosing clients. This study will contribute to having normative data corrected for background characteristic like SES.

1.3 STUDY JUSTIFICATION

SES influences almost all spheres of a person's life (American Psychology Association, 2011). It can therefore not be ignored in any study in the behavioural and social sciences. Families of low SES for instance often lack the financial, social, and educational support that characterizes high SES families. Individuals from low SES families more often than not find themselves exposed to a limited number of resources as compared to their high SES counterparts (Crnic et al., 1994; National Central Regional Laboratory, 2009; Ramey et al., 1994).

When it comes to factors influencing test performance, many of the studies have focused on education, age, gender, and ethnicity and not SES. What has been shown in the earlier studies is that SES is an important characteristic that is associated with cognitive functioning. There is therefore need to fully understand how SES relates to test performance. As emphasised by Fletcher-Janzen and Daniel (2006) regarding SES and its influence on test scores, high-SES examinees may tend to have test scores that are higher than their low SES counterparts. The variations in test scores of people of low and high SES therefore calls for examiners to make culturally competent choices when assessing individuals of different SES backgrounds.

While much of the literature shows the effect that SES has on the general wellbeing of an individual, there still remains a gap in knowledge with regard to how SES may directly influence test performance especially in a developing country like Zambia. The earlier studies have mainly just shown that SES is an important characteristic that is associated with cognitive functioning though there still remains the need to fully explore the ways in which this association operates (Schwartz et al., 2004; Strauss., 2006). Undertaking this study in Zambia would help in giving better understanding of how SES relates to test performance.

More specifically, practitioners will have a reference so to compare the clients' score to others of a similar SES background thereby enhancing the understanding of ability versus environment.

1.4 OBJECTIVES

1.4.1 GENERAL OBJECTIVE

The overall aim of this study was to investigate how socio-economic status relates to performance on the Zambian neuropsychological test battery.

1.4.2 SPECIFIC OBJECTIVES

The specific objectives were:

1. To establish the level to which each of the socio-economic status indices (education, occupation, income, and residence) predict neuropsychological test performance.
2. To determine which tests in the Zambia neuropsychological test battery show the most relationship with socio-economic status.
3. To establish if there is a significant difference in mean test scores between the low and high socio-economic status participants.

1.5 HYPOTHESES

The hypotheses for this study were as follows:

1. Of the four socio-economic status indices (education, occupation, income, and residence), education will be a better predictor of neuropsychological test performance than the other indices.
2. Tests of speed of information processing, and language fluency will positively correlate more with socio-economic status than the other tests in the Zambian neuropsychological test battery.
3. Participants of high socio-economic status will perform better than those of low socio-economic status on the neuropsychological tests.

CHAPTER 2

2.0 LITERATURE REVIEW

SES has been seen to affect almost all spheres of people's lives in one way or the other including health, education, test performance and the general quality of life. Indeed, the American Psychological Association (2010), has stressed that SES is relevant to all realms of behavioral and social science, including research, clinical practice, education, and advocacy.

SES' Relation to General Quality of Life

Kenneth et al. (1994), set out to examine processes in socialization that might account for an observed relation between early SES and later child behaviour problems. A representative sample of 585 children was followed from preschool to grade 3. The results of this study showed that there was a significant positive correlation between SES and cognitive stimulation.

With regards to physical activity and health for instance, Eva et al. (2009) in their study on 2488 randomly sampled Australian adults found that there were higher levels of positive cognitions towards physical activity and walking for leisure among those of high SES as compared to those of lower SES.

Even for people's emotional wellbeing, it has been found that SES is very important. When individuals of high SES lose their status and plunge into low SES for instance, they have been found to be at high risk of major depression (Nicklett et al., 2009). SES therefore serves as a good predictor of health (Hazuda et al., 1988; Robert, 1998).

There are indeed so many ways in which SES affects an individual's life in general which are beyond the scope of this study.

SES' Relation to Test Performance

SES affects an individual's performance on the neuropsychological tests in mainly two ways, that is, indirectly and directly (Strauss et al, 2006).

An indirect way is when SES affects another variable like education which in turn has an effect on test performance (Strauss et al. 2006). While a more direct way in which SES affects test performance is when the variance in test scores can directly be attributed to SES.

Sewell and Shah (1967) worked with a randomly selected cohort of Wisconsin high school seniors. They examined the participants' SES and intelligence at successive stages in higher education. It was found that SES had a greater effect on females' college plans, college attendance, and college graduation than intelligence. SES was found to continue influencing college graduation even after it had played its part in influencing who would attend college.

Further, with regard to influence of SES on education which in turn affects test performance, people of high SES may be more likely to go higher in education because they can afford the school expenses. They are also more likely to go to schools that offer quality education as compared to their counterparts of low SES (National Central Regional Laboratory [NCRL], 2009; Sewell et al., 1967). One of the tests, the Paced Auditory Serial Audition Test (PASAT) which is an effective measurement of cognitive functioning including auditory information processing speed and flexibility, as well as calculation ability, performance on the test has been found to positively correlate with an individual's education (Stuss et al., 1987; 1989).

In a more direct way, on some tests like the Mini Mental Status Examination (MMSE) that tests the individual's orientation, attention, calculation, recall, language, and motor skills, it has been found that education attainment and SES are highly correlated (Marcopulos et al., 1997). The MMSE scores tend to be low for individuals of low SES (Espino et al., 2001; 2004).

The Zambian test battery has also tests for *speed of information processing* like the subtests of the Wechsler adult intelligence scale (WAIS -III). WAIS-III is an individually administered measure of psychomotor speed, concentration, and graphomotor abilities intended for adults aged 16 to 89. Research shows that, "higher performance on this test is highly associated with high income" (Strauss et al., 2006:291).

SES has also been seen to relate to people's performance on the tests through the level of acculturation (exposure, incorporation and modification of an individual's cultures, values and belief systems to that of another culture). In taking a neuropsychological test therefore, participants who are less acculturated may encounter difficulties with some tasks because of limited fluency, lack of understanding, and appreciation of the type of timed sequencing tasks that are alien to their traditional cultures (Arnold et al., 1994; Manly et al., 1998). This acculturation in Zambia may be seen in the use of English language and such things as computers which originally are not part of the traditional cultures.

The tests in the Zambian battery are administered in the English language. Some people of low SES may not have gone far in their education and are most likely to stay in communities and homes where they do not frequently use the English language which may pose a great challenge for them when answering the questions as noted in Siachitema et al. (1991).

In a study by Siachitema et al. (1991), involving 352 participants on the use of English in urban Zambia, three socio-economically differentiated neighbourhoods in Lusaka were used. The three neighbourhoods Kalingalinga (a shantytown), Libala (medium cost housing), and Kalundu (high cost housing) were chosen as they were seen as being considerably representative of the social structure of Lusaka, where an individual's SES is mainly evaluated on the basis of their formal education and their degree of proficiency in the English language.

In this study, it was found that there was more use of the English language in the homes of those with higher SES living in high cost residence, and had 12 or more (college/university) years of education as compared to those of low SES who tended to use their mother tongue more in their homes and neighbourhoods.

It has also been found that lack of English language fluency may be a source of stress and negatively affect performance among people who use English as a second language (Lee, 1996; Lin et al., 1997; Nwadiora et al., 1996).

Lastly, in the Baltimore Memory Study, there were 1,140 participants aged 50-70 years who were subjected to a 90 minute test battery that included among others the Rey Complex Figure copy, Pegboard, Stroop Test (A, B and C forms), Trail-making test A and B, Finger tapping, Letter fluency, and Category fluency. After further analysis of the participants' test performance on the basis of their SES, it was found that there was an average difference of 25.8% in neurobehavioral test performance between those of high SES and those of low SES (Schwartz et al., 2004).

While much of the literature shows the effect that SES has on the general wellbeing of an individual, there still remains a gap in knowledge with regard to how SES may directly influence test performance especially in a developing country like Zambia. The earlier studies have mainly just shown that SES is an important characteristic that is associated with cognitive functioning though there still remains the need to fully explore the ways in which this association operates (Schwartz et al., 2004; Strauss., 2006).

CHAPTER 3

3.0 METHODOLOGY

3.1 STUDY DESIGN

This was quantitative study.

3.2 STUDY SAMPLE

As part of the larger study for collecting norms for the Zambia Neuropsychological Test Battery, there were 324 study participants who were selected on the basis of stratified random sampling method. These were between 18 years to 65 years of age with academic education ranging from 5 years of education to more than 13 years. Of the total sample, 157 of these were females while 167 were males.

3.3 STUDY SITES

This study was conducted in both urban and rural areas of Zambia. Sites in urban areas included the University of Zambia Clinic, Mtendere Clinic, Chelstone Clinic and Chilenje Clinic. Rural areas included health posts that fall under Chongwe Health Centre, Chibombo Clinic and Kafue Clinic. The participants from these rural areas where coming to our study sites from the deep rural places hence where seen to be appropriately and fairly representative of the Zambian rural dwellers. Of the 324 participants, 152 of them were from the rural areas and 172 of the participants were from urban areas of Zambia.

3.4 ETHICAL CONSIDERATIONS

Considering the sensitivity of this research, the investigator submitted the protocol for consideration, comments, guidance, and approval to the University of Zambia Biomedical Ethics Committee. Once approved, the Zambian Ministry of Health was then contacted for permission to conduct the research in the health centres (see **Appendix A_1**). The health centres were used as the participants needed to be HIV negative. The study participants were recruited through the ongoing Voluntary Counselling and Testing (VCT) programs by the Ministry of Health.

The VCT staffs at the selected health centres were informed of the study and the procedures. When a person came for VCT and they were tested HIV negative, they were informed of this study by the VCT staff at the clinics and requested to join voluntarily.

When the possible research participants came to the investigators, they were adequately informed of the aims, methods, institutional affiliations of the researcher, the anticipated benefits and potential risks of the study and the discomfort it entailed. They were also informed of the right to abstain from participation in the study or to withdraw consent to participate at any time without reprisal. In total there were 9 well trained investigators who assisted in the administration and scoring of the neuropsychological instruments that were used in this study. They each collected data from 36 study participants only to ensure thoroughness, accuracy, and high quality data.

After ensuring that the individual had understood the information, the investigator then proceeded to obtaining the would be participant's freely-given informed consent by having them sign the Informed Consent Form (see **Appendix A_2**). A copy was also given to the participants for their use. Once the individual signed the Informed Consent Form, a series of screening and evaluations took place to ensure that the possible study participant met all the requirements. The screening and evaluations were as shown in the paragraphs that follow.

3.5 INCUSION & EXCLUSION CRITERIA

To be part of the study, the following inclusion and exclusion criteria was applied:

Inclusion Criteria

The individual had to:

- Be HIV negative this was confirmed by means of a rapid HIV-1 antibody test.
- Have 5 years of education to 13 years and above.
- The individual had to be aged between 18 years to 65 years.
- Understand English as per Writing and Read Ability Test results.
- Neurologically normal (i.e. having no central nervous system disorders) as per Neurobehavioral Medical Screen results.
- Be a non-drug abuser as assessed by the Substance Use and Chinese Substance Use History Questionnaire.
- Have no history of Psychiatric illness as per Composite International Diagnostic International Interview and the Beck Depressive Inventory results.

Exclusion Criteria

Individuals were excluded if found to:

- Be HIV positive.
- Have a psychiatric disorder such as depression, schizophrenia, epilepsy, etc.
- Be abusing drugs.
- Have less than 5 years of education.
- Be below the age of 18 years or above 65 years.
- Be unable to read, write, and comprehend English.

3.6 PROCEDURE

3.6.1 SCREENING PROCEDURE

Upon consent, the research participant underwent the following:

Ability to speak and understand English: Since the neuropsychological assessments were done in English, there was an assessment of the participants' ability to use English by use of the Writing and Read Ability Test (WRAT) to ensure only individuals who can understand English participate.

Psychiatric and Drug Abuse Assessment: The psychiatric and drug abuse assessment included the use of the Composite International Diagnostic Interview (CIDI) which provides results in terms of presence or absence of DSM-IV/ICD-9 diagnosis of present or past depression and substance disorders. The severity of depressive symptomatology was collected using the Beck Depression Inventory (BDI). The BDI is a 21-item self-report scale with each item having 4 response options of graded severity. The inventory focuses on an individual's life for two weeks prior to the assessment.

Everyday Functioning Assessment: This included the use of the Activities of Daily Living Scale (ADL) questionnaire, and the Patient's Assessment of Own Functioning Inventory (PAOFI). These measured daily functioning level, one's difficulties with memory, language and communication, use of hands, sensory-perception, higher level cognitive and intellectual functions, work, and recreation.

3.6.2 MEASURES

3.6.2.1 SOCIO-ECONOMIC STATUS MEASURE

SES FOUR FACTOR INDEX

Development & Background

The measure for SES was developed for this study. A questionnaire (see **Appendix B**) was developed to collect information on the participant's socio-economic status (SES). The instrument measured the participants' SES based on the Four Factor Index of education, occupation, income, and residence.

Administration & Scoring Procedure

The investigator administered a questionnaire to the participants. For scoring purposes, the scales in table 3.1 were used to rate the participants SES level.

Table 3.1: Indexing of SES

Low Education	Five to 12 years of schooling.
High Education	More than 12 years of schooling.
Low occupation	A person's means of livelihood that involves more of manual work and requires less professional credentials. That is, having an unskilled job (e.g. maid, farm labourer) or semi-skilled job (e.g. plumber, bus driver).
High occupation	A person's means of livelihood that involves less of manual work and requires more professional credentials. That is having a skilled job (e.g. accountant, physician) or specialist job (e.g. consultant, analyst).

Low income	Earning K12 million or less per annum (or K1 million or less per month).
High income	Earning more than K12 million per annum (or more than K1 million per month).
Low cost residence	A neighbourhood of low cost housing (e. g a village for rural participants or a shantytown of high density nature for urban participants).
High cost residence	A neighbourhood of high cost housing (e. g places near the boma/town for rural participants or a low density area for urban participants.
Low SES	Having three or more of the following: less than 12 years of education, an unskilled job, earning less than K12 million per annum, and staying in a low cost area.
High SES	Having three or more of the following: more than 12 years of education, a skilled job, earning more than K12 million per annum, and staying in a high cost area
Socio-economic Status (SES)	A sum total of an individual's rating on the education, occupation, income, and residence indices.

3.6.2.2 NEUROCOGNITIVE MEASURES

The neuropsychological tests were administered and scored by the 9 investigators who had been fully trained in test administration and scoring in accordance with the procedures outlined in the Zambia neuropsychological tests manual. The participants' performance was then scored according to the approved HIV Neurobehavioral Research Center (2009) guidelines.

Given in **Appendix C** are all the tests in the Zambia neuropsychological test battery that were used in this study. The full details regarding the development, reliability, validity, as well as the administration and scoring procedures for these neuropsychological tests used in this study are as given in the paragraphs that follow.

Hiscock Digit Memory Test:

Development & Background

This test was designed to measure visual memory and deliberate responding or malingering. It was developed by Merill Hiscock and Cheyl Hiscock from the University of Saskatchewan in 1989. It was named after its developers. Clinically it is used to detect factious sensory or perceptual impairment and also applied to cases of claimed memory loss. Further, it is used to identify individuals thought to be purposefully feigning or faking memory impairment (Prigatano et al., 1993).

There are three versions of the Hiscock Digit Memory Test also called the forced choice test. The 72-item, 36-item and 18-item Hiscock Digit Memory Test. The 18-item HDMT is the one that is included in the Zambian neurobehavioral battery. The 18-item HDMT is usually administered in order to reduce the time demands of the Neuropsychological evaluation which is estimated to take two and half hours.

Hiscock & Hiscock (1989), recommends that, “the Hiscock Digit Memory Test is better suited for use with a broad spectrum of patients undergoing neuropsychological assessment” (Hiscock & Hiscock,1989:968).

Reliability and Validity

A study to substantiate the validity and reliability of the HDMT was carried out by Hiscock and Hiscock (1989). They administered the HDMT, Weschler adult Scale, Trails A and B, Wisconcin Card Sorting Test and other tests to a 45 year old male patient who claimed to have had a memory loss after a head injury and was referred by the provincial Worker’s Compensation Board in Canada. Two control subjects: a severely demented 53 year old woman with dementia of the Alzheimer’s type and a normal 5 year old girl were recruited.

On test administration, it was found that the scores of the patient progressively declined across the second and the third blocks leading to an overall score of 21 out of 72 (29%) which was significantly below the chance(50%) level. The severely demented 53 year old woman scored at the 51% chance level (not significantly different from chance) and the normal 5 year old girl score was 82% which is significantly above chance.

Prigatano et al. (1993), undertook a study on 37 subjects (27 with brain dysfunction and 10 normal controls). It was hypothesized that malingerers would be identified on the digit memory test (DMT). The mean level of performance for the patients with brain dysfunction and the normal controls was between 94% to 100% correct on the HDMT. For the suspected malingerers, the level of performance was below the 50% correct which is the cutoff point. Indicating that the digit memory test was both valid and reliable for detecting malingering.

These and other findings show that Hiscock Digit Memory Test(HDMT) is a reliable and valid neuropsychological tool (Hiscock et al., 1989; Prigatano et al., 1993).

Administration & Scoring Procedures

Participants were asked to remember a successive series of 5-digit numbers for 5 seconds each, which were presented one at a time on 7.6 X 12.7cm note cards attached to an easel. For each stimulus card, there was a response card containing two 5-digit numbers printed side-by-side. One of the numbers (the target) matched that which was shown on the stimulus card and the other number (foil) differed from the target in at least two digits, including either the first or the last digit.

There was a 5 second delay between the initial presentation and response during which there was no distractions or intervening cognitive tasks.

After the delay, participants were shown another note card containing two, 5-digit numbers from which they were to identify the original target number. The delay time was lengthened by 5 seconds after every block of six trials. With every increase in time delay, participants were informed that the administrator was interested in determining whether they were “still able to remember the numbers after longer periods of time.”

Participants were provided with feedback regarding the accuracy of each response by the administrator saying ‘right’, ‘correct, ‘good’ or some similar positive remark. The administrator did not respond at all after an incorrect response.

Participants were scored and classified as having passed the HDMT on the basis of performance at or above the established cutoff of 90% correct (see also Ellwanger et al., 1999; Guilmette et al., 1994).

Hopkins Verbal Learning Test-Revised:

Development & Background

The Hopkins Verbal Learning Test-Revised (HVLT-R) is a test of learning ability and immediate recall on verbal information across multiple trials. It also measures an individual's capacity to retain, reproduce, and recognise information after delay (Strauss et al., 2006).

The test was developed by Brandt and Benedict (2001) and it is methodologically similar to the Brief Visuospatial Test Revised (BVMT-R). The test was modeled after other word list learning tests such as the California Verbal Learning Test (CVLT) and the Rey Auditory Verbal Test (RAVLT). Some changes have been made to some words to make the test more adaptive to the Zambian situation. Some original items for instance emerald, sapphire, jade and pearl, have been replaced with copper, iron, lead, and zinc respectively.

Reliability & Validity

The original English language HVLT-R normative sample consisted of 1,179 adults (75% women), ranging in age from 15-92 years (M=59.0, S.D = 18.6), and education between 2 and 20 years (M = 13.4 years, S.D = 2.9). Participants were reportedly free from neurologic or psychiatric disorders. In this study, it was found that age had the largest effect accounting for 19% of the variance in test performance with education and gender having no significant effect.

Despite the broad education range, the high mean education level for the normative group suggest that higher levels of education were also overrepresented in the normative sample for HVLT-R. According to Shapiro et al. (1999), the HVLT-R also correlated strongly with other tests of verbal memory and relatively weakly with a test of general intelligence leading to conclusions that the HVLT-R is a valid test of verbal learning and memory. Woods et al. (2005), further supports the reliability, convergent, construct, predictive and discriminant validity of the learning and recall measures on the HVLT.

Administration & Scoring Procedures

Administration of the test was such that a list of 12 words (four words from each of the three semantic categories) was presented to the participant over three trials and after that they were required to say back the items on the list in any order.

The delayed trial was administered 20 minutes later in which the participants were requested to recall as many words as they could remember from the list read to them earlier.

Finally, the test administrator read out a list of 24 words which were items that were presented originally in the same semantic class as well as 'new' unrelated words. This was the recognition task and the participants were required to answer 'yes' or 'no' depending on whether or not they believed the word read out to them was in the original list of words (see also Strauss et al., 2006:760).

When scoring, minor errors in pronunciation or pluralization such as lions for lion were corrected and counted as correct. The maximum total for the HVLT-R was taken to represent the participant's measures of verbal learning and memory.

Brief Visuospatial Memory Test- Revised (BVMT-R):

Development and Background

This test provides a measure of immediate recall, learning rate, as well as delayed recall and recognition for visuospatial information. It is basically a figural learning test developed by Benedict in 1997. “The Brief Visuospatial memory Test-Revised (BVMT-R) measures visual learning and memory using a multiple-trial list learning paradigm” (Strauss et al., 2006:701).

Reliability & Validity

According to Cherner et al. (2009), the existing BVMT-R was standardized with 588 healthy English-speaking adults ranging in age from 18 to 79 years (M=38.6 S.D = 18.0), with a mean education of 13.4 years (S.D = 1.8). The sample was 64.5% female and predominantly Caucasian (82%), with small portions of African Americans (14.5%) and other ethnic groups (3.6%). Hierarchical Polynomial regression analyses were used to determine the effects of age, gender, and education on test performance.

It was concluded that education and gender did not influence test results and as such, the standard T-score generated for the BVMT-R correct only for age. Although the education range was not described, the high mean education value for the normative sample suggest that the range was limited at the low end. As such the existing norms may over estimate impairment among those with low levels of education.

To this effect, users of the BVMT-R should be cautious of some limitations of scoring and normative data. It has been noted that the combination of accuracy and spatial location score requires further research in order to ascertain whether separating these two dimensions would improve diagnostic accuracy. Literature seems to suggest that IQ is moderately related to most of BVMT-R measures thus poor performance must be interpreted with considerable caution in population with considerable below – average I.Q (Strauss et al., 2006).

Administration & Scoring Procedures

Participants were presented with an 8 1/2” by 11" card containing six simple designs in a 2" by 3" matrix. The display were presented for 10 seconds, after which it was taken away and the participant asked to reproduce as many of the designs as possible in their correct location on a blank sheet of paper.

After two more trials and a 25-minute delay, participants were once again asked to reproduce the matrix.

This was followed by a recognition trial in which participants were shown 12 designs, one at a time, and asked if the design appeared in the original matrix. The recognition trial consisted of the six original designs and six foils.

A copy trial was administered in order to rule out poor performance due to graphomotor or visuospatial impairment. In the copy trial, participants were given the display along with a blank sheet of paper and asked to copy the designs. There was no time limit for recognition trial or copy trial, and when drawing figures during recall.

Scoring of the BVMT-R was two pronged. In terms of accuracy of the design as well as location on the sheet of paper. A point was given to each of the two dimensions captured correctly. That is, a point was given if the design was correctly reproduced with regard to accuracy but not correctly placed or if the location was correct although not accurately produced was still recognizable as the target design. Designs that neither met the accuracy nor location specifications gained a zero point (see also Strauss et al., 2006:702).

WAIS III – Digit Symbol & WAIS III - Symbol Search:

Development & Background

One of the commonest measures used in many neuropsychological batteries is the Weschler Adult Intelligence Scale-III (Strauss et al., 2006). The digit symbol and symbol search tests are tests that make up the processing speed index of the WAIS-III. “WAIS-III is a revision of WAIS-R”. Weschler, (1991) postulates that measures such as letter number sequencing, *symbol search* were developed to assess working memory and processing speed. The WAIS-III therefore measures verbal comprehension, perceptual organisation, working memory, and processing speed (Strauss et al., 2006).

Reliability & Validity

Studies on the validity and reliability of these two tests have usually been incorporated in the WAIS-III as a whole measure, however emphasis has been made on the processing speed index. In their study to confirm the four description model of the WAIS-III, Gorsuch et al. (2000) concluded that, the replication of the four – factor structure (verbal comprehension, processing speed, working memory and perceptual organisation) demonstrate the psychometric integrity of the WAIS-III and attest to its portability across cultural boundaries.

