

**Preliminary Normative Indications for Xhosa Speaking Unskilled
Workers on the Rey-Osterrieth Complex Figure Test**

by

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ABSTRACT

The aim of this study was to establish preliminary normative indications for Rey-Osterrieth Complex Figure test administered in English on a non-clinical population of Xhosa, unskilled workers ($N = 33$). The population has a history of relatively poor quality education and has received no tertiary education. The sample was stratified into two age grouping (18 – 29 and 30 – 40 years). Both sex and level of education were equally distributed within these age groupings. Within-sample statistical comparisons indicated no significant sex effect was present for any of the trials (Copy, IR or DR). Similarly, no significant age effect was present in the Copy trial. Significant age effects were observed for both recall trials (IR and DR). The local sample's mean performance was descriptively and statistically compared to demographically equivalent non-local normative studies. Excluding an illiterate Columbian sample's performance, the local sample performed significantly lower than all other available normative populations. Lastly, the local sample performed significantly lower than scores derived from a meta-analysis of normative indications in respect of educationally advantaged westernized groups for all three trials ($p = .000$ in all instances). These results assert the indispensable need for, and use of, culturally appropriate normative datasets in contemporary South African psychological assessments. Equally, these findings serve to highlight the significant influence of quality of education on cognitive test performance, being a critical socio-cultural variable that needs to be taken into consideration for norming purposes.

For Ally

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Chapter 1

Literature Review

1.1 Introduction

1.1.1 Brief Overview

The aim of this research was to establish preliminary normative indications for the Rey-Osterrieth Complex Figure test administered in English on a population of Xhosa, unskilled workers. The population has a history of poor quality education and has received no tertiary education. The present investigation formed part of a series of cross-cultural norming research conducted by Shuttleworth-Edwards et al., including the performance of a Xhosa population with relatively low level and quality of education on the adult and child Wechsler Intelligence Scales (Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Edwards, Van der Merwe, van Tonder & Radloff, 2013) and on a series of more specific neurocognitive tests (Andrews, Shuttleworth-Edwards, & Radloff, 2012; Fike, Knoetze, Shuttleworth-Edwards, & Radloff, 2012; Shuttleworth-Edwards, Donnelly, Reid, & Radloff, 2004)

1.1.2 Argument Structure

Within this literature review four interlinking sections will be discussed. Each section will independently orientate the reader to contemporary research concerning an essential feature of the present study. These sections will then be synthesised to provide the rationale for the present study. Firstly, the presented study is broadly set within the field of neuropsychology. It is therefore necessary to provide a brief overview of the neuropsychological paradigm; its functional domains; clinical practices and applications. By examining these facets, the section will argue for the use of neuropsychological tests in clinical assessment. From this premise, the use of normative indications within the field of neuropsychological assessment will also be explored in detail. Herein the effects of sex, age, education and socio-cultural factors on normative indications shall be reviewed. Following this section, the interpretation of the neuropsychological paradigm imposed upon the South African context will be evaluated. This relates to how normative considerations affect local test performance. South Africa has a

long history of socio-political injustice. Salient aspects of psychological assessment in South African history will be discussed. Lastly, the Rey-Osterrieth Complex Figure test will be reviewed. By focusing on administration procedure; the neuropsychological information it elicits; and its psychometric characteristics; its relevance to the present day South African clinical context will be expounded.

It is important to bear in mind that whilst the literature review departs from a theoretical premise, it sustains a pragmatic focus. It purposefully attempts to adopt a clinical or practitioner's perspective. The various elements deliberated within this literature review therefore impact clinical assessment practices.

1.2 Neuropsychological Assessment

1.2.1 The Neuropsychological Paradigm

Neuropsychology can be broadly defined as the study of behaviourally expressed brain functioning (Uzzell, Pontón, & Ardila, 2007). Groth-Marnat (2000) further explains that neuropsychology aims to elucidate this “brain-behavior relationship” (p.3) and systematically studies this relationship through applied scientific methods (Sadock & Sadock, 2007). Neuropsychological research makes sense of observed behaviour by considering it a manifestation of cognitive functioning. Within the research, and clinical setting, these manifestations are quantified and the fluctuations in functioning can be determined (Mitrushina, Boone, Razani & D’Elia, 2005). Neuropsychology is greatly influenced by neuroscientific disciplines, in particular neurophysiological research. Through this type of research, cognitive functioning is linked to particular structures in the brain (Lezak, Howieson & Loring, 2004). Not surprisingly certain behaviours are neuroanatomically over-determined (Heilman & Valenstein, 2003). Rarely is a single area, or structure, in the brain responsible solely for a particular behaviour (Lishman, 2006). Although neurophysiological perspective is useful as an explanatory model, neuropsychology’s main interest remains behaviour. It consequently groups behaviour into functional domain or cognitive modalities.

1.2.2 Cognitive Modalities/ Functional Domains

Sadock and Sadock (2007) remarks that clinical neuropsychology is interested in the brain-behaviour relationship with regards to “the realms of cognitive, motor, sensory and emotional functioning” (p.178). Seminal neuropsychological text (Groth-Marnat, 2000; Heilman & Valenstein, 2003; Lezak et al., 2004; Mitrushina et al., 2005; Strauss, Sherman & Spreen,

2006) conventionally identify distinct functional domains. These include sensori-motor or visuoconstructional, attention, language, memory, executive functioning and emotions. As these are broad categories of functioning, each domain contains further subdivision (Heilman & Valenstein, 2003). Each of these domains play an irreplaceable role in the everyday functioning of an individual. Consequently, if any of these domains are compromised through brain-injury, the repercussions can be devastating for an individual's functioning (Lezak et al., 2004). The cognitive modalities of particular interest to the present study will be briefly discussed below.

1.2.2.1 Memory

Badderley, Kopelman and Wilson (2004) explain that neuropsychologically, memory can be conceptualised as a process involving three distinct cognitive procedures. Each process engages different areas of the brain (Helmes, 2000). This sequence includes *encoding*, which is the registration of sensory information; *storage* which involves maintenance or consolidation of information; and *retrieval* inferring recollection of information. Notably, memory and learning are often closely associated (Sadock & Sadock, 2007). Helmes (2000) elucidates that learning relates more specifically to the education setting, whilst memory is considered to imply a broader sense of information retentions. Conventionally, memory has been divided into a verbal and visual component. This division reflects the nature of the sensory information, i.e. visual and auditory, that is encoded and stored (Heilman & Valenstein, 2003). A temporal distinction is also made between *short-term* or *long-term* memory (Crawford, Parker & McKinlay, 1992). Short term memory refers to a brief period, between encoding and retrieval, whilst long term memory denotes an extended period. It must be noted that seminal texts differ in quantifying the length between encoding and retrieval of two types of memory. It is useful therefore to conceptualise short term memory as the primary memory storage, which would imply that long term memory equates to secondary memory storage (Helmes, 2000).

In considering the retrieval process, Meyers and Meyers (1995) emphasises a distinction between pure memory *recall* and *recognition*. They explain that *recognition* uses external stimuli, which is closely associated to the encoded information, to prompt retrieval, whilst *recall* provides no such assistance. Numerous studies have confirmed the validity of these categorical and temporal divisions, whilst showing the distinct physiological processes each of these divisions entail (see Lezak et al., 2004). Lishman (2006) notes that memory

functioning is an exceptionally sensitive indicator of brain pathology. Lishman asserts that due to the neurophysiological complexity of creating and retrieving memories, normal functioning can be easily disturbed by either structural damage to areas of the brain or neurochemical complications. If memory deficit is observed it affords clinicians a good general indication of interrupted brain functioning (Helmes, 2000). Notably, a deficit in recall may be due to dysfunction in the retrieval of information or the inability to retain information (Badderley, Kopelman & Wilson, 2004).

1.2.2.2 Attention

Attention can be understood as an individual's ability to become receptive to, and process incoming, stimuli (Lezak et al., 2004). These stimuli may be external, as in sensory information, or internal, as in thinking. Effective attention functioning involves multiple areas in the brain (Ponsford, 2000). Attention is consequently susceptible to dysfunction, or disorder, if any of these areas are compromised (Heilman & Valenstein, 2003). Lezak et al. explain that a deficit in attention would be marked by "distractibility or impaired ability to focused behaviour, regardless of the inpatient's intention" (p. 349). Ponsford (2000) remarks that assessment for attention can be particularly difficult especially if it involves individuals with traumatic brain injury. She notes that this is partly due to the criteria for measurement being so contested. Nevertheless, Ponsford proposes clinicians should consider several aspects of attention within neuropsychological assessment. These include "i) *visuospatial orientation* and *shifting attention*; ii) *alertness, vigilance* or *the ability to attention*; iii) *selective* or *focused attention*; iv) *working memory*" (p. 359).

1.2.2.3 Visuoconstruction ability

Visuoconstruction ability falls within the sensori-motor functional domain (Sadock & Sadock, 2007). It involves both visuo-spatial as well as perceptual motor proficiency (Lishman, 2006). Proper visuoconstructive functioning requires an individual to react corporally to spatial demands in an intentional and appropriate manner (Heilman & Valenstein, 2003). Within neuropsychological research and assessment this takes the form of tasks involving drawing or assembling objects (Lezak et al., 2004). This modality may be compromised by physical impairment as well as neurological dysfunction, caused by traumatic brain injury (TBI) or cerebrovascular accidents (CVA) (Lezak et al., 2004).