Not only have studies across cultures confirmed the reliability and validity of the WAIS-III, but the validity has also been confirmed in measuring cognitive decline in old age (Clay et al., 2009). It has been argued that, “those subsets that measure speed of processing show the greatest difference with increasing age” (Strauss et al., 2006:.289).

Another study by Paul and Kreiner (2000), confirmed the reliability of the WAIS-III across cultures and across both the clinical and standardization sample. They specifically made mention of the 11 subsets used and among those were the digit symbol and symbol search tests. They concluded that “none of the reliability estimates differed significantly from those reported for in the WAIS-III. Similar Symbol search and the digit symbol have interesting clinical findings and significance. The processing speed index (PSI) is the most affected in many forms of brain insult (Strauss et al., 2006:300). Therefore with regard to criterion validity, PSI is the most sensitive. This weakness on PSI has been shown to appear more with an increase in the severity of the insult, in particular Digit symbol (Strauss et al., 2006:300). “Symbol search also has demonstrated meaningful relationships with measures of severe traumatic brain injury (TBI) such as length of coma or presence of intracranial lesions” (Donders et al., 2001).

Administration & Scoring Procedures

On the WAIS III Digit Symbol, the participant were required to match symbols to numbers as quickly as possible, using a visual reference.

On the WAIS III Symbol Search, the participants were asked to scan two groups of symbols visually and determine if either of two target symbols matched any of five symbols appearing to the right of the target symbols. The participant then attempted to complete as many items as possible within a 120-second time limit.

The examinee’s score was determined by the number of symbols correctly scanned within the 120 second time limit.

Grooved Pegboard:

Administration & Scoring Procedures

This is a test of fine motor coordination and speed.

In this test, participants were required to place 25 small metal pegs into holes on a 3" x 3" metal board. All pegs were alike and had a ridge on one side, which corresponded to a notch in each hole on the board. First the dominant hand was tested, and participants were asked to place the pegs in the holes as fast as they could. This was then repeated with the nondominant hand.

The participant's performance on this test was the total time they took to fill the pegs in the holes. The time was recorded for each hand was recorded (both dominant and non-dominant hand).

Trail Making Tests, Part A:

Administration & Scoring Procedures

Trail Making Test A measures psychomotor speed, attention and cognitive sequencing. The Test consists of 25 numbered circles distributed over a sheet of paper.

The participant's task was to draw lines to connect the numbers in ascending order. The participants were instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. If the participant made an error, it was pointed out immediately and they were allowed to correct it. Errors affected the participant's score only in that the correction of errors is included in the completion time for the task.

The participant's test performance was recorded as the total amount of time it took for them to complete the task. It was unnecessary to continue the test if the patient had not completed both parts after five minutes had elapsed.

Color Trail Test (CTT):

Development & Background

The Color Trails Test (CTT) has been described as a culture-fair test of visual attention, graphomotor sequencing, and effortful executive processing abilities relative to the Trail Making Test (TMT). CTT measures attention, sequencing, mental flexibility, visual search and motor function. The adult version is for individuals aged 18 to 89 years and that for children (CCTT) is for ages 8 to 16 years. It is important to note at this point that these versions do not include age 17. The CTT is designed to minimize the influence of language so that it can be used in cross-cultural settings. Part 1 is similar to the trail making test (TMT) part A except that all old-numbered circles are pink and all old-numbered circles, yellow. Part 2 is similar to TMT part B - it shows all numbers from 1 to 25, alternating between pink and yellow circles and disregarding the numbers in the circles of the alternate colour, (Strauss et al., 2006).

Reliability & Validity

“Normative data for the CTT are based on the performance of 1528 health volunteers, including subsamples of 182 African Americans and 292 Hispanic Americans between the age of 18 years and 89 years, 11 months. These norms are presented separately for six education levels” (Strauss et al., 2006:555). A sample of 678 children in Los Angeles provided the normative data for ages 8 to 16.

The Color Trails Test (CTT) was developed as a culturally fair analogue of the Trail Making Test (TMT). In one study to examine the equivalence of these two tests, 180 Chinese people in Hong Kong volunteered. They were classified into four groups according to their age and level of education. Their performance on these two tests was compared. The findings suggested that age and level of education indeed played significant roles in their performance on these two tests.

Strong correlations (r=0.72) were only observed between scores on Part B of the TMT and Part 2 of the CTT when the participants were older and had higher levels of education (Lee et al., 2000). This suggests that the equivalent construct of the TMT and CTT can only be examined and established within specific age and education parameters.

With regard to the test-retest reliability for CTT, two-week reliability is reported as marginal (.64) for Part 1 and acceptable to high (.79) for Part 2. It is also stated that paired t-tests indicate that the interference index is significantly greater on the second test session. It is also reported that there are moderate correlations between CCT Parts 1 and 2 with TMT A and B of .41 and .50 respectively. It has been ascertained that there is a significant slow performance on Parts 1 and 2 in patients with traumatic brain injuries and HIV respectively (Strauss et al., 2006).

Administration & Scoring Procedures

The CTT is based on the use of numbered colored circles and universal sign language symbols.

The CTT stimuli consisted of circles with numbers printed inside. Each circle had either a vivid pink or yellow background (which are colors perceptible to color-blind individuals).

Color Trails 1 is similar to Trails A with the exception that all odd numbered circles had a pink background and all even-numbered circles had a yellow background. For Color Trails 2, each number was presented twice, once with a pink background and once with a yellow background.

When administering, 5 to10 minutes were needed and prompts and corrections were given. The time for the completion of parts 1 and 2 was recorded in seconds. The qualitative scoring involved number errors, near-misses and prompts. Score were then transformed to standard scores (M = 100, SD = 15), T scores and percentiles (see also guidelines in Strauss et al., 2006).

WMS - III Spatial Span:

Development & Background

The Wechsler Memory Scale II Spatial span is a component of the Weschler Memory Scale III (3rd ed.) which is a neuropsychological test battery used to assess learning and memory in adolescents and adults of age range 16 to 89 years of age. The WMS-III spatial span has been adopted into various batteries because of its testing properties.

It is a visual test of attention and memory and a derivative of the Corsi blocks test which was first developed by Corsi in the 1970s to compliment the verbal memory span task.

The WMS-III Spatial Span task is a test of working memory. The Spatial Span subtest taps an examinee's ability to hold a visual-spatial sequence of locations in working memory and then reproduce the sequence.

Reliability Validity and

The spatial span is a recent revision (last 15 years) of the Corsi blocks test (over 35 years) and thus has very little research done on it than the Corsi blocks test (Berch et al., 1998).

The testing of the validity of the spatial span is a more complex measure because it is based on three assumptions of which several studies have questioned. For example, a study was done to assess performance of a clinical population on the WMS spatial span subtest in comparison to the Digit span (Wilde & Strauss, 2008). The sample consisted of 44 participants referred for assessment after injury, seizure disorder, and surgery. The study reviewed records of the clients referred for neuropsychological assessment for medical reasons as mentioned and with a Glasgow coma scale of 14 and no history of unconsciousness greater than 1 hour.

The sample was comprised of 26 males and 18 females of average educational level of 12.4 years and mean age of 37.1 years.

Results showed that the raw scores for the forward digit span were higher than those for the forward spatial span while backward digit span results were lower than those of the backward spatial span. There were also generally similar raw scores for both the forward and backward spatial span results. Hence questions have been raised as to whether the spatial span is a valid measure of visual-spatial memory or perhaps its validity would be a more complex measure. Wilde and Strauss (2008) have concluded by cautioning the interpretation of the spatial span backward scores for clinical purposes. It is important to note however that generally those that performed poorly on the forward spatial span test also did poorly on the backward span test.

With regards to reliability, the spatial span is a good test or recurrent assessment of degeneration(dementia) because it has a negligible practice effect (Nuechterlein et al., 2008). It however shows reliable change indices when there is deterioration in cognition. This conclusion is based on studies done in epileptic patients in whom subtests were administered before and after surgery in order to identify tests that can be used to monitor responses to treatment. Spatial span test showed test-retest reliability and little practice effect (Martin et al., 2002).

Similar results were obtained in a study on schizophrenic patients that was done to develop a valid and reliable test battery for diagnostic and prognostic purposes. The spatial span was one of the 10 out of 36 tests that were selected to test for 5 critical areas of cognitive impairment in schizophrenic patients based on the results of the study. The study consisted of a mixed population of Caucasians, Asians, and Africans making a total of 176 (Nuechterlein et al., 2008).

Administration & Scoring Procedures

The WMS-III spatial span had two parts (spatial span forward and spatial span backward).

In the first part of the subtest, the participant was asked to replicate an increasingly long series of visually presented spatial locations. When giving the test, the administrator pointed to a series of blocks at a rate of approximately one block per second and asks the examinee to point to the same blocks in the same order (Spatial Span Forward).

In the second part of the subtest, the administrator pointed to a series of blocks and asked the participant to point to the same blocks in the reverse order (Spatial Span Backward).

Two trials (trail 1 and 2) for each sequence item were administered. Both trials of an item were administered even if the participant passed the first trial. The administrator discontinued after scores of zero on both trials of an item.

1 point score was given for each correct replication and zero point was given for a wrong replication.

The total participant's scores was recorded as per correct number of locations that they were able to replicate (on both the forward and backward span respectively).

Wisconsin Card Sorting Test - 64

Development & Background

The Wisconsin Card Sorting (WCST) test was originally meant as a test of "abstract behaviour and shift of set". It was originally created as 60 card test with one to four symbols which are a triangle, a star, cross or circle. These are in red, green, yellow or blue colours. All cards were different and there were no two identical cards. The test taker is supposed to match one of the cards at the bottom to those that are shown among the four (Lezak, 2004). The Wisconsin Card Sorting Test has for a long time been used as a test that measures abstract behaviour or executive functioning.

Reliability & Validity

The validity of WCST has been used tested by several researchers. Paolo et al. (1995), looked at the construct validity of the Wisconsin Card Sorting Test and the relationship between WCST test scores and memory and attention. In their study, they recruited 187 normal elderly and 181 persons with Parkinson's disease who were recruited from the community and retirement homes. An exclusion criterion was used by excluding all normals that scored below 130 on the Dementia Rating Scale as they were not supposed to show any signs of dementia and a score of less than 130 was associated with early dementia.

The results were analysed on both number of categories and the number of preservative errors, these indicated that there was an increased number of preservative errors among the subjects with Parkinson's disease than the normal. The results thus indicated that an increase in preservative errors increase among individuals with frontal lobe dysfunction supporting the validity of the test as a measure of frontal lobe functions.

In trying to understand the reliability of the WCST, Bowden et al. (1998), evaluated the reliability and internal validity of the WCST. In their work they had a sample of 75 university students to assess the reliability of the test and were given two forms of the test one after the other. In the administration process, the first set was given in the standard form while in the second form the administration was changed. The results were significant on the errors and the number of categories completed. There were no practice effects that were observed in this study. The results also showed low retest reliability and alternate form reliability with an average of r=.43 on Pearson's r which showed that almost 80% of the results could be attributed to error variance.

Bowden et al. (1998), have argue that the test cannot be used in a clinical sample until the reliability of the test is clearly tested. However, it is important to take note that the administration of the test was altered in this study and this could have likely affected results as standard rules of test administration were not followed.

Further it can be ascertained that WSCT is a valid test of executive functioning and the studies outlined above give some guidance on what to consider in further research as well as when making clinical decisions. It is also important to take note that the reliability of the test is not optimum and caution should be used especially in the administration of alternate forms of the test. It has also been argued that due to its low reliability the test does not have very good specificity although it reports high sensitivity to frontal brain lesions (Bowden et al., 1998).

Administration & Scoring Procedures

This test was administered using a computer. It measured executive functioning and required planning, use of feedback, and shifting cognitive sets.

Participants were required to match a card that appeared on the bottom part of the computer screen to one of four stimulus cards that were presented on the upper part of the computer screen.

The stimulus cards had four different designs on them – the first had a red triangle, the second had two green stars, the third had three yellow crosses, and the fourth had four blue circles. The cards that participants were required to match to one of the four stimulus cards varied in color, geometric form, and number. Participants received feedback each time on correct or incorrect performances. There was no time limit for this test.

There are three principles in the way the cards could be matched and these were the colour, the shape or the number of items on the card.

The computerized responses given for each test were either “right” or “wrong”, to indicate whether the card had been matched correctly.

Scores were given based on the number of categories completed and persevative errors. The persevative errors occurred when the client continued to sort the cards according to one principle. Low correct completed categories indicated problems in forming concepts, profiting from correction and conceptual flexibility (see also Lezak, 2004:587).

Controlled Oral Word Association Test:

Development & Background

Assessment of verbal fluency has long been an important component of clinical neuropsychological evaluation. Verbal fluency tests are used as a measure of executive functioning and language, and can also be used to evaluate semantic memory.

Verbal fluency is typically tested in letter and category domains. The two forms of fluency tasks most commonly employed are semantic and phonemic fluency.

Marshal (1986), pointed out that the label “word fluency” is misleading since verbal productivity in conversation or in continuous sentences is not measured. Instead, the test measures timed production of the individual word index for example, a given letter of the alphabet. Thus, to avoid confusion with the fluency/ non fluency dimension of speech, Benton et al. (1994), preferred the term “Controlled Oral word Association” (COWA). However the test is often known under the general term of “verbal fluency”.

F, A, and S are the most commonly used letters for this popular test, although other letter combinations are also used (Benton et al., 1994). The other letters include C, F and L and P, R and W. Borkowski et al. (1967), postulates that the choice of a letter set may affect the results to some extent because of differences in letter difficulty and word frequency for each letter. For younger children, words beginning with “Sh” have also been used to avoid the reliance on spelling skills.

The purpose of the ‘F’, ‘A’, ‘S’ test is to evaluate the spontaneous production of words within a limited amount of time (Straus et al., 2006).

Reliability and Validity

On internal reliability, Tombaugh et al. (1999), assessed the degree of internal consistency that existed among F, A, and S as well as among C, F and L. Coefficient alpha was computed using the total number of words generated for each letter as individual items and was found to be high (r=0.83).

In health adults, test retest correlation is typically above 0.70, for both letter and semantic fluency with short as well as long intervals. Basso et al. (1999), noted no gains among 50 healthy males re-tested following a 12 month interval on FAS. Levine et al. (2004) however, reported gains of about three words for 2145 healthy men when they were reassessed with FAS with the interval of 4 to 12 months.

Although test-retest reliabilities are reasonable for phonemic fluency, these findings suggest that relatively large changes in performance are required to conclude that real decline or improvement has occurred as opposed to being due to the effects of practice and random measurement error (Basso et al., 1999).

Administration and Scoring Procedures

In this test, the participant was asked to say as many words as possible (within 60 seconds) that begin with the letters “F,” “A,” and “S,” excluding proper names and different forms of the same word. For each letter, the participant was allowed 60 seconds to generate as many word as they could.

The participants were scored and their performance measured by calculating the total number of acceptable words produced for all three letters. Intrusions and perseverations (word repetitions) were not included in the total score. Intrusions included words that begin with the wrong letter, are proper nouns, or words that differ from a previous response by tense, plurality or grammar usage.

Category Fluency Test

Development & Background

Developed together with and in the similar line with COWAT. Both test are said to be sensitive measures of brain dysfunction and the administration of verbal fluency tasks are recognised as an important component in the comprehensive assessment of neuropsychological functioning (Lezak et al., 2004; Straus et al., 2006). Although both tasks are similar in that they impose substantial language requirements, and that they are both indicators of brain dysfunction, there is evidence to suggest that each task is sensitive to different disease processes and distinct neuroanatomical substrates.

Reliability & Validity

A similar picture emerges for category fluency as the one described on the FAS above. Bird et al. (2004), evaluated semantic (animal) fluency in 99 healthy adults. All in all, what was noticed in most of the tests done was that there was some notable practice effect on the second administration although some studies proved otherwise.

Practice effects can be reduced by changing the letter or category on each test occasion. The findings of Wilmen et al. (1999), on 81 normal controls are that Category test is reliable with only small practice effect. For this reason, there is great need for the examiner to control for practice effects so that correct recommendations can be made on patients.

Correlations among phonemic fluency task for example the FAS and the category fluency test are high.

Troyer et al. (2000), argue that the two sets of letters are roughly comparable across different settings and groups such as the healthy, psychiatric, suspected CNS dysfunction, with correlations between forms ranging from 0.85 to 0.94. Correlations between forms using different semantic categories are also moderately high at 0.66 to 0.71 for such groups as (animals and clothing) and (animals and food).

Administration & Scoring Procedures

On the Category Fluency Test which is similar in format to the Controlled Oral Word Association Test (COWAT), the participant was asked to say as many words as possible that belong to a specified category.

In this study, participants were asked by the administrator to say as many "Animal names" as they could within a space of 60 seconds. The participant was then later asked to produce as many Action words as they could of "Things that people do".

The participant's score was the number of items correctly named. Similar to the COWAT, perseverations (i.e., repetitions of a correct word) and intrusions (i.e., words not belonging to the category) were recorded.

The participants were scored and their performance measured by calculating the total number of acceptable words produced for trail 1 (Animals) and trail 2 (Actions). Intrusions and perseverations (word repetitions) were not included in the total score.

Paced Auditory Serial Addition Task:

Development & Background

Paced Auditory Serial Attention Test (PASAT) is meant to measure attention deficits including concentration, speed of processing, mental calculation, and mental tracking. It is sensitive for diagnosing cognitive impairment in individuals who are 16 years old and more. This is a challenging task that involves working memory, attention and arithmetic capabilities. It is considered to have been devised by Gronwall and others in 1974 to provide an estimate of speed of information processing (Strauss et al., 2006). The PASAT is also an auditory test of attention and memory.

Reliability & Validity

The original norms were based on a sample of 80 individuals from New Zealand. They warn however, that because this sample was predominantly male and not well described demographically, alternate norms are preferred. The demographic characteristics for the Gronwall version collected by Struss et al. (1988), were based on the normative data based on samples of healthy North American adults. There were 90 community volunteers aged 16 to 69 years with approximately 16 years of education and no history of neurological and/or psychiatric disorder.

Regarding the reliability of PASAT, the Cronbach's alpha for the four PASAT trials is very high in adults (r=.90) and that in children, the CHIPASAT's split-half reliability is approximately .90 at different ages. This implies high internal consistency. Test-retest correlations following short retest intervals (7-10 days) are excellent (r<.90). It has also been pointed out that there are significant practice effects on the PASAT (Strauss et al., 2006).

With regards to validity of PASAT, Wingenfield et al. (1999), acknowledge that although more research is needed, among auditory versions, computerized and audiotape versions appear comparable. Short and long forms are highly correlated in healthy individuals. For example, r = .86 for the PASAT-50 and r = .95 for the PASAT-100. PASAT is also thought to measure a central processing information-processing capacity similar to that seen on divided-attention tasks.

Further, the test is also said to moderately correlate to other measures of attention, such as Digit Span, Trail Making Test (particularly Trails B), and Stroop Test. According to Strauss et al. (2006), even if PASAT may not be strongly correlated with intelligence or mathematical ability, it is sensitive to mild concussion and appears to be a more sensitive indicator of information-processing capacity in head-injured patients than other standard measures of attention.

Administration & Scoring Procedures.

This test is an effective measurement of speed of information processing.

In this test, a set of randomized digits were serially presented via computer recording (Channel 1 to be specific).

Participants were asked to add the current number to the number that preceded it and respond with the total. Thus, after each new digit was presented, a new total was achieved.

The number of correct responses was scored. Both the total number of attempted answers and the total number of correct answers was recorded.

Stroop Color and Word Test

Development & Background

Stroop colour and word test was developed by John Ridley Stroop in1935. It measures “the ability to shift cognitive set by requiring the active inhibition of previously learned responses that are highly automatic” (Sacks et al., 1991:220). The focus of the test is on selective attention, habitual response, automatic response suppression ability and goal oriented and is used for executive functioning.

Reliability & Validity

The most reliable studies done on the stroop have been test-retest reliability study. This so because of the importance placed on practice effect and its impact on neuropsychological tests both in research and clinical populations.

Levines et al. (2004), sampled 37 adults between 52 and 80 years. They were tested at three time interval with an inter-assessment interval of 14 days. They found that “only the colour task did not produce decrease in completion time between the 2nd and 3rd sessions” (Levine et al., 2004:292). Completion time was found to be of greater sensitivity than error scores were to practice effect.

The test retest reliability correlation of the Stroop test has been found to be as high as r=0.90 (Cave, 2008).

A study that showed validity of the stroop test is by King et al. (2007). The sample included 22 adults that had a diagnosis of attention deficit hyperactive disorder (ADHD) in childhood and 22 healthy controls. The subjects were administered a block explicitly cued task switching paradigm and a stroop colour word test. The results showed that the ADHD group performed worse, had errors, and had an inability to control interference. The limitation of the study was the small sample size. These studies show a fair reliability and validity of the stroop test.

Administration & Scoring Procedures

This is a test of both information processing speed and executive functioning. It consisted of three pages the participant had to read through as quickly as they could (Word Reading, Color Naming and Color-Word Interference).

Each page had 100 items, presented in 5 columns of 20 items. The Word Reading page consisted of the words “RED”, “GREEN” and “BLUE” arranged randomly and printed in black ink on a white 8.5” x 11” sheet of paper. No word was allowed to follow itself within a column.

On the Stroop Test (Words), the administrator instructed the participant to read down the columns starting with the first one and continue until they participant was told to STOP after 45 seconds. The administrator then circled the item the participant ended on. This number was recorded as the score for the participant.

On the Stroop Test (Colours), the administrator informed the participant that this was a test of how fast they could name the colours on the page. They were to complete the page just as they did with the previous one. The participant was given 45 seconds before they were told to stop. The administrator then circled the item the participant ended on. This number was recorded as the score for the participant.

On the Stroop Test (Colour-Words), the administrator informed the participant that the test was just like the one they had finished earlier. Now they were required to name the colour of the ink the words were printed in, ignoring the word printed in each item. The participant was given 45 seconds before they were told to stop. The administrator then circled the item the participant ended on. This number was recorded as the score for the participant.

Halstead Category Test (Computerized):

Development & Background

The test was developed by Halsted in 1947 to assess the ability to conceptualise qualities such as size, shape, number, position and colour. In its original form it had 336 items with 9 subtests. Reitan in 1948 reduced the subtests to 7 with 208 items. Each subtest had a different principle which may be odd stimulus, number of objects, spatial position, and a combination of different principles among others. To complete the test, "the participant must rely on feedback based on correct or incorrect guesses to show what the principle in that subtest is. The test requires deduction of a classification principle by means of response bases feedback, the use of the principle while it remains effective and to abandon the principle when it is no longer effective" (Strauss et al., 2006:425).

Reliability & Validity

In a study to look at test-retest reliability, Dikmen et al. (1999), undertook a study with 354 normals or neurologically stable participants. The participants were all of at least 15 years of age. Of the total number, 138 had no recent head trauma but were friends of those with head injuries and were tested after 11 months,. Of these, 121 had recent head injury and had their baseline testing a month after the trauma and 11 months after the baseline testing. A variety of tests were used and these included the Halsted Reitan Test Battery, Wechsler's Adult Intelligence Scale (WAIS) and other memory test. The results obtained found reliability coefficient of between Pearson's r=.40 to r=.85 over a median interval of 11 months.

In this study it is argued that there are two types of reliability these are the concept of clinical reliability versus psychometric reliability which is cited in this study.

It is argued that “clinical reliability is used to consistently classify individuals’ performances as normal *versus* impaired on the basis of cut-off scores” (Dikmen et al., 1999:353). Further, the results obtained on the neuropsychological measures used including the category test had better clinical than psychometric reliability. However, the clinical reliability is easily affected by practice effects especially if the testing interval is very short. Others have also pointed out that with severely impaired neurological patients, the reliability coefficients tend to be as high as .90 even two years after the baseline testing (Goldstein et al., 1989; Matarazzo et al., 1974).

Considering that reliability is concerned with getting consistent results and a reduction of measurement error, it can be argued based on these results that the current test retest results may not be very high but they do seem to show some consistency in the way they are reported at different times. It is however important to keep in mind that the when psychometric reliability is low and clinical reliability is somewhat higher, there should be ways of ensuring the reliability of the retest of the test.

The category test has for a long time been known to measure more than one construct. It has been reported to measure diverse skills such as counting, perceptual organization, set maintenance, and learning facilitated performance (Simmel et al., 1957).

Allen et al. (1999), embarked on study to evaluate the category test based on three factors with different populations and the relationships of these factors with other cognitive abilities. In this study, a total of 601 male participants were assessed and these consisted of 195 patients with schizophrenia, 177 had different forms of structural brain damage, and a patient comparison group of 229 participants. The standard version of the Category Test was used in the assessment process as well as Wechsler’s Adult Intelligence Scale (WAIS) and all the other tests contained in Halstead-Reitan Neuropsychological Test Battery.

The category test has reported a fairly acceptable level of its reliability and validity and although like the WCST it is a measure of executive functioning. The Category Tested has been cited to have a better sensitivity to brain damage than the WCST. It is said that the Category Test should be a preferred measure if the clinician would like to measure a more difficult and sensitive measure of abstraction ability (Strauss et al., 2006).

Administration & Scoring Procedures

The Halstead Category Test was administered and completed on the computer. The participant was shown a series of geometrical figures and designs that represented a number between 1 and 4. The participant was tasked with figuring out which number the current design they were looking at represented, and then pushing the computer key (the keys numbered 1-4) on the computer keyboard.

The test consisted of 7 subtests. Between each subtest the examiner had to read more instructions to the participant, indicating to them that the current subtest had ended and they were about to begin a new one. Within each subtest, the idea, or principle used to find the correct answer never changed.

The strategy only changed between subtests, never within them. The participant was told between each subtest that the idea used to identify the correct number could be the same as in the last subtest, or it could be different. It was the participant's job to figure out if it changed or not, and then figure out the new correct idea or principle in the new subtest to get the right answers.

The test was scored based on the number of errors made.

STATISTICAL ANALYSES

Performance of the research participants on the fifteen neuropsychological tests was recorded. The raw scores were then converted to scaled scores with a mean of 10 and standard deviation of 3. The participants' performance on the neuropsychological tests was grouped according to domains of the brain that the tests were assessing to give a mean score that was used for statistical analysis.

The means for each of the domain areas were used to indicate performance on the dependent variables while SES was the independent variable for analysis purposes in the statistical package for social sciences (SPSS) version 15.0.

The four predictor variables - education, occupation, income, and residence were analysed with the 7 neuropsychological test mean scores. Only the means of groups of test scores were analysed as analysing all the 15 neuropsychological tests separately was outside the scope of this study. The domains of the brain assessed and the neuropsychological tests used is as shown in table 3.2 below.

Table 3.2: Domain Assessed and Tests Used in the Study

Domain	Tests Used
Visual Episodic Memory	Brief Visuospatial Memory Test - Learn, Delay
Verbal Episodic Memory	Hopkins Verbal Learning Test - Learn, Delay
Attention/Working Memory	Paced Auditory Serial Addition Test, & WMS-III Spatial Span
Fluency	Word Sound Fluency Test- FAS, Animals, Actions, Stroop Word Test.
Speed of Information Processing	Trails, Color Trails1, Digit Symbol, Symbol Search, & Stroop Color.
Executive Function	Color Trails2, Category Test Errors, Wisconsin Card Sorting Test - Total Errors, & Stroop Colour Word Test.
Motor Function	Grooved Pegboard - Pegs Dominant hand & Pegs Nondominant hand.
Global	All of the above

The first hypothesis of the study was that *of the four SES indices (education, occupation, income, and residence), education will be a better predictor of neuropsychological test performance than the other indices*. To find out the predictive ability of the four indices as well as the statistical significance of their predictive power, multiple regression was used. Multiple regression is a statistical technique that allows for prediction of the participant's score on one variable on the basis of their scores on several other variables (Pallant, 2007). In this case, how the participant's score on socio-economic status can predict test performance on the neuropsychological tests.

The Enter method of multiple regression in SPSS version 15.0 was used. The four indices (entered in this order: residence, education, income, occupation) were used as predictor/independent variables while the mean scores for the respective tests including visual episodic memory, verbal episodic memory, attention/working memory, language fluency, speed of information processing, executive function, and motor speed tests (as per Table 3.2), were used as dependent variables.

The second objective was to determine which tests in the Zambia neuropsychological test battery show the most relationship with SES. It was hypothesised that *tests of speed of information processing, and language fluency will positively correlate more with socio-economic status than the other tests in the test battery*. The Pearson product-moment correlation coefficient was used to test this hypothesis. SES was taken as a sum total of an individual's rating on the education, occupation, income, and residence indices, was used as the

The third objective of this study was to establish if there is a difference in neuropsychological test performance between participants of high and low socio-economic status (SES). It was hypothesised that *participants of high socio-economic status will perform better than those of low socio-economic status on the neuropsychological tests*. The independent sample T-test was used to

compare the mean scores on the continuous variable (test performance) for two different and independent groups of people (high and low SES).

For differentiation purposes, the investigator transformed and recoded the raw data so as to have two independent and differentiated groups as shown below.

(1). Low SES Group — Those having three or more of the following: less than 12 years of education, an unskilled job, earning less than K12 million per annum, and staying in a low cost area.

(2). High SES Group — Those having three or more of the following: more than 12 years of education, a skilled job, earning more than K12 million per annum, and staying in a high cost area.

This procedure resulted in two independent and differentiated groups of low SES and high SES. The two variables used for analyses therefore were:

- One categorical, independent variable – high/low SES; and
- One continuous, dependent variable – mean scores for the tests as per table 3.2.

CHAPTER 4

4.0 RESULTS

CHARACTERISTICS OF THE SAMPLE

The full characteristics of the sample in this study including their ages, gender, education levels, residences, incomes, and occupations are shown in table 4.1.

Table 4.1: Demographic Characteristics of the Sample

		rural	urban	Total
gender	Female	71	86	157
	Male	81	86	167
age	20-35 years	62	67	129
	36-45 years	37	53	90
	46-55 years	33	31	64
	56 years and above	20	21	41
education	g5-g7	21	13	34
	g8-g9	34	38	72
	g10-g11	34	32	66
	g12 and above	63	89	152
occupation	Unskilled (e.g. maid, farm laborer, etc)	59	30	89
	Semi-skilled (e.g. plumber, bus driver, etc)	51	53	104
	Skilled (e.g. accountant, physician, etc)	41	88	129
	Specialist (e.g. consultant, economist, etc.)	1	1	2
income	Less than 12 million per year	150	153	303
	K12 million and above per year	2	19	21
residence	Low cost rural area (e.g. village)	78	0	78
	High cost rural area (e.g. near boma)	77	0	77
	Low cost urban area (e.g. high density area)	0	112	112
	High cost urban area (e.g. low density area)	0	57	57
Grand Total (Rural/Urban)		152	172	324

HYPOTHESIS 1: SES INDICES PREDICTIVE ABILITY

It was hypothesised that *of the four socio-economic status indices (education, occupation, income, and residence), education may be a better predictor of neuropsychological test performance than the other indices*. The results after the analyses were as follows:

On the ***visual episodic memory tests***, the predictive power of the four SES indices was considerably low leading to results not being statistically significant ($p>.05$) see table 4.2.

On the ***verbal episodic memory tests***, of the four SES indices, occupation predicted 14% while residence predicted 13.8% of the study participants' test performance with $p<.05$. As for education and income, their predictive power was not statistically significant ($p>.05$) see table 4.2.

On the ***attention/working memory tests***, occupation predicted 19% of test performance of the study participants while education had a predictive value of 14% with $p<.05$. The predictive powers of income and residence were not statistically significant ($p>.05$) as shown in table 4.2.

Of the four aforementioned SES indices, occupation accounted for 33% while education accounted for 19% of the difference in the participants' test performance on the ***language fluency tests***. The predictive powers of income and residence were not statistically significant ($p>.05$) as shown in table 4.2.

On the ***speed of information processing tests***, occupation predicted 24% of the participant's test performance while education predicted 20% of test performance in the study participants at a statistical significance level of $p<.05$ The predictive powers of income and residence were not statistically significant ($p>.05$) as shown in table 4.2.

Of the four aforementioned SES indices, occupation accounted for 20% of the difference in test performance of the study participants on the ***executive function tests*** at a statistical significance level of $p<.05$. The predictive powers of occupation, income, and residence were not statistically significant ($p>.05$) as shown in table 4.2.

On the ***motor tests***, occupation predicted 15% of the participant's test performance while education predicted 13% of test performance in the study participants at a statistical significance level of $p<.05$ The predictive powers of income and residence were not statistically significant ($p>.05$) as per table 4.2.

On ***all the tests***, occupation predicted 27% of the participant's test performance while education predicted 19% of test performance in the study participants at a statistical significance level of $p<.05$ The predictive powers of income and residence were not statistically significant ($p>.05$) as per table 4.2.

For further results regarding the predictive ability of the whole model, the R, R Square, and Adjusted R Square is as given in **Appendix D**.

Table 4.2: Prediction of Test Performance by each of the four SES Indices

Independent/Predictor Variables	Dependent Variable	Standardized Coefficients Beta	Significance
Education	visual episodic memory	.11	.060
Occupation		.06	.320
Income		-.01	.843
Residence		.05	.372
Education	verbal episodic memory	.11	.072
Occupation		.14	.019*
Income		-.03	.608
Residence		.14	.013*
Education	Attention/ working memory	.14	.018*
Occupation		.19	.002*
Income		-.01	.880
Residence		.02	.707
Education	language fluency	.19	.005*
Occupation		.33	.005*
Income		.07	.181
Residence		.10	.056
Education	speed of information processing	.20	.005*
Occupation		.24	.005*
Income		-.01	.908
Residence		.02	.698
Education	executive function	.08	.149
Occupation		.20	.001*
Income		-.03	.634
Residence		.06	.251
Education	motor function	.13	.024*
Occupation		.15	.011*
Income		.01	.981
Residence		-.01	.968
Education	global	.19	.001*
Occupation		.27	.005*
Income		.01	.976
Residence		.07	.167

* Significant at *P*<.05 with 95% confidence interval.

HYPOTHESIS 2: CORRELATION OF TESTS & SES

It was hypothesised that the t*ests of speed of information processing, and language fluency will positively correlate more with socio-economic status than the other tests in the Zambian neuropsychological test battery*. The results after the analysis are as shown below.

The language fluency tests had the strongest positive correlation (r=.46) with SES followed by speed of information processing tests with SES at r=.32. The verbal episodic memory and working memory tests both correlated with SES at r=.24. The executive tests and motor tests correlated with SES at r=.23 and r=.20 respectively. The least correlation was that of visual episodic memory tests with SES at r=.14 (see table 4.3).

Table 4.3: Correlations of Tests and Socio-economic Status

Neuropsychological Tests	**r**
Language fluency * SES	.46**
speed of information processing * SES	.32**
verbal episodic * SES	.24**
working memory * SES	.24**
executive function * SES	.23**
motor function * SES	.20**
visual episodic memory * SES	.14**

** Correlation is significant at the 0.01 level (2-tailed). N=324.

HYPOTHESIS 3: HIGH & LOW SES PERFORMANCE

It was hypothesised that *participants of high socio-economic status will perform better than those of low socio-economic status on the neuropsychological tests*. After analysis, the results are as shown below.

When the mean scores of study participants were compared on ***visual episodic memory tests***, the low SES participants had a mean score of 10.08 while those of high SES had a mean score of 10.44. This difference in mean scores of the two groups was not statistically significant ($p>.05$) as per table 4.4.

On the ***verbal episodic memory tests*** the participants of low SES had a mean score of 9.87 while their high SES counterparts had a mean score of 11.28 on the same tests. This mean score difference between the two groups was statistically significant with $p<.05$ as per table 4.4.

On the ***language fluency tests***, it was found that the study participants of low SES had a mean score of 9.87 while the high SES group of participants had a mean score of 11.91. These mean score differences were statistically significant at $p<.05$ as shown in table 4.4.

The participants of low SES had a mean score of 9.94 while their high SES counterparts had a mean score of 11.12 on the ***information processing tests***. Comparatively, the difference in the mean scores between the two groups as shown in table 4.4 was statistically significant at $p<.05$.

On the ***executive functioning tests,*** participants of low SES had a mean score of 10.00 while those of high SES had a mean score of 10.79. This difference in the mean scores of two groups was statistically significant ($p<.05$) as shown in table 4.4.

On the ***attention/working memory tests***, participants of low SES had a mean score of 9.87 while those of high SES had a mean score of 11.16. This difference in the mean scores of two groups was statistically significant (p<.05) as shown in table 4.4.

On ***motor tests***, participants of low SES had a mean score of 9.99 while those of high SES had a mean score of 10.63. This difference in the mean scores of two groups was not statistically significant (p>.05) as shown in table 4.4.

When ***all the tests*** were put together, participants of low SES had a mean score of 9.94 while those of high SES had a mean score of 11.11. This difference in the mean scores of two groups was statistically significant (p<.05) as shown in table 4.4.

Table 4.4: Mean Test Scores for Low & High SES Participants

Mean Scores for each Test	Socio-economic Status	N	Mean	Std. Deviation	Sig.
visual episodic mean	Low SES	275	10.08	3.010	.441
	High SES	49	10.44	3.160	
verbal episodic mean	Low SES	275	9.87	2.862	.001*
	High SES	49	11.28	2.640	
language fluency mean	Low SES	275	9.87	2.179	.005*
	High SES	49	11.91	1.918	
speed of information processing mean	Low SES	275	9.94	2.317	.001*
	High SES	49	11.12	1.977	
executive mean	Low SES	275	10.00	2.052	.015*
	High SES	49	10.79	2.142	
working memory mean	Low SES	275	9.87	2.431	.001*
	High SES	49	11.16	2.503	
motor mean	Low SES	275	9.99	2.859	.139
	High SES	49	10.63	2.400	
global mean	Low SES	275	9.94	1.825	.005*
	High SES	49	11.11	1.649	

*** Results significant at *P*<.05 with 95% confidence**

CHAPTER 5

DISCUSSION

The major purpose of this study was to investigate how socio-economic status relates to test performance. For purposes of this study, methodological issues including those of cross-sectional versus longitudinal research designs, and complete review of literature was beyond the scope of this empirical study. A comparison of findings in this study with related research was however done.

Prediction of Test Performance by each of the SES Indices

In this study, the occupation status of the study participant was found to be a better predictor of test performance followed by their education whereas their income and residence were not predictive of test performance as the regression coefficients were not statistically significant. Occupation like the other variables was indexed as given in table 3.2.

One of the domains of the brain that was assessed was memory. As is well known, memory plays an important role in learning and reasoning. Madakini et al, (2009), assert that memory includes various processes like memorizing, retaining, reproducing and forgetting, and is at the centre stage of problem solving which depend on obtaining information when it is needed. On the *episodic memory tests*, the four SES indices did not play a big role in influencing the participants' test performance. On the *verbal episodic memory tests*, the participant's occupation status and residence were both good predictors of test performance while education and income did not play a significant role in predicting their test performance.

On the *attention/working memory*, *information processing, language fluency, executive functioning*, and *motor tests*, the participant's occupation was a better predictor of test performance followed by their education. Additionally, when *all the tests* were put together, still the participant's occupation was a better predictor of test performance followed by education.

It is not entirely surprising that occupation came out as the best predictor of test performance followed by education. The plausible explanation could be that in adult participants, their means of livelihood (being a bus conductor, farmer, business person, nurse, accountant, etc) which is something they do on a daily basis greatly influenced their thought patterns and how fast they processed information, reacted, and problem solved as evidenced by their test performance. Education came out as a second best predictor of test performance possibly owing to the fact that it is something they acquired some time back.

In this study, as shown by table 4.2, it has been found that of the four SES indices (education, occupation, income, and residence), income did not predict performance on any tests implying that it did not matter how much money the participant earned for them to perform well or poorly on the neuropsychological tests. It can therefore be said that how much money a patient or research participant earns should not be a concern for practitioners when interpreting people's test results as money does not directly predict test performance.

Also worth noting is that a number of recent studies have shown that despite the traditional use of years of education for neuropsychological test norm development and as a demographic correction in neuropsychological research, it is actually better to use reading ability rather than years of education as it is a better predictor of cognitive performance. In their work, Dotson et al. (2008 & 2009) found that literacy, but not years of education, significantly predicted performance on a battery of neuropsychological tests, including measures of visual and verbal memory, attention and executive functions, semantic fluency, and visuospatial abilities.

While it was hypothesised that of the four SES indices education would be a better predictor of test performance, in this adult study sample, their occupation played a major role in influencing test performance. It is possible to speculate that had levels of literacy been used rather than the number of years of education, the results may have been different.

The Relative Influence of SES on each Test

The findings concerning correlations of tests in the neuropsychological battery and socio-economic statuswere in line with the hypothesis in this study. Performance on all the tests correlated significantly with SES. The correlation of SES with language fluency tests was the strongest followed by that of SES and information processing tests.

As was hypothesised, SES played a significant role in how well the participants performed especially on tests that required speed in processing information. In the language fluency tests that highly correlated with SES, there were activities that required the participant to say as many words as possible that belonged to a certain category within a specified period of time. The participant was instructed to quickly generate correct English words beginning with the letters “F”, “A”, “S”, “Animal names”, and “Things that people do” among other tasks within a space of 60 seconds respectively. Indeed the participant’s SES level, and exposure to English and how frequently they used it can be said to have largely been related to how quickly they generated correct words (see also Siachitema et al. 1991).

As was the case with language fluency test, the tests of speed of information processing that require psychomotor speed, attention, and concentration also correlated highly with the participant’s socio-economic status. This shows that the speed and level at which the participants processed information was highly related to their socio-economic status.

It is not surprising that language fluency and information processing tests were found to be highly correlated with SES because the two highly relate to each other. Solso (2001:320) has stressed that “language is an important component of information processing and storage”. Further, language affects the way we conceive reality, process information, and store things in the memory and recall” (Ibid, 333). There is need for clinicians and researchers to ensure that when interpreting the test results, the SES factors are corrected for in order to get the correct picture of the patient’s or research participant’s test performance.

It can be said without fear of contradiction that all results of tests that may be influenced by acculturation need to be interpreted with extra care (Arnold et al., 1994; Manly et al., 1998). As has been postulated in this paper, this acculturation in Zambia may be seen in the use of English language and such artefacts as computers which originally were not part of the traditional cultures.

In Siachitema et al. (1991)'s study, it was found that there was more use of the English language by people living in high cost residence, and had 12 or more (college/university) years of education as compared to those of low SES who tended to use their mother tongue more in their homes and neighbourhoods. This implies that tests like language fluency tests render themselves more prone to the influences of SES through acculturation as compared to others like motor tests. This is owing to the fact that people who use the English language on a daily basis are at an advantage when it comes to generating as many words as possible within a specified timeframe as is a requirement on the language fluency tests. The practitioner therefore has to bear this in mind when interpreting the test results.

Difference in Test Performance Between the High and Low Socio-economic status Groups

In line with the hypothesis and available literature, it was found in this study that participants of high socio-economic status performed better than their low socio-economic status counterparts on all the tests. The difference in the mean scores between those of low SES and high SES was significant in all cases except for visual episodic memory tests and motor tests in which the differences in tests scores were not statistically significant.

The results show that there was more difference in performance between those of low and high SES on the verbal episodic memory, language fluency, speed of information processing, working memory, and executive functioning tests. Even at an early age, due to the differences in the levels of exposure to psychologically stimulating environments, children of high SES have been reported to perform better than their low SES peers who are said to acquire language skills more slowly, exhibit delayed letter recognition and phonological awareness, and are at risk of reading difficulties (American Psychological Association, 2011).

When fluency tests are used for instance, they are able to indicate general brain dysfunction and expressive language dysfunction including the presence of such diseases as Alzheimer's disease due to neuropathological changes to higher order systems (Zillmer et al., 2008:74, 415-416). Worth noting is that patients of low SES who may be less acculturated are likely to encounter difficulties with some tasks because of limited English fluency, lack of understanding, and appreciation of the type of timed sequencing tasks that are alien to their traditional cultures (Arnold et al., 1994; Manly et al., 1998). The important thing is for the clinician to always check whether poor performance on such tests is due to the presence of a disorder or the patient's low SES status.

Differences in test performance have been reported even in other studies when it comes to comparison between low and high SES participants. In one of the studies conducted in the United States of America called the Baltimore Memory Study, there were 1,140 participants aged 50-70 years who were subjected to a 90 minute test battery that included among others the Rey Complex Figure copy, Pegboard, Stroop Test (A, B and C forms), Trail-making test A and B, Finger tapping, Letter fluency, and Category fluency. It was found that after adjustment for SES, there was an average difference of 25.8% in neurobehavioral test performance among the participants of high and low SES (Schwartz et al., 2004).

The implication of study results such as the Baltimore Memory Study and indeed the current study is that clinicians and researchers would have to be cautious when interpreting test results so as to take into consideration the reference level of education, occupation and residence of the patient based on available norms for low or high SES individuals. Appropriate norm-referenced scores should always be used to avoid overdiagnosing or underdiagnosing patients (Mortensen et al., 1993; Mulenga et al., 2001; Skul et al., 2001; Attix et al., 2008).

CHAPTER 6

6.0 CONCLUSION AND RECOMMENDATIONS

In this study, it has been shown that the background factor of SES does influence test performance. It is therefore important to be cautious and take into consideration these background variables when interpreting test performance in individuals of varying SES backgrounds.

As postulated by the American Psychological Association (2010), it cannot be overemphasized that socio-economic status relates the intensity of social problems that ultimately affect everyone. Indeed the importance of always considering the effect of SES on test performance remains clear as there are inequalities with regards to access and distribution of resources among those of low and high SES. To this effect, interpreting test results of the low SES and high SES participants or patients in the same light will be doing disservice to neuropsychological practice and thereby possibly harming the very people who are supposed to be helped through the neuropsychological assessments.

The data collected for this study contributed to the larger project of collecting norms for standardization in Zambia. It is worth pointing out here that with these standardised norms, the work of neuropsychologists in Zambia will be made easier. Practitioners will have a reference point rather than use imported norms when interpreting tests performance which do not reflect the true test performance of the test takers in this part of the world.

With developed norms for the country, it cannot go without recommending that clinicians consider using the socio-economic status index developed in this study in order to help increase the accuracy with which patients' results are interpreted. That is, the practitioners have to use two sets of norms for those of low SES and those of high SES in order to avoid overdiagnosing or underdiagnosing patients because of using reference scores that are too low or too high.

The recommended SES Index is as per table 6.1 below which can be used for quick reference as to which norms to use for a particular patient when interpreting their test results. It should be made clear that the said index applies to people of 20 years and above with at least 5 or more years of education.

Table 6.1. Socio-economic Status Index

Low SES	**Having three or more of the following: less than 12 years of education, an unskilled job, earning less than K12 million per annum, and staying in a low cost area.**
High SES	**Having three or more of the following: more than 12 years of education, a skilled job, earning more than K12 million per annum, and staying in a high cost area.**

For future practice, the income threshold of K12 million per annum could be adjusted upward in keeping with economic developments. The adjustment should however not adversely affect one group's ratings over the other.

Further to this SES index, it will be prudent to use one of the validated tools in Zambia – the Zambia Achievement Test (ZAT) which has an index for measuring the quality of education and literacy levels rather than the number of years of schooling (since years of schooling did not strongly predict test performance).

Using the SES index and the ZAT index has the potential to increase the accuracy to which the test results of the patients are interpreted. This is owing to the fact that knowledge of the patient's SES augmented with knowledge of their reading ability will lead to better prediction of cognitive performance as well as better choice of appropriate norms to use for reference when interpreting the test results.