1.2.2.4 Executive Functioning

Executive functions entail those “capacities that enable a person to engage successfully in independent, purposive, self-serving behaviour” (Lezak et al., 2004, p.35). Sbordone (2000) notes that executive functioning encompasses four separate components, namely i) *volition* ii) *planning*, iii) *purposive behaviour* and vi) *effective performance* (p. 441). Executive functioning consequently pertains to planning, inhibition and affect or behaviour regulation (Mitrushina et al, 2005). Information about executive function is gained by investigating the manner in which an individual approaches a task. If a coherent and appropriate strategy is employed to complete a task executive functioning is assumed to be intact (Heilman & Valenstein, 2003). Conversely, disorganised and impulsive behaviour is frequently indicative of executive functional deficits (Lishman, 2006).

1.2.3 Clinical Neuropsychological Assessment

Clinical neuropsychological assessment operationalizes the neuropsychological perspective in order to distinguish neurocognitive functioning in an individual (Heilman & Valenstein, 2003). It uses general understanding of cognitive modalities and applies it to the particular person being assessed. The assessment process typically starts with a clinical interview (Lemsky, 2000), within which relevant biographical information, including demographic considerations, is obtained. This information affords clinicians about presenting problem, pre-morbid functioning and the individual’s experience of current functioning (Mitrushina et al, 2005). Thereafter clinicians select and use scientifically calibrated instruments to measure the identified cognitive domain or modalities (Sadock & Sadock, 2007). Tests are designed to home in on a specific modality, which allows the clinician to isolate both severity and location of potential dysfunction. A pivotal aspect of the assessment process is thus the selection of adequate test within the assessment battery (Strauss, Sherman & Spreen, 2006). The information gathered by these instruments give clinicians clear indications of current neuropsychological functioning (Heilman & Valenstein, 2003). It affords clinicians a unique understanding of an individual’s cognitive profile (Groth-Marnat, 2000).

1.2.4 Clinical Application

The information gathered from these instruments, allows the clinicians to make judgements or inferences pertaining to the diagnosis, treatment and prognosis of clients (Lezak et al., 2004). Meyers and Meyers (1995) emphasises that the data obtained from testing equips clinicians to make “diagnostic inferences” and “inferences regarding the tested ability in

absolute terms” (p.39). Here, by “absolute term” Meyers and Meyers imply the individual’s performance on a particular test in comparison to a general population. The person’s performance is thus matched to the general population to establish comparative functioning. It is important to note that average performance of the general population constitutes the norm by which the individual’s test performance is evaluated. The implication of this practice will be further elaborated below (see Section 1.3).

Lezak et. al (2004) mention several alternate situations which may require neuropsychological examination. These range from research, diagnostic consideration, designing patient treatment programs by evaluating individual needs, to patient care in the forensic setting. The diagnostic opinions based on measurements may, for instance within the forensic setting, determine whether a defendant is fit to stand trial; or within the medico-legal context may dictate whether a person is eligible for road accident compensation (Nell, 1999). Kaliski (2006) adds that neuropsychological assessment is extensively used in the South African legal system. Within personal injury claims, for instance, the extent to which traumatic brain injury has affected current functioning needs to be determined (Crawford, Parker, & McKinlay, 1992). Evaluations of this nature require clinicians to determine both pre-morbid and current functioning (Sadock & Sadock, 2007). Information pertaining to the former is achieved by corroborating the applicant’s accounts of his personal history with additional collateral information (Lezak et al., 2004), whilst the latter is determined primarily through neuropsychological test performance (Groth-Marnat, 2000).

As all these decisions influence the lives of individuals, their importance cannot be overstated. By the same token, these inferences are irrefutably linked to the psychological tools used. It follows that the accuracy and validity of the instrument is paramount. The use of valid and accurate tools is not only a scientific concern but an ethical one as well.

1.3 Clinical Interpretation

Uzzell, Pontón and Ardila (2007) highlight the challenges of applying universal neuropsychological theory to a specific context. A large majority of neuropsychological tests are developed in and designed for the Euro-American context (Foxcroft & Roodt, 2005). Studies to standardise these tests are performed primarily on the majority population groups found within these countries.

1.3.1 Normative considerations

Mitrushina et al. (2005) assert that neuropsychological test results are only meaningful if compared to a demographically similar population. In order for clinicians to make sense of test performance, in terms of both a diagnostic as well as an “absolute” sense (Meyers & Meyers, 1995, p. 39), the results should be considered in relation to the average performance of the population within which the test taker falls. Even though this principle is uniformly agreed upon by clinicians, the exact definition and specifications of demographic homogeneity is highly contested. Conventionally normative indications have been stratified to age, sex, educational level, ethnicity, language, handedness and IQ (Strauss et al., 2006). Clinicians found that each of these components significantly influence test performance and thereby should be considered in determining within which demographic group the test taker falls. A large body of normative research has subsequently confirmed the significant influence of each of these factors (Groth-Marnat, 2000; Mitrushina et al., 2005; Lezak et al., 2004; Strauss et al., 2006).

1.3.2 Sociocultural Considerations

Whilst acknowledging the function of these established normative considerations, cross-cultural research has called for a more exhaustive approach in interpreting non-Western test performance (Anderson, 2001; Nell, 2000). Researchers argue that although some degree of universalism may be assumed, for example the effect of aging on memory (Ardila & Rosselli, 1989), the influence of environmental factors on test performance may have been underestimated by traditional normative research.

1.3.2.1 Acculturation

An overarching theme within neuropsychological cross-cultural research is the influence of acculturation on test performances. Manly et al. (1998) defines acculturation in terms of “the level at which an individual participates in the values, language and practice of his or her own ethnic community verses those of the dominant culture” (p.292). Acculturation therefore applies predominantly to those who are demographically placed outside of the dominant culture. This becomes a particularly useful definition if superimposed upon the neuropsychological assessment paradigm. Nell (2000) adds that formal test taking is a distinctively Western construct. In its current form clinical psychological assessment has undergone a long development, saturated in Western socio-historical factors (Foxcroft & Davies, 2008). Nell explains that proficiency in test taking, or what he refers to as “test-

wiseness” (p. 64), depends principally upon adequate exposure to the testing environment and the subsequent assimilation and mastery of the rules of the test taking paradigm. More specifically, within the testing environment, Nell points out that test takers who are not “test-wise” may for example not realise the significance of accuracy or response speed. Such test-unwise participants may also not realise that the task in front of them demands their undivided attention. To the clinician these test takers could appear poorly motivated or resistant. Nell presages that if sufficient acculturation to the test taking environment is not present in the test taker, test performance would more readily reflect a deficit in “test-wiseness” than actual cognitive ability.

1.3.2.2 Education

Specific emphasis within sociocultural research is placed upon variances in educational factors within these countries. Various studies have noted the influence of education to an individual’s level of acculturation to the testing paradigm (Ardila, 2005; Boone, Victor, Wen, Razani, & Ponton, 2007; Nell, 1999). It is within the formal education settings that individuals learn to hold a pencil, to purposefully ignore external distraction in order to complete a task at hand or to approach a task in a specific manner (Nell, 2000). However, factors such as curriculum and access to resources may significantly influence the nature or quality of didactic practices (Kallaway, 1984). Education therefore cannot be assumed to be homogenous concept in all countries. Mathematics at high school level in Japan may be unrecognisably different to Mathematics in Gabon at the same level. It is then not surprising that conventional normative assumptions about education have received scrutiny from cross-cultural researches (Castro-Caldas, 2007; Shuttleworth-Edwards, Donnelly et al., 2004; Shuttleworth-Edwards, Kemp, et al., 2004). Manly et al. (2000) note the link between English literacy and acculturation of the testing environment. They assert that reading and writing proficiency denotes a level of contact with, or acculturation to, the formal education setting. This creates an aptitude which impacts significantly on both verbal (Andrews et al., 2012) and non-verbal (Fike et al., 2012) test performance.

1.4 The South African Context

A unique history of socio-political oppression has made the South African context distinct (Kallaway, 1984). The impact of racial policies on a vast majority of the population, have had an irrevocable and detrimental effect. The nature of the Apartheid regime was such that it infiltrated the focus, use and production of psychological knowledge (Foster, 2008).

Culturally biased conclusions were drawn from psychological theories only scientifically applicable in Western countries (Claassen, 1997). Prior to and during the Apartheid regime psychological practices became saturated with the racial political agenda (Foxcraft & Davies, 2008). As a result, present day psychological practices are, to a large extent, a reaction to this discriminatory ideology (Watts, 2008). Much of the focus of post-1994 political and social thought, has been to rectify the malevolence of the past.

1.4.1 Brief Historical Overview of Psychological Assessment in South Africa

1.4.1.1 Pre-Apartheid

Foster (2008) describes the formal coming of psychology to South Africa as clearly associated with the nationalist movement at the turn of the 20th century. He suggests that from this starting point psychology would be intertwined with political agenda. Foster remarks that the latest psychological theories were implemented to justify discriminatory social and legislative mechanisms. With the use of the newly developed mental testing, the government would be able to approach social and moral problems in a presumably “scientific” manner (p.99).

At the time the psychological instruments used were not standardised for the whole of South African population. Normative studies were performed exclusively upon a white middle class population. As a result, when test takers did not fall into this specified demographic, test results showed severe discrepancies (Foxcraft & Davies, 2008). Instead of challenging the apparent causes of these discrepancies, clinicians of the day interpreted these results as proof of some innate cognitive deficits in non-white population. Presently these differences in test performance can easily be attributed to cultural and educational bias, however in the pre-Apartheid period, it merely served to confirm and reinforced discriminatory thinking (Foster, 2008).

1.4.1.2 Apartheid

Claassen (1997) remarks that during the Apartheid regime no profession or academic field could claim to be completely devoid of political influences. This extensive period also saw great increase in the amount of available psychological instruments (Foxcraft & Davies, 2008). Foster (2008) notes that the increase in psychological tests could be largely attributed to the armed forces and industry, such a mining. These organisations needed effective ways to select personnel, and psychological testing aided in this decision making process (Watt,

2008). These new tests, however, were also primarily standardised for a white population. Similar discriminatory conclusions were drawn about non-white South Africans. What followed was that legislation regarding education and employment was drawn influenced by these biased results (Claassen, 1997).

Judged as less able, under the Act of 1953, the Apartheid government created a separate and substandard education system for non-whites (Kallaway, 1984). The Department of Education and Training (DET), also called the Bantu Education, had a separate and purposefully lower curriculum (Foxcraft, Roodt & Abrahams, 2005). These schools subsequently received substantially less resources than white Model C schools. Claassen et al. (2001) report that compared to traditionally white schools, DET schools received only 5-25% of the available educational resource. Under-resourced schools with a lowered curriculum provided black learners with a substantially lower quality of education. At the time, this policy affected approximately 75% of the South African population (Skuy, Schutte, Fridjhon, & O'Carroll, 2001).

1.4.1.3 Post-Apartheid

In 1994 Apartheid officially ended when fair and democratic elections were held. That same year the Psychological Society of South Africa (PsySSA) was founded, embracing the new milieu of social equality. The end of the Apartheid regime and coming of democracy brought with it an impetus of change. Reformation came about on many fronts, and on the forefront of discussion were policy relating to employment, education and social services (Freeman & Pillay, 1997). Legislation concerning race, education and sex equality needed to be forged.

Despite this yearning for reformation the deleterious effects of the substandard DET schooling system remained measurable in psychological test performance (Andrews et al., 2012; Fike et al., 2012). Notably, Shuttleworth-Edwards, Kemp et al. (2004) found that black South African pupils, educated in historically privilege English medium Model C schools, performance on the Weschler Adult Intelligence Scale-III (WAIS-III) was equivalent to American population norms. However, demographically equivalent pupils educated in a former DET type school achieved 20 to 30 IQ points lower. Notably, the outcome was replicated in a subsequent refinement of the original WAIS-III study and in respect of the WISC-IV (Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Van der Merwe et al., 2013). Importantly from this body of research it is evident that deleterious effects associated with a relatively poor quality of education were apparent for both verbal

and non-verbal tests. This being said, the study found that performance on the Digit Symbol-Incidental learning subtest was equivalent for both groups (Shuttleworth-Edwards, Donnelly et al., 2004). The researchers asserted that both level, or quantity, and quality of education for the most part contributes significantly to variations in cognitive test results. However, there may be exceptional culturally independent instances, such as with incidental visual learning test. Consequently, it cannot be assumed that international normative indications for all neuropsychological instruments are indiscriminately applicable to local demographic (Mitrushina et al., 2005), especially concerning previously disadvantaged population (Andrews et al., 2012; Fike et al., 2012; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Jordan, 1996).

Acknowledging the iniquities of past South African psychological practice and attempting to rectify its discrimination, the present mental health policy dictates that appropriate norms are required in assessment (Freeman & Pillay, 1997). This implies that clinician must be able to justify the use of any particular instrument and norms (Watts, 2008). This has subsequently formed part of ethical practices protocol of the HPCSA. Yet, at present, appropriate normative indications is simply not available for large sections of the population (Foxcroft & Roodt, 2005). This poses a substantial dilemma when attempting to interpret South African test performances with only Euro-American norms available. This state of affairs has led theorists to question the utility of Euro-American neuropsychological tests within the South African context. If the South African context is so wrought with socio-cultural inconsistency, to the point where inter-ethnic, inter-educational or linguistic homogeneity may not be assumed, what is the point of attempting normative research? Theorists ask if it would not be more prudent to create new South African neuropsychological tests.

Shuttleworth-Jordan (1996) argues that although such a “nihilistic” (p. 96) stance may have some merit in regards to rural or illiterate test takers, it is an intemperate and extremist reaction to the problems faced in South African psychological assessment. Firstly, this approach does not consider the difference in range and complexity of socio-cultural influence on the urbanised or non-urbanised population. Secondly, it discredits the neuropsychological, or cognitive functional, similarity of all human beings. Shuttleworth-Jordan concludes that although clinicians and researchers should continually be aware of the effect of socio-cultural influences on test performance, such as acculturation to the testing paradigm, resources in research may be more prudently spent on standardising and gaining appropriate norms for existing neuropsychological instruments.

In response to Shuttleworth-Jordan's proposition, as cited above, a series of studies have undertaken the project of finding appropriate norms data for South African populations that are least adequately represented by the existing European or American norms (Andrews et al., 2012; Fike et al., 2012; Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Edwards, Van der Merwe et al., 2013). One such neuropsychological instrument commonly employed in the medico-legal, forensic and clinical setting is the Rey-Osterrieth Complex figure (Camara, Nathan & Puente, 2000).

1.5 Rey-Osterrieth Complex Figure Test

1.5.1 Introduction

The Rey-Osterrieth Complex Figure (RCF) was developed by Swiss clinician André Rey in 1941 as a preliminary diagnostic tool. It requires participants to copy and thereafter recall an arrangement of two dimensional structures which constitutes the complex figure (Knight, 2003). Although the structures themselves do not require a great graphic aptitude, Rey (1964) noted that patients with brain injuries and other neurocognitive deficits have trouble copying and recalling the arrangement of the elements (Mitrushina et al., 2005). In 1944, seeing the test's utility, Paul-Alexandre Osterrieth, quantified Rey's 1941 complex figure test with a standardised scoring system. Osterrieth proposed that the complex figure consists of 18 distinct structural elements, each of which is scored separately (Lezak et al., 2004). In recent years a number of alternative versions and scoring systems have emerged (see Strauss et al., 2006), nonetheless the standard or RCFT version (Meyers & Meyers, 1995) remains the most popular and widely researched.

1.5.2 Administration and Scoring

Administration of the RCF is purposefully uncomplicated, requiring merely coloured pencils, some paper and a protocol or printed example of the complex figure (Knight, 2003). The Copy trial is the initial constructive trial of the test, in which a participant is asked to graphically reproduce the protocol placed in front of him. Thereafter, in the Immediate Recall (IR) trial, the completed copy and sample figure are removed and the participant is asked to recall it, in as much detail as possible, from memory. Test takers are purposefully not informed that the figure would have to be reproduced a final time. Following the completion of the IR trial, the participant is distracted for approximately 15 to 45 minutes with the remaining tests in an assessment battery (Mitrushina et al., 2005). The participant is then

asked to draw from memory the complex figure a final time. This last trial is referred to as the Delayed Recall (DR) trial. Within specified versions of the RCF, and additional recognition trial is added, where participants are asked to identify components of the complex figure (Meyers & Meyers, 1995).

Strauss, Sherman, and Spreen (2006) note that the RCF is scored both quantitatively and qualitatively. Firstly, participants are awarded points for the accuracy of reproducing each of the 18 components of the complex figure. Simultaneously, clinicians consider the manner in which participant approach the task. The most popular and extensively researched quantitative scoring system is the RCFT (Meyers & Meyers, 1995). This quantitative scoring system is used by the commercially available Rey-Osterrieth Complex Figure Test manufactured by Psychological Assessment Resources. It calls for between 0.5 to 2 points to be allotted per element depending upon the accuracy of reproduction. Accuracy is specifically considered in terms of both location and level of distortion. It follows that within this system a maximum of 36 point can be achieved within each trial.

Qualitative testing behaviour may give clinicians vital information about the cognitive functioning of the test taker. Consequently the strategy adopted in drawing the figure is carefully noted. This is achieved by systematically handing the test taker different coloured pencils whilst the test taker is drawing the figure. Coloured pencils are exchanged at the completion of predetermined components of the figure. By then looking at both the order in which the coloured pencils were presented to the participant and which component of the complex figure was drawn with a particular colour, the procedural strategy or style may be determined. In his initial research, Osterrieth (1944) observed seven distinct types of procedural styles (I-VII) associated to the drawing of the RCF (Table 1). Further qualitative information may include time taken to complete a task, pressure of pencil on paper, concentration or motivation during test taking and amount of questions asked about the task.