It is also recommended that in addition to the printed tables that clinicians use for norm referenced scores, where possible and available, as Mortensen and Gade (1993), have pointed out, regression equations available in computer programs that have been proved for reliability should be used for test results interpretation.

The computerized programs have the potential to quicken the analysis of the clients' test performance thereby enabling the neuropsychologist to make quick decisions and serve more clients in an effective way. Further, computerised equations and programs can easily be updated to take into account the changing life circumstances such as increase in opportunities for education, income, occupation, and residence among other things.

Strengths of the Study

This study has a number of strengths as follows. Firstly, the neuropsychological tests in the Zambian neuropsychological test battery that were used have been already found reliable and valid as outlined under chapter 3, section 3.7.2 on measures for the study. Secondly, the 9 administrators for the said neuropsychological tests were adequately trained in the administration and scoring procedures for the tests thereby ensuring a consistent standard in the way these tests were administered. Thirdly, as the participants were to be HIV negative, recruitments were done through the ongoing VCT programs with the help of experienced health professionals. Fourthly, the participants (both from rural and urban) were considerably a good representation of these two dichotomies. The rural participants included even those from far remote areas who were coming to access health services at the rural clinics.

Limitation of the Study

A limitation to this study is that it was restricted to people who were coming for voluntary counseling and testing (VCT) at the health centers. Further works would benefit from inclusion in the sample those people not necessary going for VCT but who meet the inclusion criteria especially for generalization purposes.

Also, future works may possibly benefit in undertaking similar research in areas away from the line of rail. Even though it is not anticipated that test performance of the rural sample that is far away from the line of rail is likely to be significantly different from the rural sample that participated in this study, it may still be worth looking into that area in order to learn more about such populations.

REFERENCES

Allen, D.N., Goldstein, G & Mariano, E. (1999). Is the Halstead Category Test a Multidimensional Instrument?, *Journal of Clinical and Experimental Neuropsychology, 21:2,237-244.*

American Psychological Association (2010). Education and social economic status. Retrieved January 5, 2010 from http://www.apa.org/pi/ses/resources/publications/factsheet-education.pdf.

Arnold, B.R., Montgomery, G.T., Castaneda, I., & Longoria, R. (1994). Acculturation and performance of Hispanics on selected Halstead-Reitan neuropsychological tests. *Assessment,* 1, 239-248.

Attix, D.K., Story, T.J., Chelune, G.J., Ball, J.D., Stutts, M.L., Hart, R.P., & Barth, J.T. (2008). The prediction of Change: Normative neuropsychological trajectories. *The Clinical Neuropsychologist*, 23(1), 21-38.

Basso, M.R. (1999). Practice Effects on Commonly Used Measures of Executive Tests British. *Journal of Clinical Psychology*, 43, 623 – 628.

Benton, A.L. (1994). Multilingual Aphasia Examination, (3rd ed.). San Antonio, IX: Psychological Corporation.

Berch, D.B., Krikorian, R. and Huha, E. H. (1998). The Corsi Block Tapping Test: Methodological and Theoretical Considerations. *Brian and Cognition*. 38 (3) 317-338.

Bird, C.M. (2004). Monitoring Cognitive Changes. Psychometric Property of Six Cognitive.

Borkowski J., Benton, A., Spreen, O. (1967). Word Fluency and Brain Damage *Neuro-pyschologia*, 5, 135 – 140.

Bowden, S.C., Fowler, K.S., Bell, R.C., Whelan, G., Clifford, C.C., et al (1998). The Reliability and Internal Validity of the Wisconsin Card Sorting Test, *Neuropsychological Rehabilitation*, 8 (3), 243–254.

Burke, H.L. (2007). Benefits of Neuropsychological Assessment. Retrieved September 10, 2009 from http://www.brain-injury-therapy.com/services/neuropsychological_testing.htm.

Cave, J. (2008). The effect of quality of education on Neuropsychological test performance. Unpublished master's thesis, University of South Africa, South Africa.

Central Intelligence Agency. (2009). The World Factbook: Zambia. Retrieved November 5, 2009 from https://www.cia.gov/library/publications/the-world-factbook/geos/za.html.

Central Statistics Office - Zambia. (2009). Socio-Demographic Data. Retrieved October 20, 2009 from http://www.zamstats.gov.zm/demo.php.

Clay, J.O., Edwards, J.D., Ross, L.A., Okonkwo, O., Wadley, G.V., Roth, D.L., et al. (2009). Visual Function and Cognitive Speed of Processing mediate Age-related Decline in Memory Span and Fluid Intelligence. *Journal of Aging and Health*, 21.547.

Crnic, K., & Lamberty, G. (1994). Reconsidering school readiness: Conceptual and applied perspectives. *Early Education and Development 5*(2), 99-105.

Dikmen, S.S., Heaton, R.K., Grant, I., & Timken N.R. (1999). Test–retest reliability and practice effects of Expanded Halstead–Reitan neuropsychological test battery. *Journal of the International Neuropsychological Society*, *5, 346–356.*

Donders, and Tulsky. (2001). In Strauss, E., Sherman, M.S.E., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary* (3rd Ed.) (pp.300). Oxford: Oxford University Press.

Dotson, VM., Kitner-Triolo, M., Evans, MK., & Zonderman AB. (2008). Literacy-based normative data for low socioeconomic status African Americans. *The Clinical Neuropsychologist.* 22(6):989–1017.

Dotson, VM., Kitner-Triolo, MH., Evans, MK., & Zonderman AB. (2009). Effects of Race and Socioeconomic Status on the Relative Influence of Education and Literacy on Cognitive Functioning. *Journal of the International Neuropsychological Society.* 15(4): 580–589.

Ellwanger, J., Tenhula, W.N., Rosenfeld, P., & Sweet, J.J. (1999). Identifying simulators of cognitive deficit through combined use of neuropsychological test performance and event-related potentials. *Journal of Clinical and Experimental Neuropsychology.*

Espino, D.V., Lichtenstein, M.J., Palmer, R.F., & Hazuda, H.P. (2001). Ethnic differences in Mini Mental Status Examinations (MMSE) scores: where you live makes a difference. *Journal of American Geriatric Society*, 49, 538-548.

Espino, D.V., Lichtenstein, M.J., Palmer, R.F., & Hazuda, H.P. (2004). Evaluation of Mini Mental Status Examination's internal consistency in a community based sample of Mexican-American and European-American elders: results from San Antonio longitudinal study of aging. *Journal of American Geriatric Society*, 52, 822-827.

Eva J., Sugiyama, T., Winkler, E., Vries, H., Poel, F., & Owen, N. (2009). *Psychosocial correlates of leisure-time walking among Australian adults of lower and higher socio-economic status*. Oxford: Oxford University Press.

Fletcher-Janzen, E., & Daniel M.H. (2006). Socio-economic status(SES) Research. Retrieved October 25, 2009 from http://www.culturalfairness.com/pdf/ses.pdf.

Ganzeboom, H.B. G., De Graaf P. M., & Treiman D.J. (1992). A Standard International Socio-Economic Index of Occupational Status. *Social Science Research*, 21, 1-56.

Gorsuch, R.L., Saklofske, D.H., & Hildebrand, D.K. (2000). Replication of the Factor Structure. The Weschler Adult Intelligence scale, Third Edition with a Canadian Sample. *Psychological Assessment*, 12 (4) :436-439.

Green, W.L. (1970). Manual for Scoring Socioeconomic Status for Research on Health Behaviour. Retrieved august 5, 2009 from http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=2031767&blobtype=pdf

Guilmette, T.J., Hart, K.J., Guiliano, A.J., & Leninger, B.E. (1994). Detecting simulated memory impairment: Comparison of the Rey Fifteen-Item Test and the Hiscock Forced Choice Procedure. *The Clinical Neuropsychologist, 8, 283–294.*

Hazuda, H.P., Haffner, S.M., Stern, M.P., & Eifler, C.W. (1988). Effects of Acculturation and Socioeconomic Status on Obesity and Diabetes in Mexican Americans: The San Antonio Heart Study. *American Journal of Epidemiology*, 128(6), 1289-1301.

Hestad, K., Ellertsen, B., & Kløve, H. (1998). Neuropsychological Assessment in Old Age. In I.H Nordhus, G.R VandenBos, S. Berg, & P. Fromholt (Eds.), *Clinical Neuropsychology* (pp. 259-287). Washington, DC: American Psychological Association.

Hiscock, M., & Hiscock, C.K. (1989). Refining the forced-choice method for the detection of malingering. *Journal of Clinical and Experimental Neuropsychology,* 11, 967–974.

HIV Neurobehavioral Research Center. (2009). *Zambia Neurobehavioral Test Battery*. San Diego, CA: University of California, Department of Psychiatry.

Hodge, W.R., & Treiman, D.J. (1968). Class Identification in the United States. *American Journal of Sociology,* 73, 535-547.

Index Mundi. (2009). Zambia Unemployment Rate. Retrieved October 5, 2009 from http://www.indexmundi.com/zambia/unemployment_rate.html

Jesuit Centre for Theological Reflection (JCTR). (2009). JCTR Basic Needs Basket: Lusaka. Retrieved October 25, 2009 from http://www.jctr.org.zm/bnb/BNBSeptember09Lusaka.pdf

Kaplan, R.M., & Saccuzzo, D.P. (2001*). Psychological Testing: Principles, Applications, and Issues* (5th Ed.). Belmont: Wadsworth/Thomson Learning.

Kenneth, A.D., Gregory, S.P., & Bates, J.E. (1994). Socialization Mediators of the Relation between Socioeconomic Status and Child Conduct Problems. *Child Development*, 65(2), 649-665.

King, J.A, Colla, M., Brass, M., Heuser, I. & Cramon, D.Y. (2007). Inefficient cognitive control in adult ADHD: evidence from trial-by-trial Stroop test and cued task switching performance. *Behavioral and Brain Functions*, 3(42).

Lee, E. (1996). Asian-American families: An overview. In M. McGoldrick, J. Giordano, & J.K. Peace (Eds.), *Ethnicity and family therapy* (2nd ed., pp. 281-294). New York: Guilford.

Lee, T.M.C. and Chan, C.C.H. (2000). Are Trail Making and Color Trails Tests of Equivalent Constructs? *Journal of Clinical and Experimental Neuropsychology,* 22(4), August 2000, 529-534.

Levine, A.J., Miller, E.N., Becker, J.T., Selnes, O.A. & Cohen, B.A. (2004). Normative Data for Determining Significance of Test-Retest Differences on Eight Common Neuropsychological Instruments*. The Clinical Neuropsychologist*, 18(3) 373-384.

Lezak, M.D., Howieson, D.B., & Loring, D.W. (2004). *Neuropsychological Assessment* (4th Ed.). New York: Oxford Press.

Lin, J.C.G., & Yi, J.K. (1997). Asian international students' adjustments: Issues and program suggestions. *College Student Journal*, 31, 473-479.

Manly, J.J., Miller, S.W., Heaton, R.K., Byrd, D., Reilly, J., Velasquez, R.J., Saccuzzo, D.P., Grant, I., & the HIV Neurobehavioral Research Center (HNRC)

Group. (1998). The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals. *Journal of the International Neuropsychological Society,* 4, 291-302.

Marcopulos, B.A., McLain, C.A., & Guliano, A.J. (1997). Cognitive impairment or inadequate norms? A study of healthy, rural, older adults with limited education. *The Clinical neuropsychologists*, 11, 111-131.

Martin, R., Sawrie, S., Gilliam, F., Mackey, M., Faught, E., Knowlton, R. et al (2002). Determining Reliable Cognitive Change after Epilepsy Surgery Development of Reliable Change Indices and Standardised Regression-based Change Norms for the WMS III and WAIS III. *Epilepsia*. 43 (12) 1551-1558

Mortensen, E.L., & Gade, A (1993). On the relation between demographic variables and neuropsychological test performance. *Scandinavian Journal of Psychology*, 34, 305-317.

Mulenga, K., Ahonen, T., & Aro, M. (2001). Performance of Zambian children on the NEPSY: a pilot study. *Developmental Neuropsychology*, 20(1), 375-383.

National Central Regional Laboratory. (2009). Social Economic Status. Retrieved August 30, 2009 from http://www.ncrel.org/sdrs/areas/issues/students/earlycld/ea7lk5.htm

Nicklett, J.E., & Burgard, A.S. (2009). Downward Social Mobility and Major Depressive Episodes among Latino and Asian-American Immigrants to the United States. *American Journal of Epidemiology*, 170(5)

Nuechterlein, K.H., Green, F.M., Kern, R.S., Baade, L.E., Barch, D.M. Cohen, J.H., et al (2008) The MATRICES Consensus Cognitive Battery, Part 1: Test Selection, Reliability, and Validity. *American Journal of Psychiatry* 165(2) 203-213.

Nwadiora, E., & McAdoo, H. (1996). Acculturative stress among American refugees: Gender and racial differences. *Adolescence*, 31, 477-486.

Pallant, Julie. (2007). *SPPS Survival Manual: A Step-by-step Guide to Analysing using SPSS Version 15*. Berkshire: McGraw-Hill Education.

Paolo A.M., Troster A. I., Axelrod B.N. & Koller C.W. (1995). Construct Validity of the WCST in Normal Elderly and Persons With Parkinson's Disease. *Archives of Clinical Neuropsychology*, Vol. 10, No. 5, pp. 463—473

Paul, A.C., Kreiner, D.S., Ray, J.J., Arb, D.J. (2000). Reliability of the WAIS-III Subtests, Indexes and IQs in individuals with Substance abuse Disorders, Assessment, 7 (2):151-156.

Prigatano, G.P., and Amin, K. (1993). Digit memory: unequivocal cerebral dysfunction and suspected malingering. *Journal of Clinical and Experimental Neuropsychology*, 15, 537–546.

Ramey, S.L., & Ramey, C.T. (1994). The transition to school: Why the first few years matter for a lifetime. *Phi Delta Kappan, 76*(30), 194-198.

Robert, S.A. (1998). Community-Level Socioeconomic Status Effects on Adult Health. *Journal of Health and Social Behaviour*, 39(1), 18-37.

Sacks, T.L., Clark, C.R., Pols, R.G. & Geffen, L.B. (1991). Comparability and stability of performance of six alternate forms of the dodrill-stroop colour-word test. *The Clinical Neuropsychologist*, 5 (3) 220-225.

Schwartz, B., Glass, T.A., Bolla, K.I., Stewart, W. F., Glass, G., Rasmussen, M., Bressler, J., Shi, W., & Bandeen-Roche, K. (2004). Disparities in cognitive functioning by race /ethnicity in Baltimore Memory Study-Research. Environmental Health Perspectives. Retrieved august 5, 2009 from http://findarticles.com/p/articals/mi_mOCYP/is_3_112/ai_115034520/.

Sewell, W.H., & Shah, V.P. (1967). Socioeconomic Status, Intelligence, and the Attainment of Higher Education. *Sociology of Education*, 40(1), 1-23.

Siachitema, A.K. (1991).The social significance of language use and language choice in a Zambian urban setting: An empirical study of three neighbourhoods in Lusaka. In J. Cheshire (Ed.), *English around the World: Sociolinguistic Perspectives* (475-490). New York: Cambridge University Press.

Skuy, M., Schutte, E., Fridjhon, P., & O'Carroll, S. (2001). Suitability of published neuropsychological test norms for urban African secondary school students in South Africa. *Personality and Individual Differences*, 30(8), 1413-1425.

Solso, R.L., Maclin, O.H., & Maclin, M.K. (2008). *Cognitive Psychology*. (8th Ed.). Boston: Pearson Education, Inc.

Solso, Robert L. (2001). *Cognitive Psychology*. (6th Ed.). Boston: Pearson Education Company, Inc.

State House (2011). Preliminary results of the 2010 census of population and housing. Retrieved March 10, 2011 from http://www.statehouse.gov.zm/index.php/component/content/article/48-featured-items/2541-zambias-population-now-13-million-census.

Strauss, E., Sherman, M.S.E., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary* (3rd Ed.). Oxford: Oxford University Press.

Stuss, D.T., Stethem, L.L., & Poirier, C.A. (1987). Comparison of three tests of attention and rapid information processing across six age groups. *The clinical Neuropsychologist*, 1, 139-152.

Stuss, D.T., Stethem, L.L., Hegenhoiltz, H., & Richard, M.T. (1989). Traumatic brain injury: A comparison of three clinical tests and analysis of recovery. *The Clinical Neuropsychologist*, 3, 145-156.

Treiman, D.J. (1977). *Occupational Prestige in Comparative Perspective*. New York: Academic Press.

Troyer, A.K. (2000). Normative data for Clustering and Switching on Verbal Fluency Task. *Journal of Clinical and Experimental Psychology*, 22, 370 – 378.

Weschler, D. (1991). *Wechsler Memory Scale*. In Strauss, E., Sherman, M.S.E., & Spreen, O. (2006). *A Compendium of Neuropsychological Tests: Administration, Norms, and Commentary* (3rd Ed.) (pp.283). Oxford: Oxford University Press.

Wilde, N. and Strauss, E. (2002). Functional equivalence of WAIS-III/WMS-III digit and spatial span under forward and backward recall conditions. *The Clinical Neuropsychologist*, 16(3), 322-330.

Woods S. (2005). Construct validity of Hopkins Learning Test-Revised Component Measures in an HIV-1 sample. *Archives of Clinical Neuropsychology*, 20 (8) :1061 – 1071.

Woods, SP., Childers, M., Ellis, R.J., Guaman, S., Grant, I., Heaton, R.K., & The HIV Neurobehavioral Research Center (HNRC) Group. (2006). A battery approach for measuring neuropsychological change. *Archives of Clinical Neuropsychology*, 21, 83-89.

Zillmer, EA., Spiers, MV., & Culbertson, WC. (2008). *Principles of Neuropsychology* (2nd Ed.). California: Wadsworth, Cengage Learning.

Zvia B., & Gabriella N. (1998). Differences in Concentration Ability among Low- and High-SES Israeli Students: a Follow-Up Study. *Journal of Genetic Psychology*, Vol. 159.

APPENDICES

APPENDIX A_1

MINISTRY OF HEALTH PROJECT APPROVAL LETTER

All Correspondence should be addressed to the
Permanent Secretary
Telephone: +260 211 253040/5
Fax : +260 211 253344

In reply please quote:

No.....

REPUBLIC OF ZAMBIA

MINISTRY OF HEALTH

NDEKE HOUSE
P. O. BOX 30205
LUSAKA

13th May 2010

School of Medicine,
Department of Pediatrics and Child Health
P.O Box 50110,
Lusaka

Dear Prof. MPS Ngoma,

Re: Request for Authority for Dissertation Proposals in respect of nine Neuro-Psychology Students

The Ministry of Health is in receipt of your request on behalf of Neuro-Psychology Students to conduct research in the following areas:

1. Neuro-cognitive functioning in Hypertension; Measured in battery – A Pilot Study.
2. The Relationship between Literacy and Neuropsychology Test Performance among Adults in Zambia
3. The Relationship Between individual's Number of Languages Spoken and Performance on the Clinical Neuropsychological Test Battery
4. Influence of Education and age in Performance on the Zambia Neurobehavioral Test Battery with the Zambia Achievement Test as a Measure of Educational Attainment.
5. Social Economic Status and Neuropsychological Assessment in Zambia
6. Cultural Influence on Neuropsychological Test in Zambia
7. Effect of Quality of Education on Neuropsychological Tests performance Among Zambian Adults
8. The Relationship between Moderate Alcohol Consumption and Cognitive function
9. Performance of Urban and Rural Adults in Neuropsychological Tests in Zambia

I wish to inform you that following submission of your research proposals and subsequent communication to my Ministry, our review of the same and in view of the ethical clearance, my Ministry has granted you authority to carry out the studies on condition that:

1. The relevant Provincial and District Directors of Health where the study is being conducted are fully appraised
2. Progress updates are provided to MOH quarterly from the date of commencement of the study.
3. The final study report is cleared by the MoH before any publication or dissemination within or outside the country.

Yours sincerely,

Dr. Peter Mwaba
Permanent Secretary

THE UNIVERSITY OF ZAMBIA

BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: 260-1-256067
Telegrams: UNZA, LUSAKA
Telex: UNZALU ZA 44370
Fax: + 260-1-250753
E-mail: unzarec@unza.zm
Assurance No. FWA00000338
IRB00001131 of IORG0000774

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia

No objection
P.C. Chongwe
DMO

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
CHONGWE DISTRICT HEALTH MANAGEMENT TEAM
06 MAY 2010
DISTRICT DIRECTOR OF HEALTH
P.O. BOX 25, CHONGWE

16 April, 2010
Ref.: 018-02-10

Mr Katongo Owen Kabanda
Department of Physiological Sciences
School of Medicine
University of Zambia
LUSAKA

Dear Mr Kabanda,

RE: SUBMITTED RESEARCH PROPOSAL: **"SOCIAL ECONOMIC STATUS AND NEUROPSYCHOLOGICAL TEST PERFORMANCE IN ZAMBIA"**

The above-mentioned research proposal was presented to the Biomedical Research Ethics Committee on 16 February, 2010 where changes/clarifications were recommended. We would like to acknowledge receipt of the corrected version with clarifications. The proposal is now approved.

CONDITIONS:

- This approval is based strictly on your submitted proposal. Should there be need for you to modify c change the study design or methodology, you will need to seek clearance from the Research Ethics Committee.
- If you have need for further clarification please consult this office. Please note that it is mandatory that you submit a detailed progress report of your study to this Committee every six months and a final copy of your report at the end of the study.
- Any serious adverse events must be reported at once to this Committee.
- Please note that when your approval expires you may need to request for renewal. The request shou be accompanied by a Progress Report (Progress Report Forms can be obtained from the Secretariat).
- **Ensure that a final copy of the results is submitted to this Committee.**

Yours sincerely,

Dr James Munthali
A/CHAIRPERSON

Date of approval: 16 April, 2010 **Date of expiry**: 15 April, 2011

THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

Telephone: 252641
211440 (UTH) 254824 (Pre-Clinical) Ridgeway Campus
Fax: + 260 – 1 – 250753

P.O. Box 50110
Lusaka, Zambia

Permission granted

REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
CHONGWE DISTRICT HEALTH MANAGEMENT TEAM
06 MAY 2010
DISTRICT DIRECTOR OF HEALTH
P.O. BOX 25, CHONGWE

19th April, 2010

The District Medical Officer,
Chongwe District Health Management Team,
Lusaka.

Dear Sir / Madam,

RE: Permission to Conduct Research Projects by MSc-Students

We are running an MSc in Clinical Neuro-Psychology program and have the first cohort of students proceeding into the Thesis stages of their studies. These students are to do research projects in the Clinical sphere. Some urban and rural clinics have been selected to be the ideal sites for these projects.

I write to request your express permission for the following student to do the research within your clinics.

Name : OWEN KATONGO

Computer No. 528003381

Project Title: Social Economic Status and neuropsychological test performance in Zambia

Supervisors: Dr. S. Mwaba and Dr. M. Banda

Find attached the letter of approval from the Biomedical Research Ethics Committee.

I thank you in anticipation of your usual assistance towards these activities that enhance learning and training of our graduate students.

THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE
HEAD OF DEPARTMENT
DEPARTMENT OF PHYSIOLOGICAL SCIENCES

I remain sincerely yours,

Fastone M. Goma MD(UNZA), MSc(Lon), PhD(Leeds)
Senior Lecturer

APPENDIX A_2

INFORMED CONSENT FORM

THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINES
DEPARTMENT OF PSYCHIATRY
P. O. Box 32379, Lusaka, Zambia

PLEASE READ THIS DOCUMENT CAREFULLY. SIGN YOUR NAME BELOW **ONLY** IF YOU AGREE TO PARTICIPATE AND YOU FULLY UNDERSTAND YOUR RIGHTS. YOUR SIGNATURE IS REQUIRED FOR PARTICIPATION. FOR THIS PROJECT, YOU MUST BE 18 YEARS OF AGE AND ABOVE TO PARTICIPATE. IF YOU DESIRE A COPY OF THIS CONSENT FORM, YOU MAY REQUEST ONE AND WE WILL PROVIDE IT.