Table 1. Osterrieth (1944) Rey Complex Figure Procedural Types

Type	
I	Subject begins drawing the large central rectangle and details are added in relation to it
II	Subject begins with a detail attached to the central rectangle, or with a subsection of the central rectangle, completes the rectangle and adds remaining detail in relation to the rectangle
III	Subject begins by drawing the overall contour of the figure without explicit differentiation of the central rectangle and then adds the internal details
IV	Subject juxtaposes details one by one without an organising structure
V	Subjects copies discrete parts of the drawing without any semblance of organization
VI	Subject substitute the drawing of a similar object, such as a boat or house
VII	The drawing is an unrecognisable scrawl

Note. as cited by Lezak et al., 2004

1.5.3 Psychometric Characteristics

Psychometrically, the RCF constitutes three separate trials (Copy, IR and DR). As a result, an array of studies investigating the psychometric properties of each individual's trial as well as inter-trial correlations, have emerged (see Knight, 2003). In reviewing both factor analytical and correlational studies, Strauss, Sherman and Spreen (2004) assert the validity of the RCF "as measures of visuo-constructional ability (copy) and memory (recall and recognition)" (p. 831). Exemplifying this, Meyers and Meyers (1995) report inter-test correlation between IR and DR of .88. This correlation indicates that these trials access different components (*short term vs. long term*) of the same cognitive modality (*visual memory*).

A substantial body of research has indicated internal reliability of greater than .60 for Copy trial and above .80 for IR and DR trials (see Strauss et al, 2006). Mitrushina and associates (2005) note that inter-rater reliability could theoretically pose a problem as the scoring of "distortion" to structural elements of the complex figure could be viewed as a "subjective judgement" (p.248). However, the majority of studies report excellent inter-rater reliability ranging from 0.80 to 0.99. In addition, moderate to high test-retest reliability for Immediate Recall ($r = .76$) and Delayed Recall ($r = .89$) when investigating 12 participants with an interval of 6 months (Meyers & Meyers, 1995). It is this psychometric rigour and its clinical

utility which seems to attest to the ROCF's popularity among neuropsychological practitioners the world over (Strauss et al., 2006).

1.5.4 Neuropsychological characteristics

Numerous studies have affirmed Rey's initial observations that patients with brain injuries have difficulty with Copy, IR and DR trials (see Lezak et al., 2004). Although each of the RCF's trials can be used to examine different neuropsychological faculties (Knight, 2003), its primary clinical function remains to assess "visual-spatial construction abilities and visual memory" (Strauss et al., 2006, p. 811). From the discussion above (see Section 1.2.2), it is clear that these are broad descriptions of functional modalities. It is therefore important to look at the rich neuropsychological information elicited by each trial separately.

1.5.4.1 Copy Trial

As Rey (1964) discovered, the deceptively simple Copy trial accesses a variety of functional modalities. It predominantly taps into attention and visuoconstructional ability, it also requires a great deal of spatial organizational ability or executive functioning to successfully execute (Lezak et al., 2004). Deficits in any of these cognitive modalities may consequently be highlighted if the task is attempted. For instance, difficulties in visuoconstructional ability may express itself through enlarged figures (Knight, 2003), rotation errors (Meyers & Meyers, 1995) or loss of detail (Mitrushina et al., 2005). Binder (1982) found that individuals with right hemisphere damage find the Copy trial particularly difficult. Notably these individuals would reproduce the complex figure, by drawing it in a disorganised and piecemeal manner.

1.5.4.2 Immediate Recall Trial

The Immediate Recall (IR) trial also accesses attention, visuoconstructional ability and executive functioning, however it relies heavily on short term visual memory (Knight, 2003). Subjects are not forewarned that they will have to reproduce the figure, which eliminates mnemonic strategies being employed by the test taker (Lezak et al., 2004). Performance thereby allows clinicians to determine whether incidental encoding of the sensory information has taken place.

1.5.4.3 Delayed Recall Trial

As participants are also not warned about the Delayed Recall (DR) trial, it provides clinicians evidence of whether long term visual memory encoding has taken place (Meyers & Meyers,

1995). The unexpected nature of the DR trial also minimises the effect of rehearsal taking place and thereby emphasises the implicit visual memory component (Knight, 2003). It provides clinicians evidence relating to encoding, retention and retrieval of information.

1.5.4.4 Organisation Procedure

Of equal importance is the procedural type the participant follows in completing the trials. Osterrieth (1944) asserts it relates to planning and is thereby indicative of executive functioning. Strauss, Sherman and Spreen (2006) remark that the manner in which the participants approach all of the trials gives clear indication of whether effective encoding and retrieval have taken place. In his original study, Osterrieth (1944) found that 83% of healthy adults who followed procedure Type I or II, whilst 15% used Type IV. Therefore within the control sample Type V to VII, was not followed. The same study also noted that 63 % of his sample who had suffered traumatic brain injury also followed Type I and II. Considering these results, Visser (1973) remarked that in attempting to copy the RCF, individuals who have suffered significant brain injury, especially damage to the right hemisphere, lose the overall gestalt or configuration of the figure. These individuals are thereby presented with the difficult task of remembering disjointed element of the design. Kramer and Wells, (2004) explains that healthy individuals view the design from a global perspective, whereas individual's with cognitive deficits or impairments consider the design from a local vantage point.

Lezak et al. (2004) add that the procedural type employed by test takers within the Copy Trial significantly influences the manner in which the figure is recalled. They assert that the organisational strategy used has a strong influence on the amount of detail recalled. Fujii, Lloyd and Miyamoto (2000) found that this is significantly more evident in lower intellectual functioning test takers as opposed to higher intellectual functioning test takers. Mitrushina et al. (2005) cite numerous studies which correlate deficits or marked impairment of organisational strategies to ADHD in adults, Alzheimer's disease, frontal lobe damage, and even Obsessive Compulsive Disorder. It is thus suggested that the RCF trials are consider both individually and within relation to each other (Meyers & Meyers, 1995). It is asserted that this analysis may help distinguish between disorders (Knight, 2003).

1.5.5 Demographic effect on the RCF

To the author's knowledge there have been no South African normative studies performed on the RCF. Despite this, it remains a commonly employed neuropsychological test in present

day clinical settings (Foxcroft, & Roodt, 2005). The effects of local demographic factors on test performance therefore remain unstudied. Based upon cross cultural studies clinicians can at best assume the effects of demographic features (Ardilla & Rosselli, 2007). In order to provide the reader with insight into the effect of demographic factors on test performance as well as organisational strategy, relevant international normative research will be reviewed below.

1.5.5.1 Sex

Although contemporary feminist theories have critiqued sex difference in psychological research (Eagly, Eaton, Rose, Riger & McHugh, 2012), normative studies have found significant difference in neuropsychological test performance. Fletcher-Janzen, Strickland and Reynolds (2000) explain that the structural and functional difference between the male and female brain may explain this discrepancy. Citing several neuroscientific studies, they conclude that differences in brain weight, size, blood flow and metabolism rate, may translate into neuropsychological differentiation between sexes. Although these differences are observed primarily in certain functional modalities (Sadock & Sadock, 2007), Fletcher-Janzen et al. warn that if these differences are not acknowledged in neuropsychological norms it “will overpathologize the scores of the underperforming sex and at the same time fail to detect true declines in the sex with the higher baseline” (p. 73).

Strauss, Sherman and Spreen (2006) note that the effect of sex on RCF test performance remains contentious. Whilst some studies have found that males perform better than females (Ardilla & Rosselli, 1989; Fastenau, Denburg, & Hufford, 1999; King, 1981), others found difference in test performance to be too small to consider (Boone et al., 1993; Meyers & Meyers, 1995). Strauss and colleagues conclude that the studies cited do not conclusively exclude the effect of other variables, such as “handedness”, “familial handedness” and “academic concentration” (p. 826), to make a confident claim on sex effect. Similar ambiguity about sex effect on test performance is found in other seminal normative text books (Groth-Marnat, 2000; Mitrushina et al., 2005). This discrepancy in research findings may merely indicate large inter-sex variance. To the authors knowledge no studies have investigated the influence of sex upon procedural type as defined by Osterrieth (1944) (as delineated earlier in Section 1.5.2).

1.5.5.2 Age

The normal effect of aging upon memory is well documented (Ardilla & Rosselli, 1989; Groth-Marnat, 2000; Lezak et. al., 2004; Lishman, 2006). More specifically, normative studies of the RCF found a robust age effect for Copy, IR and DR trial (Mitrushina et al., 2005). Notably a significant decline in mean performance is observed from middle adulthood onwards (Ardilla, Rosselli & Rosa, 1989; Chiulli et al., 1995; Fastenau et al., 1999; Ostrosky-Solis, Jaime, & Ardila, 1998). Research is however unclear as to whether scores decline gradually with age or whether there is an abrupt drop in performance at a particular age (Gallagher & Burke, 2007). Seminal texts note the significant effect age has on performance, and contend the importance of considering its effect upon normative indications (Knight, 2003; Lezak et al, 2004; Strauss et al., 2006). Meyers & Meyers (1995) have the most widely used normative results the effect of age on overall RCF performance.

In regards to organisational strategy, research notes that age has some effect upon the way individuals approach the RCF. Osterrieth (1944) observed that within his control sample, beyond the age of seven, test takers employ Type I to IV, but do not followed Type V to VII. He also observed that past the age of thirteen the majority of test takers follow Type I or II, which remains stable until advanced age (Chiulli et. al, 1995). Strauss, Sherman and Spreen (2006) assert that “organisational abilities of older adults are not only well preserved but also appear important for maintaining a high level of performance” (p. 832).

1.5.5.3 Education

The effect of education upon RCF test performance is similarly contentious. Cross cultural researchers have reported significant education effect on all three trials (Ardila & Rosselli, 2007; Ardila, Rosselli, & Rosa, 1989; Berry, Allen & Schmitt, 1991; Ponton, Satz, Herrera, Ortiz et al., 1996). However, the influence of level of education may be more pronounced within certain demographic, such as geriatric or minority populations (Mitrushina et al, 2005). Ponton et al. (1996) investigated the effect of level of education on a healthy Spanish-speaking population living in Los Angeles, California. Test performance of Copy and Delay Recall trials were stratified according to age, sex and level of education. Significant differences were observed for both trials, between same sexed participants of the similar age with either less or more than 10 years of formal education. The researchers noted that formal education influences both the manner in which the RCF is approached as well as the

proficiency of recall. Ponton et al. concluded that no measure of cognitive functioning can be considered free from education effects.

This being said, seminal normative textbooks (Lezak et al., 2004; Mitrushina et al., 2005; Strauss et al., 2006) and standardisation studies (Fastenau et al., 1999; Meyers & Meyers, 1995; Knight, 2003) recount the validity of these cross cultural studies. To account for the ambivalence of research surrounding education, Mitrushina et al. (2005) suggest a “threshold” theory (p. 250). They argue that once test-takers have achieved a particular level of education, test performance may more readily be influenced by other variables, such as age, IQ or sex, rather than the effect of education. Therefore, whilst significant variance may be found within the sub-threshold range, beyond this threshold point the effect of education becomes nullified. Mitrushina and colleagues place this threshold at the completion of high school, thus ≤ 12 years of education. There is current no international studies available investigating the effect of quality of education upon RCF test performance.

Lastly, Ardila and Rosselli (2007) have noted the impact of education upon visuospatial and visuoconstructive abilities in general. Correspondingly, Castro-Caldas (2007) discussed the relationship between functional brain organisation and education. These researchers have proposed that if test takers have achieved a sufficient level of formal education, it may equip them with mnemonic and organisational strategies with which to approach the tasks asked of them (Rosselli & Ardila, 2003). Test takers are consequently better versed in construction tasks, such as writing and assembling objects. These researchers rationale is, here, resonant of both Nell’s (2000) and Manly et al.’s (2000) assertions that education may be considered a form of acculturation to the test taking environment. To the author’s knowledge, there is currently no study available describing the effect of education upon organisational strategy (as delineated earlier in Section 1.5.2)

1.5.6 Meta-analytic Findings

Gallagher and Burke (2007) notes that due to the variance in administrative and scoring systems, meta-analytical studies performed on the RCF, are few and far between. Nevertheless, Mitrushina et al. (2005) performed a meta-analysis on all available normative studies of the RCF. The central parameter for the meta-analyses was the use of a standard 36 points scoring system, which therefore incorporated the above mentioned Meyers and Meyers (1995) approach. This analysis included a total of nine studies, with a total sample size of 1340 for Copy trial, 1086 for Immediate Recall and 1056 for Delayed Recall. It is important

to note that this analysis focuses primarily upon mean performance of the three trials and does not mention organisational strategy. Within these studies Mitrushina and colleagues, investigated the relationship between age and mean test performance (Table 2).

Table 2. Meta-analytical Predicted Mean Scores of RCF, by Age – Copy, IR and DR

Age	Copy		Immediate Recall		Delayed Recall	
	M	SD	M	SD	M	SD
22-24	35.04	1.10	24.92	4.87	25.18	6.67
25-29	34.99	1.39	24.82	5.49	24.87	6.67
30-34	34.88	1.70	24.58	6.07	24.41	6.67
35-39	34.69	2.01	24.18	6.55	23.85	6.67
40-44	34.43	2.32	23.64	6.93	23.17	6.67
45-49	34.11	2.64	22.95	7.19	22.38	6.67

Note. Mean (M) and Standard Deviations (SD) represents score out of 36 using the Standard and RCF scoring system. On the basis of a regression of SDs on age, the SD for the aggregate sample is used with all age groups (after Mitrushina et al., 2005, p.792).

Using regression analyses, they found that age had a significant effect upon all three trial's performance. Conversely, they observed that sex did not consistently significantly influence mean performance. An additional analysis was performed by Mitrushina and colleague, utilising the same parameters. They sought to investigate the effect of education on test performance. As with sex, it was noted that education did not have a consistent significant effect on test performance. Nevertheless large variance in the studies were observed, which they attributed to extraneous factors not mentioned by the researcher.

1.5.7 Applicability to the South African Context

From the discussion above it is evident that the RCF is a sensitive and serviceable neuropsychological instrument (see Section 1.5.4). It provides clinical insight into multiple functional modalities, including attention, visuoconstruction ability, visual memory and executive functioning (see Section 1.2.2), which allows for diagnostic and absolute inferences to be made (Meyers & Meyers, 1995). A characteristic of the RCF which gives it particular applicability to the South African context is that the materials used in the test, such as paper and pencils, are easily available in rural settings. The most specialised of the materials used

in the test are the protocol of the RCF itself and the scoring sheet. It is therefore an inexpensive test to administer. This being said it provides clinicians with a huge amount of invaluable information about the test-taker's functioning. Of equal importance is that the RCF is a non-verbal test. Instructions given to test taker are designed to be simple and clear. Within the clinical setting, assessments are frequently achieved by use of an interpreter or relative to translate for the test-taker. The clarity and simplicity of the instruction facilitate this translation processes. In a country such as South Africa with 11 official languages and a myriad of dialects, this becomes an irreplaceable feature of the RCF.

1.6 Rationale for the present study

The above reviewed research advocates both the robust neuropsychological utility and the administrative and scoring clemency of the RCF (Meyers & Meyers, 1995). It is not surprising that the RCF has become one of the most widely used neuropsychological tests worldwide (Camara, Nathan & Puente, 2000). RCF test performance can only be interpreted, and be considered meaningful, if compared to demographically equivalent norms (Mitrushina et al., 2005). The discussion above has shown that defining demographic homogeneity in test takers may be a difficult task. It was noted that, in particular, for South African test takers, a myriad of influential factors which include South Africa's socio-political history, ethnicity, quality of education and geographical location may drastically alter test performance. It was also pointed out that by ignoring these considerations and persisting to assume cultural, ethnic or linguistic homogeneity, clinicians run the risk of commenting upon proficiency in a culturally defined practice (test-wiseness) as opposed to actual neurocognitive ability (Nell, 2000). An overview of relevant history has illustrated that this unscientific and unethical practice has a longstanding history within the South Africa context (see Section 1.4).

Contemporary South African studies have shown the significant influence these factors have on test performance assessing a wide variety of cognitive modalities (Andrews et al., 2012; Fike, et al., 2012; Nell, 1999; Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Kemp et al., 2004; Skuy et al., 2001; Shuttleworth-Edwards, Van der Merwe, et al, 2013). On the other hand, investigating a similarly disadvantaged population Shuttleworth-Edwards, Donnelly et al. (2004) found that these factors did not significantly influence performance on an incidental visual memory test. From the variance in these findings, it follows that without accurate normative research clinicians cannot know which, or to what extent, cognitive modalities are influenced by socio-cultural factors. Research

incorporating appropriate local demographics becomes paramount in establishing culturally fair and scientifically accurate neuropsychological test batteries (see Section 1.3).

The RCF is one such neuropsychological test which due to psychometric and practical reasons is particularly suited to the South African context, requiring inexpensive materials and simple and easily translatable instructions (see Section 1.5.7). Despite this suitability, to the author's knowledge, there are currently no African or Southern African normative indications available. Due to this hiatus, clinicians are forced to interpret South African test performance using Euro-American norms (Foxcroft & Roodt, 2005). However, unlike the Digit Symbol Incidental Learning test, which showed no cultural effect for visual recall (Shuttleworth-Edwards, Donnelly et al., 2004), the RCF is neuropsychologically a considerably more complex task (see Section 1.5.4). To successfully complete the RCF's multifaceted design, organizing strategies are employed (see Section 1.5.4.4). Conversely, the relatively simple stimuli on the Digit Symbol Incidental Learning test (see Section 1.2.2.4) do not elicit this executive functioning element (see Section 1.4.1.3). The use of multiple cognitive modalities makes the RCF a comparatively more challenging recall task. It cannot be assumed that as with the Shuttleworth-Edwards, Donnelly et al. study, no cultural effect will be present in local RCF performance.