Dear Sir/Madam,

RE: SOCIO-ECONOMIC STATUSAND NEUROPSYCHOLOGICAL TEST PERFORMANCE IN ZAMBIA

We are kindly asking you to participate in the above captioned study. It is specifically meant:

1. To establish the level to which each of the socio-economic status indices (education, occupation, income, and residence) predict neuropsychological test performance.
2. To determine which tests in the Zambia neuropsychological test battery show the most relationship with socio-economic status.
3. To establish if there is a significant difference in mean test scores between the low and high socio-economic status participants.

Description and Purpose of the Study:
The study will involve an assessment of people's thought processes and behaviour using standardized neuropsychological tests. You will be required to answer questionnaires and take a group of tests of attention, language, motor functions and memory. This will involve answering questions and doing certain activities. There is currently no data for the standardisation of neuropsychological tests in Zambia. This study is therefore aimed at collecting such information from different Zambians.

Time Involvement
The whole process will take approximately 2:30 to 3:00 hours to complete.

Risks and Benefits:

- You may experience fatigue due to the length of time required for the testing process. To reduce on this you are free to ask for a short break whenever you require it.
- We cannot guarantee that you will receive any direct benefits from this study though you will have an opportunity to contribute to neuropsychological assessments that will help Zambians in general by participating in this study.

Compensation for Your Time:

You will be compensated for your time with a transport and meal allowance of K50, 000.

Participation Rights:

- Participation in this study is purely voluntary so that if you decide to withdraw at any point, there will be no consequences to you.
- All personal identifying information will be kept confidential and the data sheets will be kept in secured lockers in accordance with the standards of the University of Zambia Biomedical Ethics Committee. If the results of this study are required for publication, your identity will still be kept private.

Signatures

I,……(name) have read and understood the above information. As the participant in this project, my signature testifies that I understand the consent process and management of confidentiality as indicated above. I also understand that I can withdraw at any time.

Signature of Research Participant…….....Date:...../...../2010

Name and Signature of Witness……...……...Date:...../...../2010

Owen Katongo Kabanda (Researcher) ……..... Date: ...../...../2010

Contacts

If you have any further questions about this research please contact:

Dr. A. Menon
Project Coordinator
University of Zambia
Psychology Department
P. O. Box 32379
LUSAKA
Mobile: 0977 846116

Owen Katongo Kabanda
Principal Investigator
University of Zambia
Department of Psychiatry
P. O. Box 32379
LUSAKA
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Secretary to
Biomedical Ethics
Ridgeway Campus
P. O. Box 50110
LUSAKA
Telephone: 256067

APPENDIX B:

DEMOGRAPHIC QUESTIONNAIRE

THE UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT OF PSYCHIATRY

P. O. Box 32379, Lusaka, Zambia

QUESTIONNAIRE

FOR

ZAMBIAN NEUROPSYCHOLOGICAL ASSESSMENT

FOR OFFICIAL USE ONLY

Date:……

Clinic/Centre:……

Examiner:……

Participant's Number:……

INSTRUCTIONS

A. Please give/tick [√] the appropriate answer to the question.

B. All the information you will provide will be used for the purpose of this study only, therefore, provide genuine information and ensure that all questions are carefully answered. All information will be kept confidential.

For Official use only

EDUCATION

Q1. In general, what type of pre-tertiary school did you attend?

1.1. Primary [ ]

1.1.1. Community school [ ]

1.1.2. Private school [ ]

1.1.3. Mission [ ]

1.1.4. Public School [ ]

1.2. Secondary [ ]

1.2.1. Community school [ ]

1.2.2. Private school [ ]

1.2.3. Mission [ ]

1.2.4. Public School [ ]

Q2. At these levels of education, approximately how big were your classes?

2.1. Primary

2.1.1. Below 36 [ ]

2.1.2. 36 to 50 [ ]

2.1.3. More than 50 [ ]

2.2. Secondary

2.2.1. Below 36 [ ]

2.2.2. 36 to 50 [ ]

2.2.3. More than 50 [ ]

Q3. How many hours did you spend learning at school per day

3.1. Primary

3.1.1. Less than 4hrs [ ]

3.1.2. 4hrs – 5hrs [ ]

3.1.3. 6hrs and more [ ]

3.2. Secondary

3.2.1. Less than 4hrs [ ]

3.2.2. 4hrs – 5hrs [ ]

3.2.3. 6hrs and more [ ]

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Q4. How many hours did you spend studying (in prep) at school per day

4.1. Primary

4.1.1. None [ ]

4.1.2. 1hr [ ]

4.1.3. 2hrs and more [ ]

4.2. Secondary

4.2.1. None [ ]

4.2.2. 1hr [ ]

4.2.3. 2hrs and more [ ]

Q5. With regards the sitting arrangement in your said classes, how adequate where they?

5.1. Primary

5.1.1. No desks [ ]

5.1.2. Few [ ]

5.1.3. Adequate [ ]

5.2. Secondary

5.2.1. No desks [ ]

5.2.2. Few [ ]

5.2.3. Adequate [ ]

Q6. How adequate were the reading materials in your classes?

6.1. Primary

6.1.1. Not available [ ]

6.1.2. Few [ ]

6.1.3. Adequate [ ]

6.2. Secondary

6.2.1. Not available [ ]

6.2.2. Few [ ]

6.2.3. Adequate [ ]

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Q7. Did your school have the following:

7.1. Primary school library

7.1.1. Yes [ ]

7.1.2. No [ ]

7.2. Primary school laboratory

7.2.1. Yes [ ]

7.2.2. No [ ]

7.3. Secondary school library

7.3.1. Yes [ ]

7.3.2. No [ ]

7.4. Secondary school laboratory

7.4.1. Yes [ ]

7.4.2. No [ ]

Q8. What were the qualifications of most (≥70%) of your teachers:

8.1. Primary

8.1.1. I do not know [ ]

8.1.2. Primary teachers' Certificate [ ]

8.1.3. Secondary teachers' diploma [ ]

8.1.4. Bachelors degree [ ]

8.2. Secondary

8.2.1. I do not know [ ]

8.2.2. Primary teachers' Certificate [ ]

8.2.3. Secondary teachers' diploma [ ]

8.2.4. Bachelors degree [ ]

8.2.5. Masters degree [ ]

For Official use only

Q9. Has your education been helpful in your execution of daily activities?

9.1. Yes [ ]

9.2. No [ ]

Q10. In what four major ways would you say your education has been helpful? (please indicate)

10.1. ..... [ ]

10.2. ..... [ ]

10.3. ..... [ ]

10.4. ..... [ ]

Q11. How often would you say you read (any reading material)?

11.1. Not at all [ ]

11.2. Sometimes (≤4 times in a 6 months) [ ]

11.3. Often (at least once in a week) [ ]

11.4. Very often (at least once in a day) [ ]

Q12. If you read, what materials do you most often read?

12.1. Religious materials [ ]

12.2. Political materials [ ]

12.3. Work related materials [ ]

12.4. Anything interesting [ ]

12.5. Anything as the need arise [ ]

Q13. With your currently attained education, are you considering furthering your studies?

13.1. Yes [ ]

13.2. No [ ]

Q14. How old are you? .....

Q15. Where have you spent most of your life?

15.1. In the rural area [ ]

15.2. In the urban area [ ]

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EMPLOYMENT, INCOME, & RESIDENCE

Q16. What are you currently doing?

16.1. Unemployed [ ]

16.2. Self-employed [ ]

16.3. Employed [ ]

16.4. Retired [ ]

Q17. What is your occupation?

17.1. Unskilled (e. g maid, farm labourer, etc) [ ]

17.2. Semi-skilled (e. g plumber, bus driver, etc) [ ]

17.3. Skilled (e. g, accountant, physician, etc) [ ]

17.4. Specialist (e. g consultant, economic analysts) [ ]

Q18. What is your income per year?

18.1. Less than K12 million [ ]

18.2. K12 million and above [ ]

Q19. Where do you currently live?

19.1. Low cost rural area (e. g village) [ ]

19.2. High cost rural area (e. g 'boma') [ ]

19.3. Low cost urban area (e. g high density area) [ ]

19.4. High cost urban area (e. g low density area) [ ]

LANGUAGE & TECHNOLOGY

Q20. What is your mother tongue?

20.1. Bemba [ ]

20.2. Chewa [ ]

20.3. Tonga [ ]

20.4. Lozi [ ]

20.5. Other (please indicate)..... [ ]

For Official use only

Q21. From a scale of 1 to 5 rate your knowledge of your mother tongue.

21.1. 1. very poor [ ]

21.2. 2. poor [ ]

21.3. 3. fair [ ]

21.4. 4. good [ ]

21.5. 5. very good [ ]

Q22. Apart from your mother tongue list any other languages that you speak (List them in the order of frequency of use).

……

……

……

……

……

……

……

……

……

……

Q23. How much do you know each of the languages you have listed above? (Rate yourself on a scale of 1 to 5 for each of the languages you have listed above.)

23.1. 1. very poor [ ]

23.2. 2. poor [ ]

23.3. 3. fair [ ]

23.4. 4. good [ ]

23.5. 5. very good [ ]

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Q24. Of the languages you just mentioned which of them do you frequently use?

……

……

……

……

……

……

Q25. At what age did you acquire the languages you speak?

……

……

……

……

……

……

Q26. How much would you say you use the English language in communicating?

26.1. Rarely (just know and use one or two words) [ ]

26.2. Sometimes (only in formal situations) [ ]

26.3. Often (at least in one conversation in a week) [ ]

26.4. Very often (in almost all my conversations) [ ]

Q27. How often do you use computers?

27.1. Not at all [ ]

27.2. Sometimes (less than 4 times in a year) [ ]

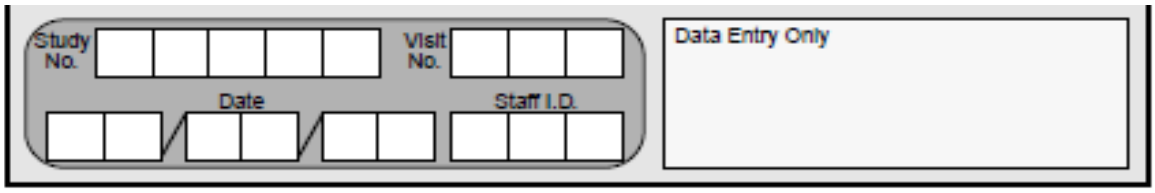
27.3. Often (at least once in a month) [ ]

27.4. Very often (at least once in a week) [ ]

Thank you for your cooperation and contributions

APPENDIX C:

ZAMBIA NEUROPSYCHOLOGICAL BATTERY



ZAMBIA NEUROBEHAVIORAL BATTERY

_____ **Handout: Beck Depression Inventory-II (CH3)**
_____ **Handout: Patient's Assessment of Own Functioning (NP6)**
_____ **Handout: Activities of Daily Living (NC2)**
_____ **Handout: Substance Use (CH13A)**
_____ **Handout: Substance Use History (CH13D)**
_____ **Handout: Use of Academic Skills Questionnaire (CN18)**

_____ **Neurobehavioral Medical Screen (CH42)**
_____ **Behavioral Notes (NP31)**
_____ **Hiscock Digit Memory Test (NC3)**
_____ **Hopkins Verbal Learning Test - Revised Record Form A (TB15Z)**
_____ **Brief Visuospatial Memory Test - Revised (TB16)**
_____ **WAIS-III Digit Symbol (ND16)**
_____ **WAIS-III Symbol Search (ND18)**
_____ **Grooved Pegboard Test (TB31)**
_____ **Hopkins Verbal Learning Test - Revised Record Form A (TB15A)** - *20 min delay*
_____ **Brief Visuospatial Memory Test - Revised (TB16)** - *25 min delay*
_____ **Trail Making Test A (NP19A)**
_____ **Color Trails 1 (NP41A)**
_____ **Color Trails 2(NP41B)**
_____ **WMS-III Spatial Span (ND30)**
_____ **Wisconsin Card Sorting Test - Computerized 64 Items**
_____ **Controlled Oral Word Association Test - FAS (NP23A)**
_____ **Category Fluency Test (NP27)**
_____ **Paced Auditory Serial Addition Task (NP17B)**
_____ **Stroop Color and Word Test (NC6-N)**
_____ **Halstead Category Test (NP12)**

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BECK DEPRESSION INVENTORY-II

FS SCORE: BECK TOTAL:

INSTRUCTIONS TO PARTICIPANT: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group.

1. **Sadness**
   - I do not feel sad 0
   - I feel sad much of the time 1
   - I am sad all the time. 2
   - I am so sad or unhappy that I can't stand it. 3

2. **Pessimism**
   - I am not discouraged about my future 0
   - I feel more discouraged about my future than I used to be 1
   - I do not expect things to work out for me 2
   - I feel my future is hopeless and will only get worse 3

3. **Past Failure**
   - I do not feel like a failure 0
   - I have failed more than I should have 1
   - As I look back, I see a lot of failures 2
   - I feel I am a total failure as a person 3

4. **Loss of Pleasure**
   - I get as much as I ever did from the things I enjoy 0
   - I don't enjoy things as much as I used to 1
   - I get very little pleasure from the things I used to enjoy 2
   - I can't get any pleasure from the things I used to enjoy 3

5. **Guilty Feelings**
   - I don't feel particularly guilty 0
   - I feel guilty over many things I have done or should have done 1
   - I feel quite guilty most of the time 2
   - I feel guilty all of the time 3

6. **Punishment Feelings**
   - I don't feel I am being punished 0
   - I feel I may be punished 1
   - I expect to be punished 2
   - I feel I am being punished 3

7. **Self-Dislike**
   - I feel the same about myself as ever 0
   - I have lost confidence in myself 1
   - I am disappointed in myself 2
   - I dislike myself 3

8. Self-Criticalness

I don't criticize or blame myself more than usual 0
I am more critical of myself than I used to be 1
I criticize myself for all my faults 2
I blame myself for everything bad that happens 3

9. Suicidal Thoughts or Wishes

I don't have any thoughts of killing myself 0
I have thoughts of killing myself, but I would not carry them out 1
I would like to kill myself 2
I would kill myself if I had the chance 3

10. Crying

I don't cry any more than I used to 0
I cry more than I used to 1
I cry over every little thing 2
I feel like crying, but I can't 3

11. Agitation

I am no more restless or wound up than usual 0
I feel more restless or wound up than usual 1
I am so restless or agitated that it's hard to stay still 2
I am so restless or agitated that I have to keep moving or doing something 3

12. Loss of Interest

I have not lost interest in other people or activities 0
I am less interested in other people or things than before 1
I have lost most of my interest in other people or things 2
It's hard to get interested in anything 3

13. Indecisiveness

I make decisions about as well as ever 0
I find it more difficult to make decisions than usual 1
I have much greater difficulty in making decisions than I used to 2
I have trouble making any decisions 3

14. Worthlessness

I do not feel that I am worthless 0
I don't consider myself as worthwhile and useful as I used to 1
I feel more worthless as compared to other people 2
I feel utterly worthless 3

15. Loss of Energy

I have as much energy as ever 0
I have less energy than I used to have 1
I don't have enough energy to do very much 2
I don't have enough energy to do anything 3

16. Changes in Sleeping Pattern

I have not experienced any change in my sleeping pattern 0
I sleep somewhat more than usual 1a
I sleep somewhat less than usual 1b
I sleep a lot more than usual 2a
I sleep a lot less than usual 2b
I sleep most of the day 3a
I wake up 1-2 hours early and can't get back to sleep 3b

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17. Irritability

I am no more irritable than usual 0
I am more irritable than usual 1
I am much more irritable than usual 2
I am irritable all the time 3

18. Changes in Appetite

I have not experienced any change in my appetite 0
My appetite is somewhat less than usual 1a
My appetite is somewhat greater than usual 1b
My appetite is much less than before 2a
My appetite is much greater than usual 2b
I have no appetite at all 3a
I crave food all the time 3b

19. Concentration Difficulty

I can concentrate as well as ever 0
I can't concentrate as well as usual 1
It's very hard to keep my mind on anything for very long 2
I find I can't concentrate on anything 3

20. Tiredness or Fatigue

I am no more tired or fatigued than usual 0
I get more tired or fatigued more easily than usual 1
I am too tired or fatigued to do a lot of the things I used to do 2
I am too tired or fatigued to do most of the things I used to do 3

21. Loss of Interest in Sex

I have not noticed any recent change in my interest in sex 0
I am less interested in sex than I used to be 1
I am much less interested in sex now 2
I have lost interest in sex completely 3

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PATIENT'S ASSESSMENT OF OWN FUNCTIONING

INSTRUCTIONS TO PARTICIPANTS: Please answer each of the following questions by circling the number that best describes your response to each of the following statements. There is no right or wrong answer. Express how you have been feeling lately. It will tell us more about your daily functioning and any problems you might be having in your daily living.

Manner of Inventory Administration:

[ ] Participant read and answered items independently.
[ ] Items read by examiner.
[ ] Examiner read items, and marked verbal given answers.
[ ] Examiner marked answers given verbally.

SCALE I: MEMORY

	Almost Always	Very Often	Fairly Often	Once in A While	Very Infrequently	Almost Never
1. How often do you forget something that has been told to you within the last day or two?	1	2	3	4	5	6
2. How often do you forget events which have occurred in the last day or two?	1	2	3	4	5	6
3. How often do you forget people whom you met in the last day or two?	1	2	3	4	5	6
4. How often do you forget things that you knew a year or more ago?	1	2	3	4	5	6
5. How often do you forget people whom you knew or met a year or more ago?	1	2	3	4	5	6
6. How often do you lose track of time, or do things either earlier or later than they are usually done or are supposed to be done?	1	2	3	4	5	6
7. How often do you fail to finish something you start because you forgot that you were doing it? (Include such things as forgetting to put out cigarettes, turning off the stove, etc.)	1	2	3	4	5	6
8. How often do you fail to complete a task that you start because you have forgotten how to do one or more aspects of it?	1	2	3	4	5	6
9. How often do you lose things or have trouble remembering where they are?	1	2	3	4	5	6
10. How often do you forget things that you are supposed to do or have agreed to do (such as putting gas in the car, paying bills, taking care of errands, etc.)?	1	2	3	4	5	6

SCALE II: LANGUAGE AND COMMUNICATION

	Almost Always	Very Often	Fairly Often	Once In A While	Very Infrequently	Almost Never
11. How often do you have difficulties understanding what is said to you?	1	2	3	4	5	6
12. How often do you have difficulties recognizing or identifying printed words?	1	2	3	4	5	6
13. How often do you have difficulty understanding reading material which at one time you could have understood?	1	2	3	4	5	6
14. Is it easier to have people show you things than it is to have them tell you about things?	1	2	3	4	5	6
15a. When you speak, are your words indistinct or improperly pronounced?	1	2	3	4	5	6
15b. If this happens, how often do people have difficulty understanding what words you are trying to say?	1	2	3	4	5	6
16. How often do you have difficulty thinking of the names of things?	1	2	3	4	5	6
17. How often do you have difficulty thinking of the words (other than names) for what you want to say?	1	2	3	4	5	6
18. When you write things, how often do you have difficulty forming the letters correctly?	1	2	3	4	5	6
19. Do you have more difficulty spelling, or make more errors in spelling, than you used to?	1	2	3	4	5	6

SCALE III: USE OF HANDS

	Almost Always	Very Often	Fairly Often	Once In A While	Very Infrequently	Almost Never
20. How often do you have difficulty performing tasks with your right hand (including such things as writing, dressing, carrying, lifting, sports, cooking, etc.)?	1	2	3	4	5	6
21. How often do you have difficulty performing tasks with your left hand?	1	2	3	4	5	6

SCALE IV: SENSORY-PERCEPTUAL

	Almost Always	Very Often	Fairly Often	Once In A While	Very Infrequently	Almost Never
22. How often do you have difficulty feeling things with your right hand?	1	2	3	4	5	6

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	Almost Always	Very Often	Fairly Often	Once In A While	Very Infrequently	Almost Never
23. How often do you have difficulty feeling things with your left hand?	1	2	3	4	5	6
24a. Lately do you have more difficulty than you used to in seeing all of what you are looking at, or all of what is in front of you (in other words, are some areas of your vision less clear or less distinct than others)?	1	2	3	4	5	6

	To The Right	To The Left	Cannot Tell Whether One Side Is Worse Than The Other
24b. If you are having this kind of trouble with your vision, is it more difficult to see things located to your right or to your left?	1	2	3

SCALE V: HIGHER LEVEL COGNITIVE AND INTELLECTUAL FUNCTIONS

	Almost Always	Very Often	Fairly Often	Once In A While	Very Infrequently	Almost Never
25. How often do your thoughts seem confused or illogical?	1	2	3	4	5	6
26. How often do you become distracted from what you are doing or saying by insignificant things which at one time you would have been able to ignore?	1	2	3	4	5	6
27. How often do you become confused about (or make a mistake about) where you are?	1	2	3	4	5	6
28. How often do you have difficulty finding your way about?	1	2	3	4	5	6
29. Do you have more difficulty now than you used to in calculating or working with numbers (including managing finances, paying bills, etc.)?	1	2	3	4	5	6
30. Do you have more difficulty now than you used to in planning or organizing activities (i.e., deciding what to do and how it should be done)?	1	2	3	4	5	6
31. Do you have more difficulty now than you used to in solving problems that come up around the house, at your job, etc.? (In other words, when something new has to be accomplished, or some new difficulty comes up, do you have more trouble figuring out what should be done and how to do it?)	1	2	3	4	5	6
32. Do you have more difficulty than you used to in following directions to get somewhere?	1	2	3	4	5	6

	Almost Always	Very Often	Fairly Often	Once in A While	Very Infrequently	Almost Never
33. Do you have more difficulty than you used to in following instructions concerning how to do things?	1	2	3	4	5	6

34. Do you think you are as "bright" now as you were before your accident or present illness?

Yes 1
No 2
I don't know 3

SCALE VI: WORK

35. Are you presently holding a job?

Yes, Full-time 1
Yes, Part-time 2
No ..... SKIP TO QUESTION 39 3

36. What kind of job do you have, and briefly describe your duties:

_____
_____
_____

37. What is your salary per month: _____

38. On your job how much supervision is being given to you now?

I am closely observed and supervised in almost everything I do. 1
There is a supervisor around most of the time, but supervision is not really constant. 2
I receive only occasional supervision, though there may be more when a new job is given or after a job is completed. 3
I usually receive supervision only when being given a new job to do, or after a job has been completed. 4
I function very much on my own at work. 5
I am self-employed. 6

39. Are you a student?

Yes, Full-time 1
Yes, Part-time 2
No ..... SKIP QUESTIONS 40 & 41 3

40. Are you currently taking regular academic courses or special education courses?

All special education courses 1
Mostly special education courses 2
About an equal number of each type of course 3
Mostly regular academic courses 4
All regular academic courses 5

41. What is your approximate grade point average in regular academic courses only (i.e., leaving out grades in special education courses)?

Better than 3.7 (A) 1
3.0 to 3.6 (B to A minus) 2
2.0 to 2.9 (C to B minus) 3
1.0 to 1.9 (D to C minus) 4
Less than 1.0 (F) 5

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ACTIVITIES OF DAILY LIVING

INSTRUCTIONS TO PARTICIPANT: We are interested in knowing how well you are able to perform common tasks.

- Please circle the number under the "NOW" column that most accurately indicates your current ability level.
- Then circle the number under the "BEST" column that most accurately indicates your highest ability level (this would be the time in your life when you were functioning at your best).

Please add any comments that you feel will help clarify your responses (e.g., when you started having difficulties and what you think are the causes of the problem).

1. Housekeeping	Now	Best
I maintain my house/apartment by myself or only need occasional help for larger jobs	0	0
I only perform light daily tasks (wash dishes, make bed)	1	1
I perform some light tasks, but have difficulty keeping my place clean	2	2
I need help with all housekeeping tasks	3	3
I am fully able to do housekeeping, but choose not to do so	8	8

Comments_____

2. Managing finances	Now	Best
I manage all of my finances (check cashing, banking, handling money) by myself	0	0
I manage routine small purchases, but need help with banking, checking and balancing accounts	1	1
I am not able to handle money accurately	2	2
I am able to handle my own finances, but someone else does them for me	8	8

Comments_____

3. Buying Groceries	Now	Best
I create my own grocery list and do my own shopping	0	0
I need occasional assistance in buying groceries	1	1
I need someone else to do my grocery shopping for me	2	2
I am able to create my own grocery list and do my own shopping, but someone else does it for me	8	8

Comments_____

4. Cooking	Now	Best
I plan, prepare, and serve many of my own meals	0	0
I prepare meals if someone else provides me with the right ingredients	1	1
I heat and serve meals provided by others	2	2
I need to have meals prepared and served to me	3	3
I am able to plan, prepare, and serve my own meals but someone else does it for me	8	8

Comments_____

5. Planning social activities	Now	Best
I frequently initiate and plan social activities (e.g., going out, having a party)	1	1
I rarely initiate and plan social activities	2	2
I do not plan and initiate social activities	3	3

Comments_____

_____

6. Understanding reading materials/TV	Now	Best
I understand reading materials (e.g., novels, newspaper) and TV (plots, etc.) without difficulty	0	0
I have occasional difficulty understanding reading materials or TV	1	1
I have frequent difficulty understanding reading materials or TV	2	2
I am unable to understand reading materials or TV	3	3

Comments_____

_____

7. Transportation	Now	Best
I drive my own car or take public transportation on my own (if you do not own a car)	0	0
I arrange my own travel using taxis, but do not drive or use public transportation	1	1
I can travel on public transportation or use taxis if I am assisted by another	2	2
I do not travel at all	3	3

Comments_____

_____

8. Using the telephone	Now	Best
I handle using the telephone without difficulty (looking up and dialing new numbers, etc.)	0	0
I only dial a few well-known numbers	1	1
I answer the telephone, but do not dial	2	2
I do not use the telephone at all	3	3
I do not have access to a telephone	8	8

9. Home repairs	Now	Best
I handle most minor home repairs (plumbing, gardening)	0	0
I need assistance with most minor home repairs	1	1
I am unable to do most repairs by myself	2	2
I am capable of making minor repairs but choose not to	8	8

Comments_____

_____

10. Bathing	Now	Best
I handle all of my bathing needs by myself	0	0
I need occasional assistance with bathing (getting in and out of the tub/shower, etc.)	1	1
I always need help from others when bathing	2	2

Comments_____

_____

11. Dressing	Now	Best
I am able to dress myself and pick out my own clothes	0	0
I dress myself, but someone else must pick out my clothes for me	1	1
I need occasional assistance getting dressed or frequently make mistakes in choosing clothes	2	2
I need frequent assistance in getting dressed	3	3

Comments_____

_____

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	Now	Best
12. Shopping (e.g., clothes, other non-food goods)		
I take care of all of my shopping needs	0	0
I only make small purchases	1	1
I need someone to go with me on any shopping trip	2	2
I am unable to shop	3	3
I am able to shop, but choose to have someone else do my shopping for me	8	8

Comments _____

_____

	Now	Best
13. Laundry		
I do all of my own laundry	0	0
I need occasional help in doing the laundry	1	1
I launder only small items (e.g., rinse socks, stockings, etc.)	2	2
All laundry must be done by others	3	3
I am able to do my own laundry, but choose to have others do it for me	8	8

Comments _____

_____

	Now	Best
14. Taking/keeping track of medication		
I take sole responsibility for taking medications in correct dosages at the correct time	0	0
I take medications that are prepared in individual doses by someone else	1	1
I am unable to track my own medications	2	2
I am able to take care of my own medications, but choose to have someone else do it for me	8	8

Comments _____

_____

	Now	Best
15. Child Care		
I am fully able to handle child care	0	0
I need occasional assistance in caring for my children	1	1
I need constant assistance in caring for my children	2	2
I do not have children	8	8

Comments _____

_____

	Now	Best
16. Work		
I am efficient at work	0	0
I am not very efficient at work and have difficulty maintaining attention or finishing tasks	1	1
I am having a great deal of difficulty in maintaining attention or finishing tasks at work	2	2
I am no longer able to work	8	8

Comments _____

_____

17. Please tell us of any other areas in which you are having difficulty:

_____

_____

_____

18. **What do you think are your major areas of difficulty at this time?**

_____

_____

_____

19. **I feel that the difficulties that I am having on the above tasks, if any, are due to:** **Now**

Primarily cognitive problems (e.g., thinking, memory, paying attention) 1
Primarily physical problems (e.g., fatigue, feeling sick) 2
Equally cognitive and physical problems 3
I am not having any difficulties on the previous tasks 8

Comments _____

_____

20. **If you are having more difficulty than you used to with the above tasks, approximately when did the difficulties begin?**

Within the last month 1
1 to 6 months ago 2
6 months to 2 years ago 3
2 to 5 years ago 4
More than 5 years ago 5
I am not having any difficulties 8

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Data Entry Only

SUBSTANCE USE

INSTRUCTIONS TO CLINICIAN: Ask the participant if he/she has used or even tried any substances from the following categories listed below EVER (if Cross-Sectional visit) or SINCE THE LAST VISIT (if longitudinal visit). Provide examples of substances from each substance category. (This list does not encompass all illicit substances; these are just a few examples. Refer to your reference manual for a longer list.) Circle the number that corresponds best to the participant's response.

Code "1" if the participant has used the substance 5 or more times in the period of interest.
Code "2" if the participant has used the substance 4 or less times in the period of interest.

For each substance coded "1," complete the Substance Use History (CH13B or ND25) for that substance.

	NO	YES ≥5X	YES ≥4X
1. Alcohol	0	1	2
2. Tobacco (e.g., cigarettes, cigars, chew, snuff)	0	1	2
3. Marijuana	0	1	2
4. Cocaine / Crack	0	1	2
5. Methamphetamine (i.e., Crystal Meth, Ice, Glass)	0	1	2
6. Other Stimulants (e.g., amphetamines, Ritalin)	0	1	2
7. Heroin	0	1	2
8. Other Opioids (e.g., Vicodin, Oxycontin)	0	1	2
9. Sedatives (e.g., Rohypnol, GHB, Quaaludes, etc.)	0	1	2
10. Antianxiety Drugs (e.g.,Valium, Xanax, Ativan)	0	1	2
11. Hallucinogens (e.g., LSD, mushrooms, Acid, etc.)	0	1	2
12. Dissociative Drugs (e.g., PCP, Angel Dust, Ketamine)	0	1	2
13. Inhalants (e.g., Nitrous Oxide, gasoline, glue, Whippits, etc.)	0	1	2
14. Poppers (e.g., Amyl Nitrate, Butyl Nitrate)	0	1	2
15. Ecstasy (i.e., MDMA, E, X)	0	1	2
16. Other: _____	0	1	2

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CHINESE SUBSTANCE USE HISTORY

INSTRUCTIONS TO CLINICIAN: Refer to detailed instructions on substance categories.

1. Substance: _____

2. Last Use: ____

Hours ago 1
Days ago 2
Weeks ago 3
Months ago 4
Years ago 5

3. Current Age: ____

4. Age Of 1st Use: ____

AGE AT ONSET OF EPOCH	DURATION (NUMBER)	PERIOD OF DURATION				DAILY QUANTITY USED	QUANTITY UNIT			FREQUENCY AMOUNT (NUMBER)	FREQUENCY PERIOD				PRIMARY ROUTE						IN USE DURING EPOCH	
		Day(s)	Week(s)	Month(s)	Year(s)		Units	Grams	Other		Day	Week	Month	Year	Smoking	Ingesting	Intranasal	Injection	Rectal	Mucosal	No	Yes
Last 7 days		1					1	2	3		1				1	2	3	4	5	6	0	1
Last 8-30 days		1	2	3			1	2	3		1	2	3		1	2	3	4	5	6	0	1
2-12 months ago		1	2	3	4		1	2	3		1	2	3	4	1	2	3	4	5	6	0	1
Peak Use: _____		1	2	3	4		1	2	3		1	2	3	4	1	2	3	4	5	6	0	1

1 unit = 1 drink = 1 cigarette = 1 pill = 1 tab = 1 dose

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USE OF ACADEMIC SKILLS QUESTIONNAIRE

1. **How often do you read in your everyday life:**

Never.....SKIP TO QUESTION 7.....1
Rarely (less than once per day).....2
Sometimes (at least once per day, but less than 3 times/day).....3
Often (3 times per day or more).....4

If participants reads in everyday life, does he/she always or almost always understand (for each item code "yes", "no" or "not applicable/ does not attempt to read).

	NO	YES	N/A
2. Signs and product names	0	1	8
3. Instructions (how to use products, or go places, etc.)	0	1	8
4. Mail, or written messages on mobile phone	0	1	8
5. Newspapers, magazine articles or subtitles on foreign TV/movies	0	1	8
6. Books	0	1	8

7. **How often do you write in your everyday life?**

Never.....1
Rarely (less than once per day).....2
Sometimes (at least once per day, but less than 3 times/day).....3
Often (3 times per day or more).....4

8. **How often do you use addition or subtraction?**

Never.....1
Rarely (less than once per day).....2
Sometimes (at least once per day, but less than 3 times/day).....3
Often (3 times per day or more).....4

9. **During a typical day, how many non-family people do you talk with?** ☐☐ Number of people

10. **During all years you attended school, how often did you skip or miss classes except for sick time or sick leave?**

Never missed classes except sick leave.....1
On average, missed less than one week per year.....2
On average, missed one week or more, but less than one month per year.....3
On average, missed on month or more, but less than 3 months per year.....4
On average, missed three months or more, but less than 6 months per year.....5
On average, missed 6 months or more per year (missed more than half of the classes).....6

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NEUROBEHAVIORAL MEDICAL SCREEN

Date of Birth: _____ MM/DD/YY Age: _____

INSTRUCTIONS TO EXAMINER: Ask the subject the following questions. If "Yes" is circled for any of the items below, write a summary of the incident in the space provided. Also, list any aftereffects (e.g., changes in vision, headaches, nausea, vomiting, amnesia, dizziness) or related events (e.g., artificial resuscitation, hospitalization).

1. In your lifetime, have you ever...
   a. Had an open or closed head injury? Yes / No
   b. Had a CHI with a loss of consciousness? Yes / No
   c. Been in a coma? Yes / No
   d. Had a blackout from alcohol and/or drugs? Yes / No
   e. Passed out from alcohol and/or drugs? Yes / No
   f. Been unconscious for any other reason (exclude surgery)? Yes / No
   g. Had a seizure? Yes / No
   h. Had a heart attack? Yes / No
   i. Had a stroke? Yes / No
   j. Fainted for any reason? Yes / No
   k. Overdosed on alcohol, drugs or medication? Yes / No

2. Is there a history of neurologic illness in your family such as Parkinson's Disease, Alzheimer's Disease, Huntington's Chorea, Multiple Sclerosis, Epilepsy, etc.? If so, who and was this from maternal or paternal side of the family?

3. Did you ever have any difficulty in school learning basic academic skills (i.e., problems in math or problems with reading). If so, were you in special classes or require tutoring?

4. Were you ever diagnosed as having a learning disability, dyslexia, attention deficit disorder or attention-deficit hyperactivity disorder? Who diagnosed you? How old were you when diagnosed?

5. Were you ever held back or skipped a grade in school? Why?

6. How many years of education have you completed? (Tester: List specific degrees or units/semesters completed and <u>when</u> and <u>where</u>.)

   High school diploma or GED?_____ If GED, what was the last grade completed? _____

   If degree(s) earned, please list college and degree obtained _____

   _____

   If no college degree, college and number of classes/units completed _____

   _____

   Total years of education: ☐☐

7. How much sleep did you get last night? Is this more or less sleep than usual? Was it restless or restful?

8. Are you currently employed? If so, what is your occupation? If not, how long has it been since you last worked? What was highest position you ever held? How long did you have this position? (Indicate dates)

9. What medications are you currently taking? When did you last take them? (Tester: only list non-HIV medications.)

Name of Medication	When did you last take it?	What is it for?

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BEHAVIORAL NOTES

EDUCATION: AGE:

1. **Confounds:** (LIST REASON(S) FOR CONFOUND(S) IN ITEM #28)

	NO	YES
Alcohol	0	1
Drug	0	1
Language	0	1
Education	0	1
CHI with LOC	0	1
Medical	0	1
Psychiatric	0	1

2. **Gender at Birth:** ☐ SEE ITEM #28
   - Male 1
   - Female 2

3. **Handedness:** ☐ SEE ITEM #28
   - Right 1
   - Left 2

4. **Ethnicity and Code:** ☐ SEE ITEM #28
   _____ ☐☐

5. **Language Tested: Spanish / English** (CIRCLE ONE)

6. **First Language:** _____

7. **Transportation:** _____

8. **Employment:** _____

9. **Affect:** ☐ SEE ITEM #28
   - Euthymic 1
   - Dysthymic 2
   - Dysphoric 3

10. **Appropriateness**
    - Appropriate 1
    - Inappropriate 2

11. **Demeanor:** ☐ SEE ITEM #28

	NO	YES
Friendly	0	1
Cheerful	0	1
Anxious	0	1
Humorous	0	1
Defensive	0	1

12. **Rapport:** ☐ SEE ITEM #28
    - Good 1
    - Fair 2
    - Poor 3

13. **Cooperation:** ☐ SEE ITEM #28
    - Excellent 1
    - Good 2
    - Adequate 3
    - Fair 4
    - Poor 5

14. **Effort:** ☐ SEE ITEM #28
    - Excellent 1
    - Good 2
    - Adequate 3
    - Fair 4
    - Poor 5

15. **Gait Disturbance:** ☐ SEE ITEM #28
    - Severe 1
    - Moderate 2
    - Moderate/Mild 3
    - Mild 4
    - None 5

16. **Impaired Use of Hands:** ☐ SEE ITEM #28
    - Severe 1
    - Moderate 2
    - Moderate/Mild 3
    - Mild 4
    - None 5

17. **Speech:** ☐ SEE ITEM #28

	NO	YES
Rapid	0	1
Average	0	1
Slow	0	1
Slurred	0	1
Pressured	0	1
Stuttering	0	1

18. **Sensory - Auditory:** ☐ SEE ITEM #28
    - Adequate 1
    - Poor 2

19. Sensory - Visual: ☐ SEE ITEM #28

Adequate 1
Poor 2

20. Attention Concentration: ☐ SEE ITEM #28

Good 1
Fair 2
Poor 3

21. Distractibility: ☐ SEE ITEM #28

Low 1
Moderate 2
High 3

22. Understanding of Instructions: ☐ SEE ITEM #28

Very Good 1
Good 2
Adequate 3
Fair 4
Poor 5

23. Memory: ☐ SEE ITEM #28

	NO	YES
Intact	0	1
Impaired: Poor - Recent	0	1
Impaired: Poor - Remote	0	1

24. Frustration Tolerance: ☐ SEE ITEM #28

Very Good 1
Good 2
Adequate 3
Fair 4
Poor 5

25. Nonstandard or Invalid Test: ☐ SEE ITEM #28

None 1
Yes - See Comments Below 2

26. Step Down:

No 1
Yes - Explain Below 2

27. Reliability: ☐ SEE ITEM #28

28. Examiner's Observations:

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HISCOCK DIGIT MEMORY TEST

TOTAL:

	BLOCK A (5" Delay)		BLOCK B (10" Delay)		BLOCK C (15" Delay)	
	TARGET	RESPONSE	TARGET	RESPONSE	TARGET	RESPONSE
1.	81359		61827		18475	
2.	92785		18475		85321	
3.	80623		29381		20317	
4.	95321		95321		52187	
5.	75142		48970		76123	
6.	53619		31027		61827	
7.	61827		18475		81359	
8.	18475		85321		92785	
9.	29381		20317		80623	
10.	95321		52187		95321	
11.	48970		76123		75142	
12.	31027		61827		53619	
	CORRECT:		CORRECT:		CORRECT:	

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HOPKINS VERBAL LEARNING TEST REVISED - RECORD FORM Z

Time Trial 3 Completed: _____ Time Delay Recall Complete: _____ Delay Interval (20 min.): _____

TRIALS 1-3 & DELAY:

PROBLEM	TRIAL 1	TRIAL 2	TRIAL 3	DELAY
1. Lion				
2. Copper				
3. Horse				
4. Tent				
5. Iron				
6. Hotel				
7. Cave				
8. Lead				
9. Tiger				
10. Zinc				
11. Cow				
12. Hut				

Trial 1 Total: ____ Trial 2 Total: ____ Trial 3 Total: ____ Delay Total: ____

True Positives: ____

False Positives: ____

TRIAL RECOGNITION:

PROBLEM	YES/ NO	
1. Horse	**Y**	N
2. House*	Y	**N**
3. Hut	**Y**	N
4. Tent	**Y**	N
5. Steel*	Y	**N**
6. Copper	**Y**	N
7. Lead	**Y**	N
8. Mountain	Y	**N**
9. Cave	**Y**	N
10. Tiger	**Y**	N
11. Iron	**Y**	N
12. Cat*	Y	**N**
13. Balloon	Y	**N**
14. Boat	Y	**N**
15. Dog*	Y	**N**
16. Hotel	**Y**	N
17. Coffee	Y	**N**
18. Scarf	Y	**N**
19. Apartment*	Y	**N**
20. Cow	**Y**	N
21. Lion	**Y**	N
22. Zinc	**Y**	N
23. Kwacha	Y	**N**
24. Bronze*	Y	**N**

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BRIEF VISUOSPATIAL MEMORY TEST - REVISED

Time Trial 3 Completed: _____ Time Delay Recall Completed: _____ Delay Interval (25 min.): _____

Form Administered: 1 2 3 4 5 6 (circle one)

	Raw Score	T Score	Percentile
Trial 1			
Trial 2			
Trial 3			
Total Recall[1]			
Delayed Recall			
Percent Retained[2]			
Recognition Hits (True Positives)			
Recognition False Alarms			
Recognition Discrimination Index[3]			
Reconition Response Bias			
Copy (optional)			

Normative table/comparison group_____

[1]Total Recall = (Trial 1 raw score + Trial 2 raw score + Trial 3 raw score).
[2]Percent Retained = [Delayed recall raw score/(higher value of Trial 2 raw score or Trial 3 raw score)] x 100.
[3]Recognition Discrimination Index = Recognition Hits raw score - Recognition False Alarms raw score.

Recognition Trial Scoring Worksheet

Item	Response	
	Hits	False Alarms
1.	**YES** no	
2.		yes **NO**
3.	**YES** no	
4.		yes **NO**
5.		yes **NO**
6.	**YES** no	
7.	**YES** no	
8.		yes **NO**
9.	**YES** no	
10.		yes **NO**
11.		yes **NO**
12.	**YES** no	
Total raw score		
Discrimination Index (Hits minus False Alarms)		
Response Bias (Find the cell corresponding to Total Hits and False Alarms raw scores in look-up table below.)		

Response Bias Look-up Table

	False Alarms						
Hits	0	1	2	3	4	5	6
0	.07	.19	.28	.35	.41	.46	.50
1	.08	.21	.31	.39	.45	.50	.54
2	.10	.25	.36	.44	.50	.55	.59
3	.13	.30	.42	.50	.56	.61	.65
4	.17	.38	.50	.58	.64	.69	.72
5	.25	.50	.63	.70	.75	.79	.81
6	.50	.75	.83	.88	.90	.92	.93

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WAIS-III DIGIT SYMBOL

TOTAL: (Maximum Score is 133)

1	2	3	4	5	6	7	8	9
—	⊥	⊐	L	⊔	○	∧	×	=

SAMPLES

2	1	3	7	2	4	8	2	1	3	2	1	4	2	3	5	2	3	1	4

5	6	3	1	4	1	5	4	2	7	6	3	5	7	2	8	5	4	6	3

7	2	8	1	9	5	8	4	7	3	6	2	5	1	9	2	8	3	7	4

6	5	9	4	8	3	7	2	6	1	5	4	6	3	7	9	2	8	1	7

9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

2	7	3	6	5	1	9	8	4	5	7	3	1	4	8	7	9	1	4	5

7	1	8	2	9	3	6	7	2	8	5	2	3	1	4	8	4	2	7	6

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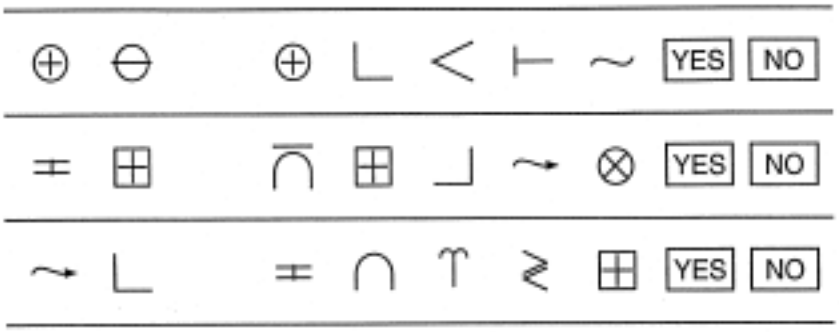
WAIS-III SYMBOL SEARCH

TOTAL: (Maximum 60)

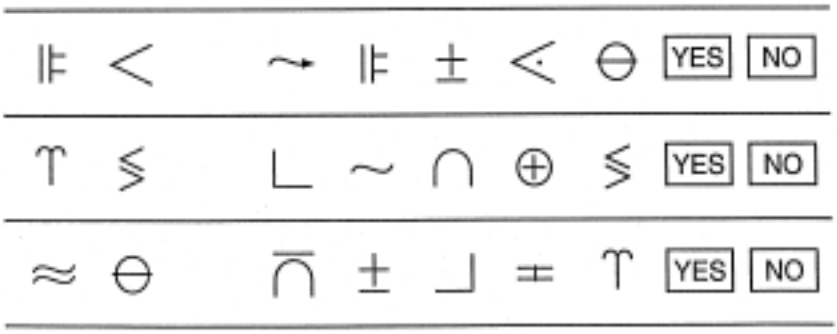
INSTRUCTIONS TO EXAMINER: Discontinue after 120 seconds.