As Shuttleworth-Jordan (1996) has pointed out, neuropsychological assessment research within South Africa may take two approaches in addressing this problem. The first approach is to create new instruments exclusively for the South African context. The second is to conduct appropriate normative investigation on existing well established international tests. The present study wishes to affirm Shuttleworth-Jordan's (1996) position that the latter approach is most cost effective and prudent. The present study forms part of a wider study and aspires to expand upon earlier cross-cultural research conducted on the WAIS III (Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Kemp et al., 2004; Shuttleworth-Edwards, Van der Merwe, et al., 2013) as well as a series of more specific neurocognitive tests (Andrews, et al, 2012; Fike et al., 2012; Shuttleworth-Edwards, Donnelly et al., 2004). This study therefore aims to provide preliminary normative indications for a South African population highly influenced by the above mentioned socio-culture factors and thereby least adequately represented by available Euro-American and Meta-analytical norms.

1.7 Hypotheses

Based on the above discussion the following hypotheses pertaining to a non-clinical sample of black, Xhosa speaking unskilled workers, with a highest level of education of between Grade 11 and 12, achieved in a traditionally black township schools, are proposed:

- i. In contrast to the lack of cultural effects on the Digit Symbol Incidental Learning test (Shuttleworth-Edwards, Donnelly et al., 2004), it is hypothesized that the greater visuoconstructional complexity of the Rey Complex Figure test will result in the presence of a significant culture effect (see Section 1.6). More specifically, it is hypothesized that the mean scores of all three trials (Copy, IR and DR) will be significantly lower than that of international participants of equivalent age and level of education presented in Mitrushina and colleagues' (2005) meta-analysis (see Section 1.5.6).
- ii. In accordance with the age effect that has been noted in the literature (see Section 1.5.5.2) it is hypothesized that there will be a significant age effect present in the local sample's performance for all three trials of the RCF (Copy, IR and DR).
- iii. In accordance with the lack of significant sex effect that has been noted in the literature (see Section 1.5.5.3), it is hypothesized that there will be no significant sex effect present in the local sample's performance for all three trials of the RCF (Copy, IR and DR).
- iv. Although to the author's knowledge, no study has investigated the effect of quality of education upon organisational strategy (see Section 1.5.4.4) two possible hypotheses are posed:
 - a. Given the nonclinical nature of the study's sample, it is postulated that the local sample will mirror Osterrieth's control sample (1944), thereby most frequently following the optimal Type I and Type II organisational procedure.
 - b. Alternatively, given the fact that the literature indicates deleterious effects on procedural (i.e., non-verbal) cognitive abilities, it is postulated that the local sample will not mirror the westernized Osterrieth's control sample in

following Type 1 and Type II organisational procedures, but rather employ a more disorganized procedure.

Chapter 2

Methodology

The principal aim of the present study is to provide preliminary normative indications for the Copy, Immediate Recall (IR) and Delayed Recall (DR) trials of the Rey Complex Figure test (RCF), for a Xhosa population living in the Eastern Cape, with a Grade 11 to 12 education received in the relatively disadvantaged setting of a former Department of Education and Training (DET) township school. The study forms part of a larger research project in which preliminary normative indications were obtained for 16 commonly employed neuropsychological tests on the same sample. The larger research project was funded by a Rhodes University Council research grant. The author was not involved in the administration and scoring of the instruments. The test battery was administered by four intern psychologists under the coordination of Professor Ann Edwards. Groupings of similar tests, including tests of attention and concentration, hand motor speed, verbal ability and malingering indicators, as well as WMS visual and verbal memory were allocated to the various clinicians. This allowed for the development of four separate theses from the local sample's performance. In the process of this distribution, the Rey Complex Figure test outcomes were omitted for analysis. This data set was subsequently made available for the purpose of the present study.

2.1 Sampling

2.1.1 Participants

For the purposes of the larger research study, a non-clinical sample of 33 black Xhosa speaking South African participants (21 female and 12 male) with basic proficiency in English were selected. Participant's ages ranged from 18 – 40 years ($M=28.39$, $SD. = 5.99$). Those selected for the study worked and lived in Grahamstown, Eastern Cape. Participants' level of education ranged between Grade 11 and 12, with no tertiary education or qualification. Their education was obtained in the Eastern Cape at a township school therefore a former-DET institution. At the time of the study, all participants were Level F unskilled workers as, defined by the Employment Equity Act (S. Robertson, personal communication, October 12, 2007). Seven of the participants (21.21%) were unemployed and the remaining twenty six (78.79%) were employed in jobs ranging from housekeeping, garden service, and serving as waiters to kitchen staff at a fast food restaurant. Nineteen of

the participants (57.58%) were drawn from the casual support staff membership of Rhodes University.

2.1.2 Language

As noted above participants were required to have a basic proficiency in English, which was assessed by identifying candidates who had passed English as a 2nd language at a minimum of level of Grade 11. Secondly, participants needed to either currently be working in, or to have a history of working in, an English environment. In their respective working environments, some participants received instruction from managers in English whilst others needed to communicate with customers in English. Lastly, participants were asked to assess their own proficiency with a self-report questionnaire (Appendix C). This allowed researchers to obtain a self-generated quantified measure of participant's grasp of English. According to this questionnaire, all participants felt confident to converse in English. The inclusion of these language criteria allowed researchers to assume a degree of linguistic homogeneity within the sample. As the literature review noted, the RCF does not require an excellent grasp of spoken English or an advanced level of literacy. This said the RCF was only one of the 16 neuropsychological tests administered in a larger battery (Table 3). For several of the tests, such as the *Word-a-minute* test (Baker & Leland, 1967) and *Stroop Test* (Golden, 1978) a level of English reading, writing and speaking ability was needed. Although a good grasp of English is not a specific prerequisite for the completion of a non-verbal test such as the RCF, English literacy in general can significantly impact upon test performance. Manly and colleagues (2000) highlight this link between English literacy and acculturation, concluding that reading and writing proficiency denotes a level of exposure or acculturation to the formal education setting and thus the test-taking environment, which significantly impacts upon test performance in general. Controlling for this variable therefore becomes important irrespective of whether it is utilised by the cognitive modality elicited by the particular instrument.

Table 3. Neuropsychological Assessment Battery Order of Tests

Position in Test Battery	Test	Author
1	Wechsler Memory Scale (WMS) Reproduction for Designs - Immediate Recall	Wechsler, 1945
2	Wechsler Memory Scale (WMS) Paired Associates - Immediate Recall	Wechsler, 1945
3	Successive Finger Tapping Test	Denckla, 1973
4	Purdue Pegboard	Tiffin & Asher, 1948
5	Trail Making Test – Trail A and Trail B	Reitan, 1956
6	Wechsler Memory Scale (WMS) Reproduction for Designs - Delayed Recall	Wechsler, 1945
7	Wechsler Memory Scale (WMS) Paired Associates - Delayed Recall	Wechsler, 1945
8	Digit Span Subtest of WAIS-III - Forwards and Backwards	Wechsler, 1997
9	Rey-Osterreith Complex Figure – Copy	Osterreith, 1944
10	Rey-Osterreith Complex Figure - Immediate Recall	Osterreith, 1944
11	TOMM - Trial 1 and Trial 2	Tombaugh, 1996
12	Words-in-a-Minute	Baker & Leland, 1967
13	‘S’ Words-in-a-Minute	Benton, Hamsher, & Sivan, 1994
14	Stroop Test	Golden, 1978
15	TOMM - Retention Trial	Tombaugh, 1996
16	Rey-Osterreith Complex Figure - Delayed Recall	Osterreith, 1944
17	Rey 15-Item Memory Test	Rey, 1964

2.1.3 Education

The literature reviewed emphasised the influence of education upon test performance (see Section 1.5.5.3). Importantly, research indicates that both level and quality of education may

contribute to performance (Andrews, et al, 2012; Fike et al., 2012; Shuttleworth-Edwards, Gaylard, & Radloff, 2013; Shuttleworth-Edwards, Kemp et al., 2004; Skuy et al., 2001; Shuttleworth-Edwards, Van der Merwe, et al, 2013). Correspondingly, parameters were put in place to investigate the potential influence of both these elements.

2.1.3.1 Level of Education

Firstly, participants eligible for the present study were required to have achieved a minimum of Grade 11, whilst not having attended any tertiary institution. The sample’s highest level of education ranged from Grade 11 to 12 (M = 11.73). Specifically, out of the 33 participants eligible for the study, nine successfully passed Grade 11 whereas a majority of 24 individuals attained a highest level of education of Grade 12. Special care was taken to ensure equivalence of educational level within each age grouping (18 – 29 years and 30 – 40 years). An Independent t-tests confirmed that both age groups contained participants with statistically similar distribution of level of education ($p = > .05$) (Table 4).