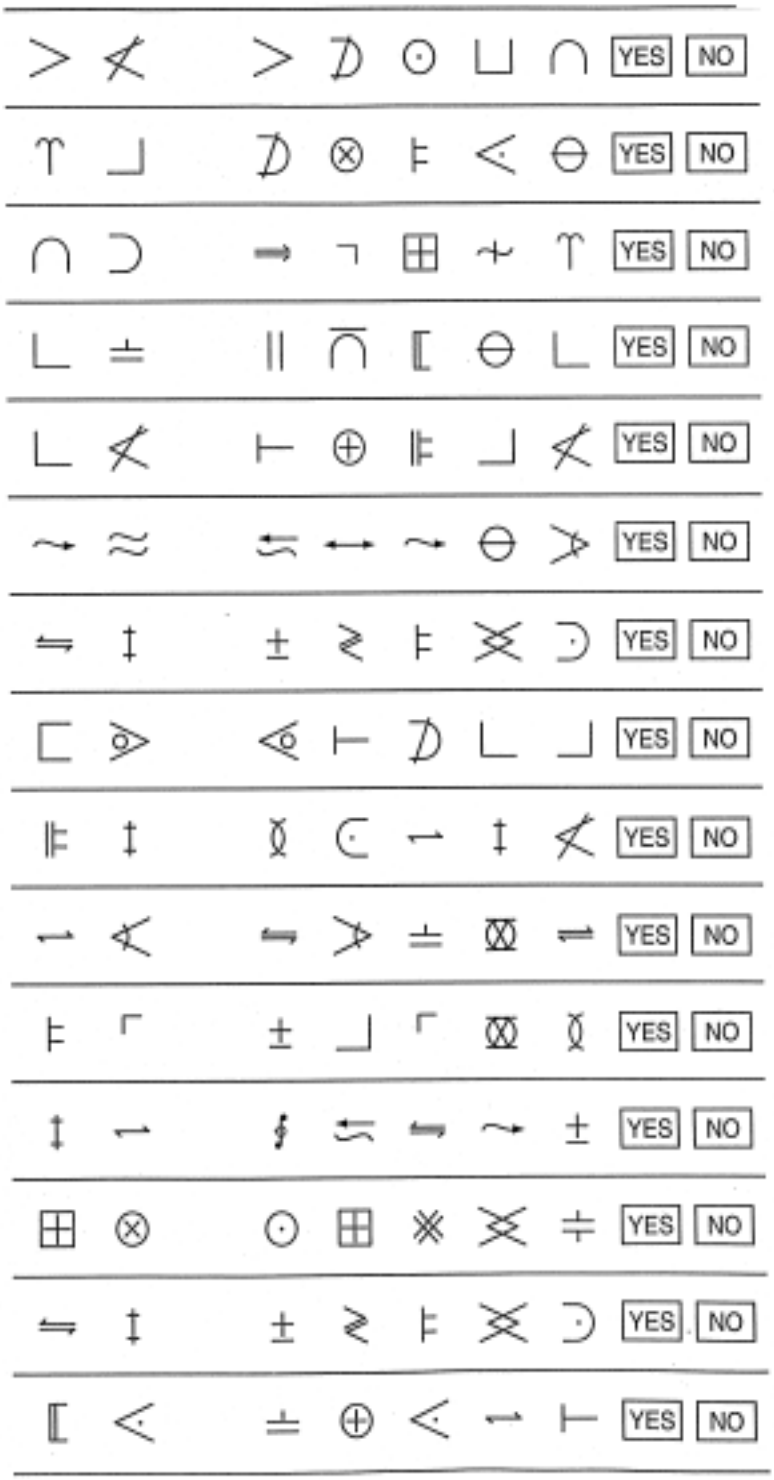
TIME LIMIT	COMPLETION TIME (Seconds)	NUMBER CORRECT	NUMBER INCORRECT
120"			

Sample Items



Practice Items

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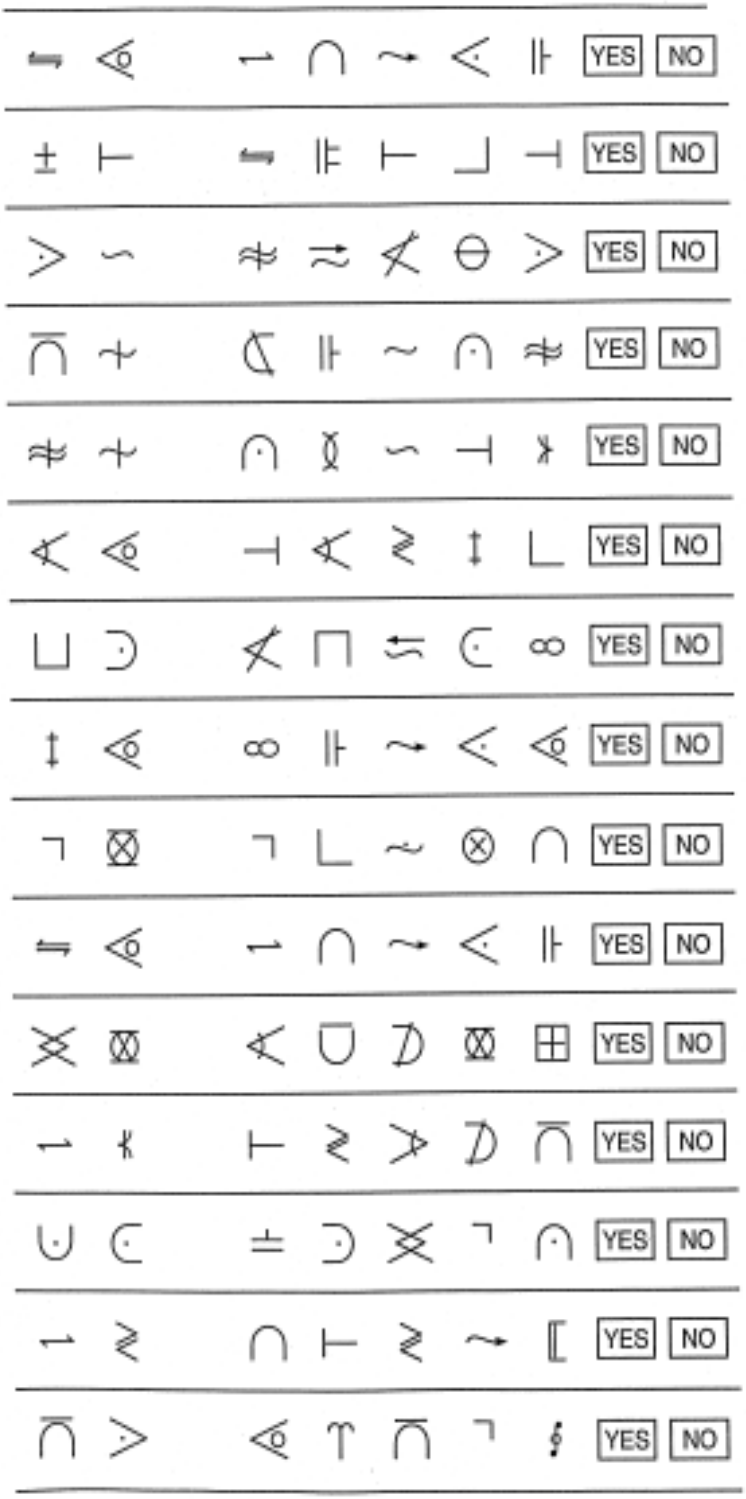

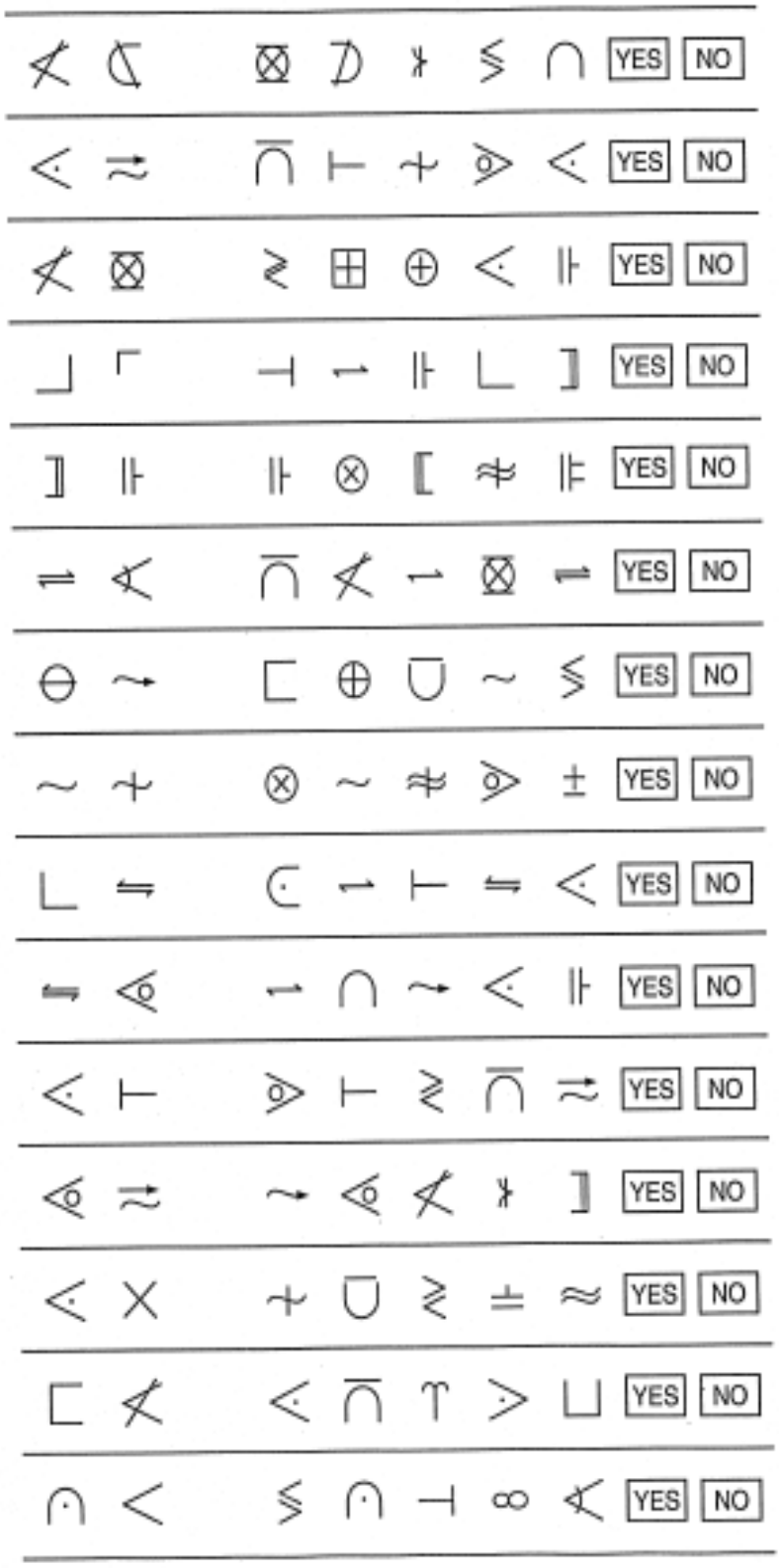
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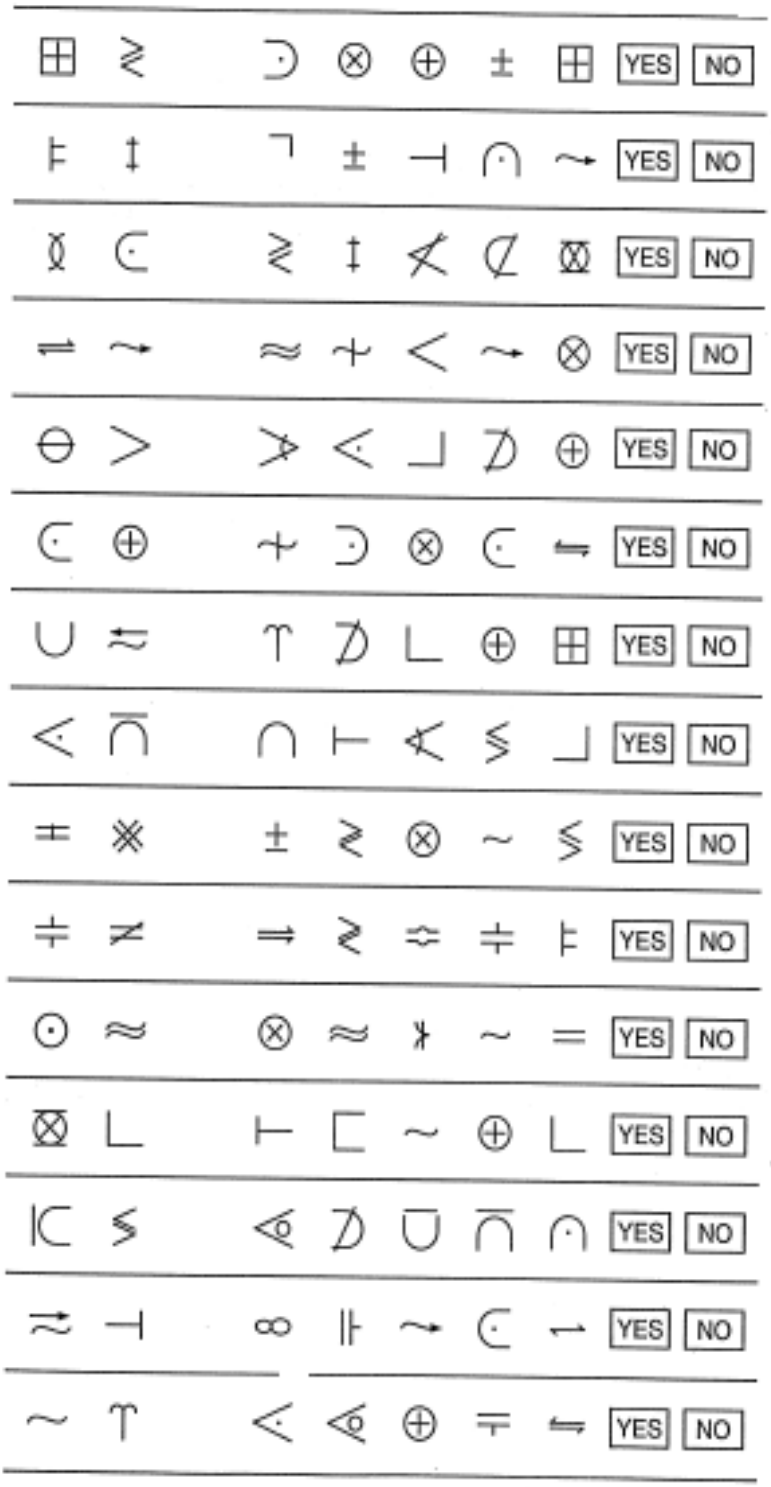

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GROOVED PEGBOARD TEST SUMMARY SHEET

DOMINANT TRIAL

Handedness (CIRCLED): LEFT RIGHT

Time: ___ SECONDS

No. In: ___ PEGS

Dropped: ___ PEGS

NON-DOMINANT TRIAL

Handedness (CIRCLED): LEFT RIGHT

Time: ___ SECONDS

No. In: ___ PEGS

Dropped: ___ PEGS

NOTES:

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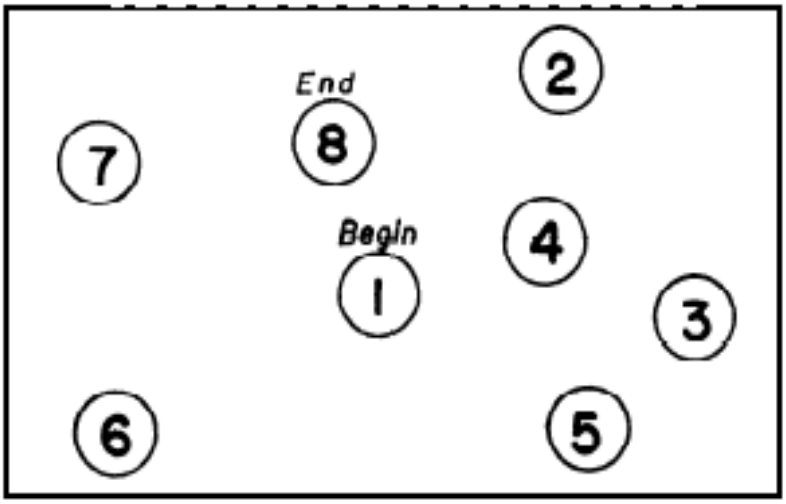
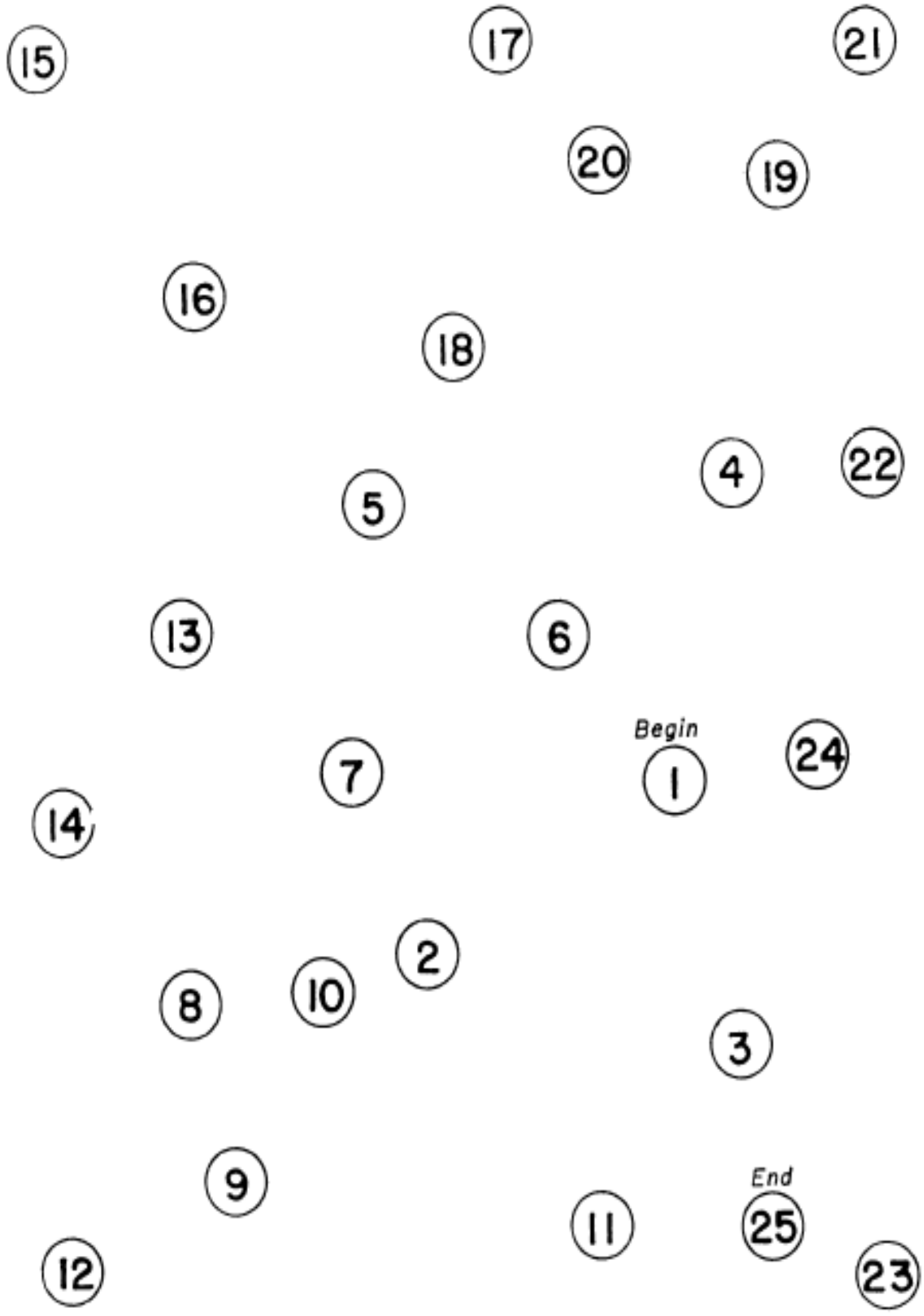
TRAIL MAKING TEST - PART A

SAMPLE TIME: | PART-A TIME: | PART-A ERRORS:

SAMPLE

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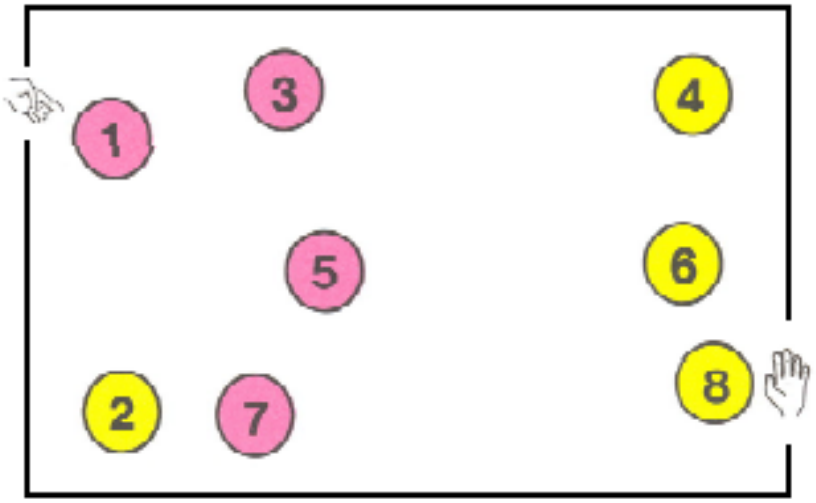
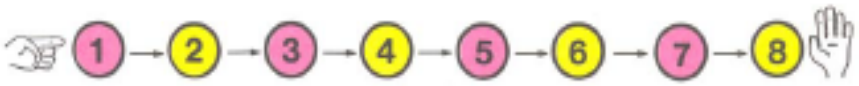
COLOR TRAILS 1 - FORM A

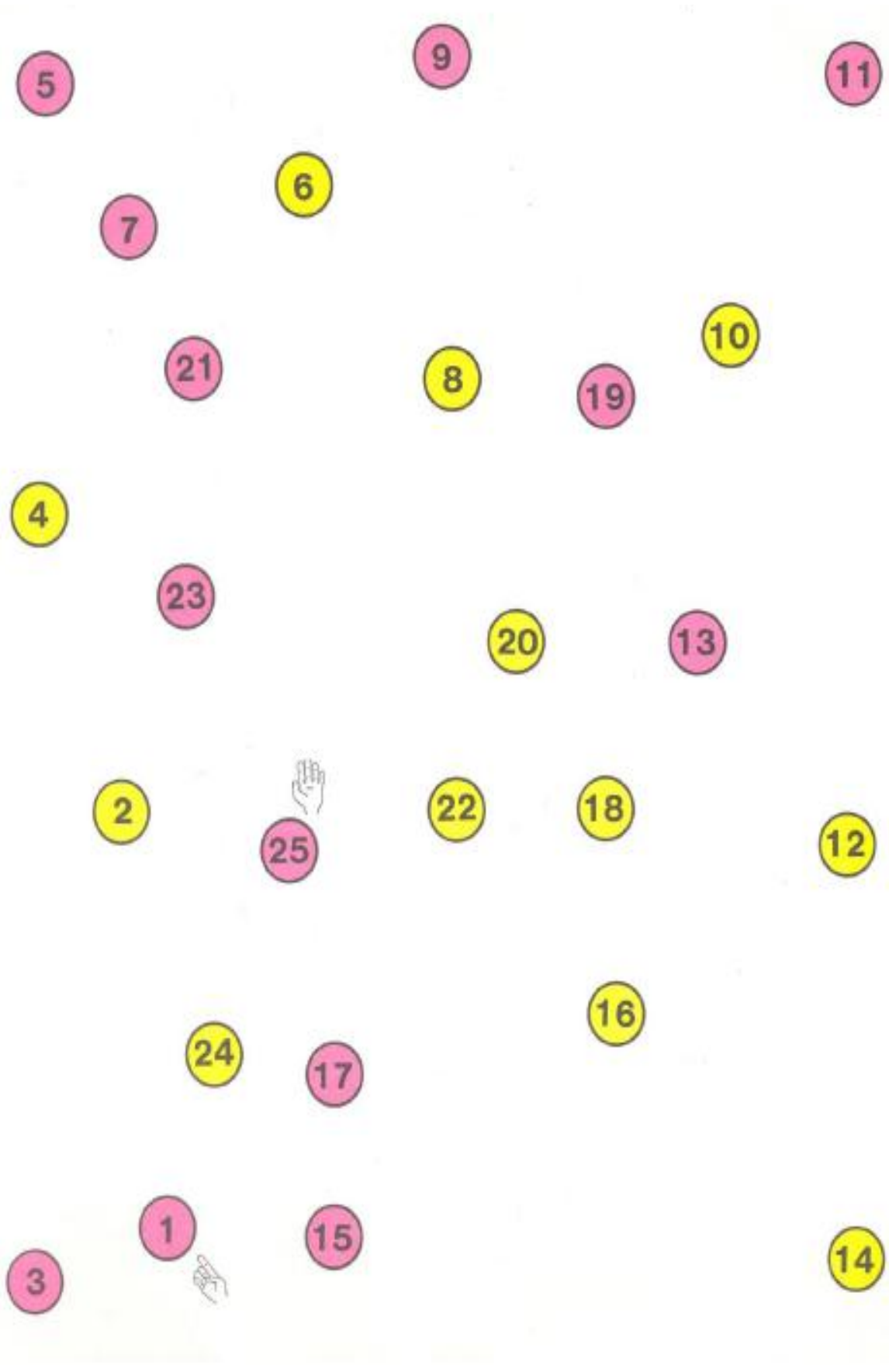
SAMPLE TIME: TRAILS 1 TIME: TRAILS 1 ERRORS:

Louis F. D'Elia, PhD and Paul Satz, PhD





PAR Psychological Assessment Resources, Inc. • 16204 N. Florida Avenue • Lutz, FL 33549 • 1.800.331.8378 • http://www.parinc.com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NPTRLS2 NP41B

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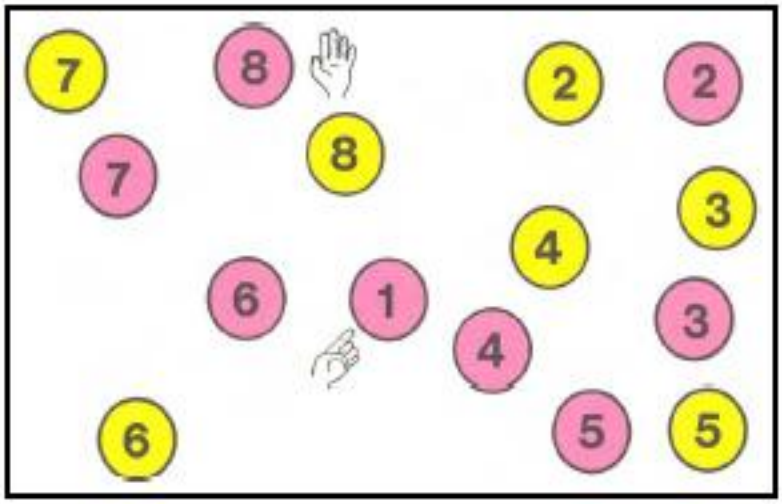
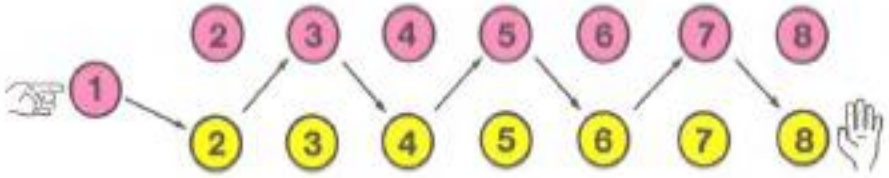
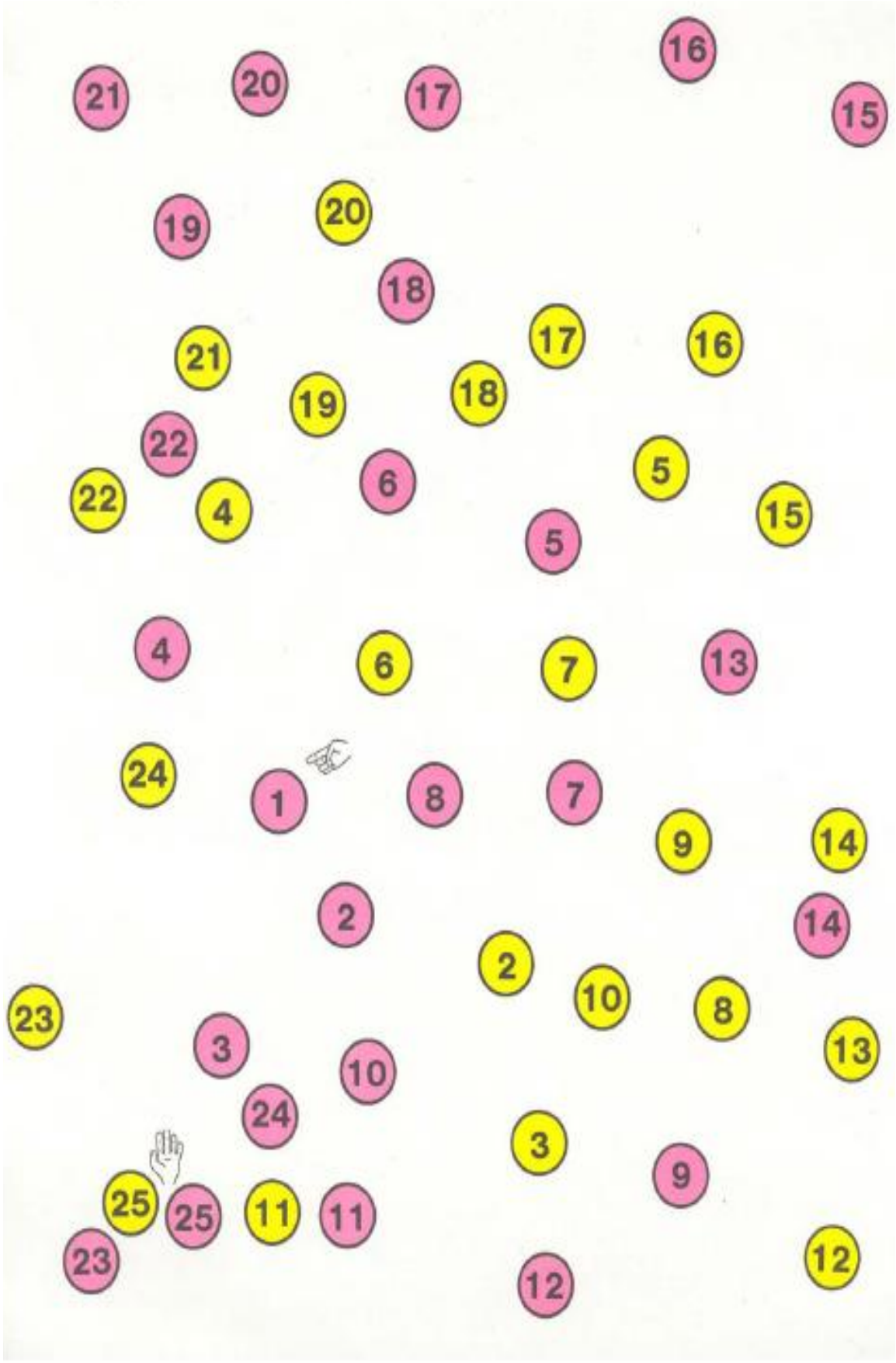
COLOR TRAILS 2 - FORM A

SAMPLE TIME: TRAILS 2 TIME: TRAILS 2 ERRORS:

Louis F. D'Elia, PhD and Paul Satz, PhD



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WMS-III SPATIAL SPAN

TOTAL SCORE:

INSTRUCTIONS TO EXAMINER: Administer both trials of each item, even if examinee passes first trial. Discontinue after failure on both trials of any item. Maximum score for both trials is 32.

SPATIAL SPAN FORWARD

ITEM	TRIAL	RESPONSE	SCORE
1.	Trial 1	3 - 10	0 1
	Trial 2	7 - 4	0 1
2.	Trial 1	1 - 9 - 3	0 1
	Trial 2	8 - 2 - 7	0 1
3.	Trial 1	4 - 9 - 1 - 6	0 1
	Trial 2	10 - 6 - 2 - 7	0 1
4.	Trial 1	6 - 5 - 1 - 4 - 8	0 1
	Trial 2	5- 7- 9- 8 - 2	0 1
5.	Trial 1	4 - 1 - 9 - 3 - 8 - 10	0 1
	Trial 2	9 - 2 - 6 - 7 - 3 - 5	0 1
6.	Trial 1	10 - 1 - 6 - 4 - 8 - 5 - 7	0 1
	Trial 2	2 - 6 - 3 - 8 - 2 - 10 - 1	0 1
7.	Trial 1	7 - 3 - 10 - 5 - 7 - 8 - 4 - 9	0 1
	Trial 2	6 - 9 - 3 - 2 - 1 - 7 - 10 - 5	0 1
8.	Trial 1	5 - 8 - 4 - 10 - 7 - 3 - 1 - 9 - 6	0 1
	Trial 2	8 - 2 - 6 - 1 - 10 - 3 - 7 - 4 - 9	0 1

Forward Total Score

SPATIAL SPAN BACKWARD

ITEM	TRIAL	RESPONSE	SCORE
1.	Trial 1	7 - 4 (4 - 7)	0 1
	Trial 2	3 - 10 (10 - 3)	0 1
2.	Trial 1	8 - 2 - 7 (7 - 2 - 8)	0 1
	Trial 2	1 - 9 - 3 (3 - 9 - 1)	0 1
3.	Trial 1	10 - 6 - 2 - 7 (7 - 2 - 6 - 10)	0 1
	Trial 2	4 - 9 - 1 - 6 (6 - 1 - 9 - 4)	0 1
4.	Trial 1	5 - 7 - 9 - 8 - 2 (2 - 8 - 9 - 7 - 5)	0 1
	Trial 2	6 - 5 - 1 - 4 - 8 (8 - 4 - 1 - 5 - 6)	0 1
5.	Trial 1	9 - 2 - 6 - 7 - 3 - 5 (5 - 3 - 7 - 6 - 2 - 9)	0 1
	Trial 2	4 - 1 - 9 - 3 - 8 - 10 (10 - 8 - 3 - 9 - 1 - 4)	0 1
6.	Trial 1	2 - 6 - 3 - 8 - 2 - 10 - 1 (1 - 10 - 2 - 8 - 3 - 6 - 2)	0 1
	Trial 2	10 - 1 - 6 - 4 - 8 - 5 - 7 (7 - 5 - 8 - 4 - 6 - 1 - 10)	0 1
7.	Trial 1	6 - 9 - 3 - 2 - 1 - 7 - 10 - 5 (5 - 10 - 7 - 1 - 2 - 3 - 9 - 6)	0 1
	Trial 2	7 - 3 - 10 - 5 - 7 - 8 - 4 - 9 (9 - 4 - 8 - 7 - 5 - 10 - 3 - 7)	0 1
8.	Trial 1	8 - 2 - 6 - 1 - 10 - 3 - 7 - 4 - 9 (9 - 4 - 7 - 3 - 10 - 1 - 6 - 2 - 8)	0 1
	Trial 2	5 - 8 - 4 - 10 - 7 - 3 - 1 - 9 - 6 (6 - 9 - 1 - 3 - 7 - 10 - 4 - 8 - 5)	0 1

BACKWARD TOTAL SCORE: ☐

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CONTROLLED ORAL WORD ASSOCIATION TEST - FAS

SECONDS	TRIAL 1 Letter "F"	TRIAL 2 Letter "A"	TRIAL 3 Letter "S"
0 - 15			
16 - 30			
31 - 45			
46 - 60			

	"F" Trial	"A" Trial	"S" Trial
Correct Words:			
Perseverations:			
Intrusions:			
Variants:			

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CATEGORY FLUENCY TEST

SECONDS	TRIAL 1 "Animals"	TRIAL 2 "Actions"
0 - 15		
16 - 30		
31 - 45		
46 - 60		

	"Animals" Trial	"Actions Trial"
Correct Words:		
Perseverations:		
Intrusions:		

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PACED AUDITORY SERIAL ADDITION TASK - 1 CHANNEL

Channel 1

	Correct Response	
1.	9.....11	____
2.	1.....10	____
3.	4.....5	____
4.	2.....6	____
5.	8.....10	____
6.	6.....14	____
7.	5.....11	____
8.	3.....8	____
9.	4.....7	____
10	9.....13	____
11.	1.....10	____
12.	3.....4	____
13.	6.....9	____
14.	8.....14	____
15.	2.....10	____
16.	5.....7	____
17.	1.....6	____
18.	8.....9	____
19.	6.....14	____
20.	9.....15	____
21.	2.....11	____
22.	4.....6	____
23.	3.....7	____
24.	5.....8	____
25.	6.....11	____
26.	5.....11	____
27.	8.....13	____
28.	9.....17	____
29.	4.....13	____
30.	3.....7	____
31.	1.....4	____
32.	2.....3	____
33.	6.....8	____
34.	3.....9	____
35.	4.....7	____
36.	8.....12	____
37.	9.....17	____
38.	5.....14	____
39.	1.....6	____
40.	2.....3	____
41.	8.....10	____
42.	1.....9	____
43.	2.....3	____
44.	5.....7	____
45.	3.....8	____
46.	9.....12	____
47.	6.....15	____
48.	4.....10	____
49.	3.....7	____
50.	6.....9	____

#Attempted:

#Correct:

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STROOP TEST

INSTRUCTIONS TO THE EXAMINER: Begin by instructing the participant: (Page with word in black ink.) *"This is a test of how fast you can read the words on this page. After I say "BEGIN", read down the columns starting with the first one (point to the leftmost column) until you complete it (run hand down the leftmost column) and then continue without stopping down the remaining columns in order (run your hand down the second column, then third, etc.). If you finish all the columns before I say "STOP", then return to the first column and begin again (point to the first column). Remember, do not stop reading until I say "STOP" and read out loud as quickly as you can. If you make a mistake, I will say, "NO" to you. Correct your error and continue without stopping. Are there any questions?"* Instructions may be repeated or paraphrased as often as necessary until the subject understands what is to be done. *"Ready?....Then begin."* As the subject starts, begin timing. After 45 seconds, say: "STOP". Circle the item they are on.

WORDS:

1.	RED	21.	BLUE	41.	GREEN	61.	RED	81.	BLUE
2.	GREEN	22.	GREEN	42.	RED	62.	BLUE	82.	GREEN
3.	BLUE	23.	RED	43.	BLUE	63.	GREEN	83.	RED
4.	GREEN	24.	BLUE	44.	RED	64.	RED	84.	BLUE
5.	RED	25.	RED	45.	GREEN	65.	BLUE	85.	GREEN
6.	BLUE	26.	GREEN	46.	BLUE	66.	GREEN	86.	RED
7.	RED	27.	BLUE	47.	GREEN	67.	BLUE	87.	GREEN
8.	BLUE	28.	GREEN	48.	RED	68.	GREEN	88.	RED
9.	GREEN	29.	RED	49.	BLUE	69.	RED	89.	BLUE
10.	BLUE	30.	GREEN	50.	GREEN	70.	BLUE	90.	GREEN
11.	GREEN	31.	RED	51.	BLUE	71.	RED	91.	RED
12.	RED	32.	BLUE	52.	RED	72.	GREEN	92.	BLUE
13.	GREEN	33.	RED	53.	BLUE	73.	RED	93.	GREEN
14.	BLUE	34.	BLUE	54.	RED	74.	GREEN	94.	RED
15.	RED	35.	GREEN	55.	GREEN	75.	BLUE	95.	BLUE
16.	BLUE	36.	BLUE	56.	RED	76.	GREEN	96.	RED
17.	RED	37.	GREEN	57.	BLUE	77.	RED	97.	GREEN
18.	GREEN	38.	RED	58.	GREEN	78.	BLUE	98.	BLUE
19.	RED	39.	BLUE	59.	RED	79.	GREEN	99.	RED
20.	GREEN	40.	RED	60.	GREEN	80.	BLUE	100.	GREEN

Word Total: ___

INSTRUCTIONS TO THE EXAMINER: (Page with colored X's.) *"This is a test of how fast you can name the colors on this page. You will complete this page just as you did the previous page, starting with this first column. Remember to name the colors out loud as quickly as you can. Are there any questions?"* If the subject has had any trouble following the instructions, they should be repeated in their entirety. As with Page 1, the subject should be allowed 45 seconds.

COLORS:

1.	BLUE	21.	RED	41.	BLUE	61.	GREEN	81.	RED
2.	RED	22.	BLUE	42.	GREEN	62.	RED	82.	BLUE
3.	GREEN	23.	GREEN	43.	RED	63.	BLUE	83.	GREEN
4.	BLUE	24.	RED	44.	BLUE	64.	GREEN	84.	RED
5.	GREEN	25.	GREEN	45.	RED	65.	RED	85.	BLUE
6.	RED	26.	BLUE	46.	GREEN	66.	BLUE	86.	GREEN
7.	GREEN	27.	GREEN	47.	RED	67.	GREEN	87.	RED
8.	RED	28.	RED	48.	BLUE	68.	RED	88.	BLUE
9.	BLUE	29.	BLUE	49.	GREEN	69.	BLUE	89.	GREEN
10.	RED	30.	RED	50.	RED	70.	GREEN	90.	BLUE
11.	BLUE	31.	BLUE	51.	GREEN	71.	BLUE	91.	GREEN
12.	GREEN	32.	GREEN	52.	BLUE	72.	RED	92.	RED
13.	RED	33.	BLUE	53.	RED	73.	BLUE	93.	BLUE
14.	GREEN	34.	GREEN	54.	GREEN	74.	RED	94.	GREEN
15.	BLUE	35.	RED	55.	BLUE	75.	GREEN	95.	RED
16.	GREEN	36.	GREEN	56.	GREEN	76.	BLUE	96.	BLUE
17.	BLUE	37.	RED	57.	RED	77.	GREEN	97.	RED
18.	RED	38.	BLUE	58.	BLUE	78.	RED	98.	GREEN
19.	GREEN	39.	RED	59.	GREEN	79.	BLUE	99.	BLUE
20.	BLUE	40.	GREEN	60.	BLUE	80.	RED	100.	RED

Color Total: | | | |

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INSTRUCTIONS TO THE EXAMINER: (Page with colors and words.) *"This page is like the page you just finished. I want you to name the color of the ink the words are printed in, ignoring the word that is printed in each item. For example, (point to the first item of the first column), this is the first item: what would you say?"* If the subject is correct, go on with the instructions. If incorrect, say: *"No, that is the word that is spelled there. I want you to say the color of the ink the word is printed in. Now (pointing to the same item) what would you say to this item? That's correct (point to the second item), what would the response be to this item?"* If correct, proceed; if incorrect, repeat above as many items as necessary until the subject understand or it becomes clear that it is impossible to go on. *"Good. You will do this page just like the others, starting with the first column (pointing) and then going on to as many columns as you can. Remember, if you make a mistake, just correct it and go on. Are there any questions?"* (As with the other two pages, the instructions can be repeated or paraphrased as often as necessary.) "Ready? ...Begin!" After 45 seconds, say: Stop; Record on the form how many correct responses

COLORS - WORDS:

1.	BLUE	21.	RED	41.	BLUE	61.	GREEN	81.	RED
2.	RED	22.	BLUE	42.	GREEN	62.	RED	82.	BLUE
3.	GREEN	23.	GREEN	43.	RED	63.	BLUE	83.	GREEN
4.	BLUE	24.	RED	44.	BLUE	64.	GREEN	84.	RED
5.	GREEN	25.	GREEN	45.	RED	65.	RED	85.	BLUE
6.	RED	26.	BLUE	46.	GREEN	66.	BLUE	86.	GREEN
7.	GREEN	27.	GREEN	47.	RED	67.	GREEN	87.	RED
8.	RED	28.	RED	48.	BLUE	68.	RED	88.	BLUE
9.	BLUE	29.	BLUE	49.	GREEN	69.	BLUE	89.	GREEN
10.	RED	30.	RED	50.	RED	70.	GREEN	90.	BLUE
11.	BLUE	31.	BLUE	51.	GREEN	71.	BLUE	91.	GREEN
12.	GREEN	32.	GREEN	52.	BLUE	72.	RED	92.	RED
13.	RED	33.	BLUE	53.	RED	73.	BLUE	93.	BLUE
14.	GREEN	34.	GREEN	54.	GREEN	74.	RED	94.	GREEN
15.	BLUE	35.	RED	55.	BLUE	75.	GREEN	95.	RED
16.	GREEN	36.	GREEN	56.	GREEN	76.	BLUE	96.	BLUE
17.	BLUE	37.	RED	57.	RED	77.	GREEN	97.	RED
18.	RED	38.	BLUE	58.	BLUE	78.	RED	98.	GREEN
19.	GREEN	39.	RED	59.	GREEN	79.	BLUE	99.	BLUE
20.	BLUE	40.	GREEN	60.	BLUE	80.	RED	100.	RED

Color/Word Total: | | | |

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HALSTEAD CATEGORY TEST RECORD FORM

ERRORS TOTAL:

INSTRUCTIONS TO EXAMINER: The right-hand column is used to check correct responses and the left-hand incorrect.

	SUBTEST I	SUBTEST II	SUBTEST III	SUBTEST IV	SUBTEST V	SUBTEST VI	SUBTEST VII
1.	1	1	1	1	1	1	1
2.	3	3	3	3	3	3	3
3.	1	1	1	1	1	1	1
4.	4	4	4	4	4	4	4
5.	2	2	2	2	2	2	2
6.	4	4	4	4	4	4	4
7.	1	1	1	x 1	1	1	1
8.	2	2	2	2	2	2	2
9.		x 3	3	3	3	3	3
10.		2	2	2	2	2	2
11.		3	3	3	3	3	3
12.		1	1	1	1	1	1
13.		4	4	4	4	4	4
14.		3	3	3	3	3	3
15.		4	4	4	4	4	4
16.		2	2	2	2	2	2
17.		1	1	1	1	1	1
18.		4	4	4	4	4	4
19.		1	1	1	1	1	1
20.		3	3	3	3	3	3
21.			2	2	2	2	
22.			1	1	1	1	
23.			2	2	2	2	
24.			4	4	4	4	
25.			3	3	3	3	
26.			2	2	2	2	
27.			4	4	4	4	
28.			3	3	3	3	
29.			1	1	1	1	
30.			4	4	4	4	
31.			2	2	2	2	
32.			1	1	1	1	
33.			3	3	3	3	
34.			1	1	1	1	
35.			3	3	3	3	
36.			2	2	2	2	
37.			4	4	4	4	
38.			3	3	3	3	
39.			4	4	4	4	
40.			2	2	2	2	

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APPENDIX D:

FURTHER OBJECTIVE ONE RESULTS

APPENDIX D4.1.1 Performance on the *Visual Episodic Memory Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.155(a)	.024	.012	3.013

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	71.742	4	17.936	1.976	.098(a)
	Residual	2895.433	319	9.077		
	Total	2967.175	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: visual episodic mean scale

APPENDIX D4.1.2 Performance on the *Verbal Episodic Memory Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.255(a)	.065	.053	2.794

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	172.565	4	43.141	5.528	.000(a)
	Residual	2489.679	319	7.805		
	Total	2662.243	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: verbal episodic mean scale

APPENDIX D4.1.3 Performance on the *Attention/Working Memory Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.255(a)	.065	.053	2.794

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	172.565	4	43.141	5.528	.000(a)
	Residual	2489.679	319	7.805		
	Total	2662.243	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: verbal episodic mean scale

APPENDIX D4.1.4 Performance on the *Language Fluency Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.479(a)	.230	.220	1.996

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	379.546	4	94.887	23.809	.000(a)
	Residual	1271.336	319	3.985		
	Total	1650.882	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: fluency mean scale

APPENDIX D4.1.5 Performance on the *Speed of Information Processing Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.359(a)	.129	.118	2.166

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	221.035	4	55.259	11.783	.000(a)
	Residual	1496.054	319	4.690		
	Total	1717.089	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: speed of information processing mean scale

APPENDIX D4.1.6 Performance on the *Executive Function Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.257(a)	.066	.055	2.024

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.721	4	23.180	5.660	.000(a)
	Residual	1306.432	319	4.095		
	Total	1399.153	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: executive mean scale

APPENDIX D4.1.7 Performance on the *Motor Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.234(a)	.055	.043	2.740

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	138.851	4	34.713	4.624	.001(a)
	Residual	2394.729	319	7.507		
	Total	2533.580	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: motor mean scale

APPENDIX D4.1.8 Performance on All *Tests*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.395(a)	.156	.146	1.706

a Predictors: (Constant), Residence, Education, Income, Occupation

ANOVA(b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	171.792	4	42.948	14.760	.000(a)
	Residual	928.186	319	2.910		
	Total	1099.978	323			

a Predictors: (Constant), Residence, Education, Income, Occupation
b Dependent Variable: global mean scale