Table 4. Level of Education Distribution of Sample across Two Age Groupings (18 – 29, 30 – 40)

Age		Grade		Total
		11	12	
18-29	N	4	13	17
	% within Age	23.5%	76.5%	100.0%
30-40	N	5	11	16
	% within Age	31.2%	68.8%	100.0%
Sample	N	9	24	33
	% within Age	27.3%	72.7%	100.0%

Note. No significant difference in education distribution within the two age groupings ($p = > .05$).

2.1.3.2 Quality of education

Particularly pertinent to the present study, was that all participants received their education from a former DET school located within the Eastern Cape. The literature review elaborated

the significance of this inclusion criterion (see Section 1.3.2.2). It was assumed that all participants received approximately the same quality of education through a former DET type institution. This being said it is possible that although all participants attended a DET typed school, the quality therein may have fluctuated. This could be in part due to annual resource availability to the specific school. Not enough historical information existed about the various schools that were attended, in order to irrefutably assert educational standard homogeneity. Therefore the study assumed a certain general quality of relatively disadvantaged education by virtue of restricting the type of education to that of former DET/ township schooling.

2.1.4 Age

Importantly, the sample's ages ranged from 18 to 40 years ($M = 28.39$, $SD = 5.99$). This age band was selected as Nell and Ormond Brown (1991) note that within South Africa they are most at risk for traumatic brain injury. It follows that prevalence of neuropsychological assessments would be equally higher within this age band. Within the South African clinical context, obtaining accurate normative indications for this age band is much needed. Various studies have demonstrated that age has a significant effect on performance in all three trials of the RCF (See Section 1.5.5.2). In order to investigate this phenomenon, the sample was divided into two age groupings, 18 – 29 and 30 – 40 years. Independent t test confirmed that there was no significant difference in terms of distribution of sex or level of education between the two age groups ($p > .05$ in all instances. The younger group contained 17 participants between 18-29 years old (mean age = 23.65 years, $SD = 3.463$; Mean level of education = 11.76 years, $SD = 0.437$), whereas the older group consisted 16 participants of 30-40 year olds (mean age = 33.44 years, $SD = 3.326$; mean level of education = 11.69 years, $SD = 0.479$).

2.1.5 Sex

Lastly, research provides contradictory accounts of the effects of sex on RCF test performance (see Section 1.5.5.1). This being said, seminal neuropsychological texts note significant sex effect in the performance of other neuropsychological instruments (Lezak et al., 2004; Mitrushina et al, 2005; Strauss et al., 2006). Acknowledging this potential influence of sex on performance, the present study's sample was stratified into two sex groups consisting of 21 females (63.64%) and 12 males (34.36%). An Independent t-tests noted that the distribution of sex within the two above mentioned age groups was significantly similar ($p = > .05$) (Table 5). Consequently, the two age groups were statistically similar in terms of

both sex and level of education. This is noteworthy as the potential influence of both these factors could be control for within statistical comparison of these groups' RCF performance.

Table 5. Sex Distribution of Sample across Two Age Groupings (18 – 29, 30 – 40)

Age		Sex		Total
		Female	Male	
18-29	N	10	7	17
	% within Age	58.8%	41.2%	100.0%
30-40	N	11	5	16
	% within Age	68.8%	31.2%	100.0%
Total	N	21	12	33
	% within Age	63.6%	36.4%	100.0%

Note. Sex distribution within the two age groupings is significantly similar ($p = > .05$)

2.1.6 Exclusion Criteria

As the primary aim of this study was to provide preliminary normative indications of RCF performance for a previously disadvantaged sample, the influence of certain extraneous factors needed to be controlled. Guided by research (see Section 1.3 and 1.5.5), the present study proposed to exclude participants whose test performance may be significantly influenced by the following factors: (i) a history of neurological or psychiatric disorder, be it mild or severe enough to require hospitalisation; (ii) the past or present use of psychotropic medications;. (iii) a prior head injury with loss of consciousness for longer than one hour; (iv) history of prenatal or birth complications;(v) prior diagnosis of a learning disability or having received education in a special-needs facility; (vi) the need to repeat a grade more than once; (vii) history of alcohol or substance dependence, or having ever been admitted to a substance abuse treatment or rehabilitation institution.

In order to assure that participants did not meet any of the exclusion criteria, a self-report questionnaire (Appendix B) was given to all potential participants. The questionnaire elicited biographical information pertinent to these criteria. An additional detailed pre-test screening questionnaire (Appendix C) was also administered on the day of testing. Both these measures were put in place to minimise the extraneous influence of these factors. Admittedly the study

relied upon accurate transparency from participants. Due to limited resources this information was taken at face value, as researchers were unable to validate information with collateral or historical documents.

2.2 Procedure

2.2.1 Participant selection process

The researchers approached the Human Resource Department of Rhodes University in order to find participants within its faculty which approximately fitted the predetermined criteria as described above under the description of the sample. Guided by the Human Resource department's recommendation, Rhodes University casual workers appeared most applicable for the research purposes. Permission was subsequently obtained to gain access to the database and paper files of recent casual workers.

From this information, researchers identified casual workers with a highest level of education of between Grade 11 and 12, thus no tertiary education. These identified participants were then contacted telephonically and invited to attend a presentation, within which the research purposes would be explained. Following this briefing, these potential candidates were asked to complete a biographical questionnaire (Appendix B). The information elicited by this self-report questionnaire enabled researchers to identify suitable participants who fitted within the study's participant parameter. Suitable candidates were informed that they would receive R100 Steers voucher if they choose to participate. This monetary compensation served as both an incentive to participate, as well as showing the researchers gratitude for their participation.

At this point researchers noted that the sample size was too small. In order to increase the sample size and to efficiently identify additional participants, snowball sampling was thereafter used (Terre Blanche, Durrheim, & Painter, 2006). The newly identified participants were telephonically contacted, and the nature and purpose of the research project was fully explained to them. These new candidates were then asked to complete the biographical questionnaire. After reviewing the questionnaire, eligible participants were re-contacted and informed about the testing date and compensation for their participation.

2.2.2 Test administration Preparations

It was decided that four clinicians would administer the test battery. The testing team consisted of three clinical and one counselling intern psychologist. As the allocated clinicians were still in training, certain preparatory steps were taken to ensure testing was performed correctly. Strict adherence to the standardised administration of the test was paramount to ensure accurate and scientific normative indications. The team consequently underwent specific training in the administration and scoring procedures of each test by the research supervisor, Prof. Ann Edwards. To consolidate what was learned during training, clinicians administered and scored the test battery on each other.

2.2.3 Pre-Testing

Once individual participation was confirmed, the sample was divided up amongst the four clinicians. Clinicians were responsible for administering the test battery as well as scoring performance of participants allocated to them. Before formal testing commenced, clinicians explained how testing would work to participants and asked them to sign a consent form (Appendix D). It was re-emphasised that test-taking was completely voluntary and that participants might discontinue at any point. Participants were lastly given a pre-screening questionnaire (Appendix C) to complete.

2.2.4 Data Collection

2.2.4.1 Testing

As indicated above, the present author was not part of the team of clinicians who administered the test battery. Testing took place in each of the clinician's offices. Special care was taken to ensure that the testing environment remained quiet and well lit. All instructions were given in English and participants were given the tests in a set order (as delineated earlier in Section 2.1.2). The battery took on average two hours to administer, which included a 10 min break. Testing behaviour was carefully noted and recorded (Appendix A). The RCF's administration consequently formed part of the larger test battery. The test battery of 16 neuropsychological tests was tailored to investigate six broad functional modalities such as are typically delineated in core neuropsychological texts including Visual and Verbal memory, Hand Motor function, Attention, Visual Perception, Language and Executive Function (Strauss et al., 2006). The RCF contributed to evaluation of skills in Visual Perception, Executive Function and Visual Memory, and was administered towards the end

of the battery (9th, 10th and 16th for RCF Copy, Immediate Recall and Delayed Recall, respectively) (see Section 2.1.2). Special care was taken to ensure that the other visual memory tasks from the Wechsler Memory Scale did not serve as interference for the RCF delayed recall, and they were administered early on in the battery. A series of verbal and executive tasks served as intervening tasks prior to the administration of the RCF delayed recall task.

2.2.5 Data Processing

2.2.5.1 Scoring

The tests were scored according to standardized administration of the RCF (Meyers & Meyers, 1995). For all trials of the RCF (Copy, Immediate and Delayed Recall), a score of 0 to 2 points were assigned to each of the 18 structural elements of the figure. This meant that total scores were calculated out of 36 as defined by Osterrieth (Knight, 2003). The participants' organizational strategy for drawing the complex figure were recorded for each trial and classified into one of seven procedural types (Osterreith, 1944).

Each clinician within the larger study was responsible for the administration of a randomly selected group of the sample. Researchers also scored participant allocated to them within these groups. Standardised guidelines proposed by Meyers and Meyers (1995) were strictly adhered to. To improve inter-rated validity of scoring as well as to ensure the exact standardization of scoring, another intern rescored all the tests. Lastly, out of the larger sample, two participants were randomly selected and their tests were scored for a third time by another intern. This implied that three separate measures were put in place to ensure accuracy of scores. No further scoring discrepancies were identified.

2.2.6 Data Analysis

As mentioned above, of the 16 neuropsychological tests within the battery, the data from all except the RCF have examined and analysed for thesis purposes elsewhere. The aim of this present study, consequently, was to investigate and analyse these previously unprocessed RCF data. The primary aim of this analysis was to establish preliminary normative indications of RCF test performance for a population underrepresented by existing norms. In addition, the study set out to examine the effects of age and sex on the sample's RCF test performance. The Rey Complex Figure constitutes three separate trials (Copy, Immediate Recall and Delayed), thus the sample's mean scores and standard deviations were calculated

for each of these trials. Additionally, the mean organisational strategies were also noted. These data would serve as the preliminary normative indications. In addition, Independent *t*-test analyses were used to determine whether age and sex had a significance effect upon test performance.

Finally, the two age group's performances were compared to available international meta-analytical normative data. The comparison was achieved in two ways. A table was compiled displaying international and local norms, which allowed for a descriptive comparison. Secondly, an independent *t*-test was performed to establish whether the sample's performance differed significantly from international test takers. This was achieved by taking an average of the international normative performances that fell within the stratified age band, i.e. 18-29 and 30-40, and comparing these to the sample's corresponding performance. All the above mentioned statistical tests were conducted using an alpha level of 0.5 to determine the significance of the results.

Chapter 3

Results

In this chapter the sample's mean performance on all three trials of the Rey Complex Figure (RCF) Test were calculated and are presented. The sample was stratified into two age groups (18-29 and 30-40) as well as two groups for sex (Male and Female). Performances of these groups were compared using Independent t-test to establish whether significant age and sex effects were present within the sample. As the organisation types can only be understood as a nominal measurement, the frequency of use of each type of trial was reported for each of the three trials. A comparative table collating the local sample's mean performance on all three trials with international normative performances was drawn up. Lastly, the sample's overall performance was statistically compared with international meta-analytical norms provided by Mitrushina and colleagues (2004).

3.1 Rey-Complex Figure

Table 6 depicts the sample's overall performance of the Copy, Immediate Recall (IR) and Delayed Recall (DR) trials.

Table 6. Descriptive Statistics of Overall RCF Performance – Copy, IR and DR

		Copy	Immediate Recall	Delayed Recall
M		21.99	12.80	12.73
SD		5.51	4.91	5.543
Range		7.0 – 30.5	4.0 – 22.0	2.5 – 21.5
Percentile	25	19.00	8.75	8.50
	50	24.00	14.00	12.50
	75	25.50	16.25	17.25
Mode				
Organisational Type		1	1	1

Note. Mean (M) and Standard Deviations (SD) represents score out of 36 using the RCFT scoring system (Meyers & Meyers, 1995)

Within the Copy trial scores ranged between 7 and 30.5 (M = 21.99, SD = 5.51), 4 to 22 (M = 12.80, SD = 4.91) for the IR and between 2.5 and 21.5 (M = 12.73, SD = 5.54) for the DR trial. The Independent t-test analysis confirmed that performances between the Copy and both

IR and DR trials were significantly different ($p = .000$). Whereas comparative performance between the IR and DR trials were negligible ($p = .823$). Lastly, the most frequently used organisational strategy for all three trials was Type 1.

3.1.1 Within Study Comparison

3.1.1.1 Age Effect

Table 7 notes that 17 participants fell within the younger age stratification (18 – 29), whereas the older age grouping (30 – 40) consisted of 16 individuals. The younger group’s mean performances for the Copy, Immediate Recall and Delayed Recall trials were 22.24 (SD. 4.55), 14.71 (SD. 4.48) and 15.03 (SD. 4.77) respectively thereby outperforming the older group’s mean performances of 21.72 (SD. 6.54), 10.78 (SD. 4.64) and 10.28 (SD. 5.37) respectively. T-test analysis indicated that this difference was marginal for the Copy trial ($p = .792$), however significant for IR ($p = .019$) as well as DR ($p = .011$) trials.

Table 7. *t*-test Comparison of RCF Performance across Two Adult Age Groupings (18 – 29, 30 – 40) – Copy, IR and DR

Trial	Age	n	M	SD	<i>P</i>
Copy	18 to 29	17	22.24	4.52	.792
	30 to 40	16	21.72	6.54	
Immediate Recall	18 to 29	17	14.71	4.48	.019
	30 to 40	16	10.78	4.64	
Delayed Recall	18 to 29	17	15.03	4.77	.011
	30 to 40	16	10.28	5.37	

Note. Mean (M) and Standard Deviations (SD) represents score out of 36 using the RCFT scoring system (Meyers & Meyers, 1995).

3.1.1.2 Sex Effect

Independent t-test analysis indicated no significant difference in performance between the sex groupings for any of the trials ($p > 0.05$ in all instances) (Table 8). Similarly, no significant

differences were found when the sex stratifications were subdivided into younger (18 – 29) and older (30 – 40) age groupings ($p > 0.05$ for all trials). No consistent trend was noted for the sample as a whole, with Females outperforming Males on the Copy trial and Males outperformed females on the IR and DR trials. Within the younger subgroup, however, Males consistently outperformed Females in all three trials.

Table 8. *t*-test comparison of RCF, Two Adult Age Groupings (18 – 29, 30 – 40) and Sex - Copy, IR and DR.

	Sex	Sample			Age 18 to 29			Age 30 to 40		
		N	M	SD	N	M	SD.	N	M	SD.
Copy	M	12	21.79	4.49	7	22.29	3.91	5	21.10	5.61
	F	21	22.10	6.11	10	22.20	5.11	11	22.00	7.16
		$p = .251$			$p = .383$			$p = .648$		
Immediate Recall	M	12	13.38	5.23	7	15.21	4.77	5	10.80	5.78
	F	21	12.48	4.81	10	14.35	4.48	11	10.77	4.64
		$p = .992$			$p = .996$			$p = .873$		
Delayed Recall	M	12	13.96	5.98	7	15.57	5.02	5	11.70	7.05
	F	21	12.02	5.30	10	14.65	4.83	11	9.64	4.69
		$p = .752$			$p = .886$			$p = .499$		

Note. Mean (M) and Standard Deviations (SD) represents score out of 36 using the RCFT scoring system (Meyers & Meyers, 1995).

3.1.1.3 Organisational Strategy

Table 9 shows that the majority of participants used organisational Type 1 to complete the Copy (60.6 %), Immediate Recall (66.7%) and Delayed Recall (69.7%) trials. The second most used organisational strategy for the Copy and Immediate Recall trials was Type 2 (21.2% and 12.1% respectively), whereas for the Delayed recall trial it was Type 4 (12.1%).

Table 9. RCF Organisational Type Frequency of Use – Copy, IR and DR.

Trial	Type							Mode
	1	2	3	4	5	6	7	
Copy	60.6%	21.2%	6.1%	12.1%	0%	0%	0%	1
Immediate Recall	66.7%	12.1%	6.1%	9.1%	3.0%	3.0%	0%	1
Delayed Recall	69.7%	9.1%	6.1%	12.1%	3.0%	3.0%	0%	1

Note. Organisational Type as defined by Osterrieth (1944)

3.2 Between-Studies Normative Comparison

A collation of demographically equivalent international normative indications for the Rey Complex Figure test is presented in Table 10. The table shows that the local sample scored lower than all international samples, excluding the Columbian illiterate population (Ardila et al., 1989). In this instance the present study Copy mean score of around 22 was only marginally higher than the Columbian population in the Ardila et al. study scores which ranged between 19 and 21. The local sample's performances were further compared to the international normative data obtained from a meta-analytical study (Mitrushina et al., 2004) discussed in the literature review. Within this meta-analysis, age was stratified at 2 year intervals. An average was taken of the meta-analytical results falling within the present study's age stratifications. i.e. 18-29 years and 30-40 years.

Table 10. RCF: A Comparison of Present Study Results and Other Published Normative Indications for Two Adult Age Groupings (18 – 29, 30 – 40)

Study	Country	Age	N	Education	Copy	Immediate Recall	Delayed Recall
Present Study	South Africa	18 – 29	17	11 – 12	22.24 (4.52)	14.71 (4.48)	15.03 (4.77)
		30 – 40	16		21.72 (6.54)	10.78 (4.64)	10.28 (5.37)
Mitrushina et al, 2005¹	International Meta-analysis	18 – 29		14.33 (0.98)	34.99	24.82	24.87
		30 – 40			34.69	24.18	23.85
Ostrosky-Solis et al., 1998¹	Mexico	20-29	15	≥6	35.1 (4.9)	25.8 (4.9)	24.1 (6.8)
		30-39	15		32.8 (2.8)	24.1 (4.7)	24.6 (4.4)
Ponton et al., 1996¹	USA	16-29	23	<10	30.14 (4.05)		19.23 (6.59)
			55	>10	32.17 (2.98)		20.56 (5.77)
		30-39	35	<10	28.32 (5.96)		16.01 (7.03)
			62	>10	31.86 (4.14)		21.17 (6.31)
Ardila et al, 1989¹	Colombia	16-25	20	Illiterate	20.7		
			20	≥10	35.3		
		26-35	20	Illiterate	21.0		
			20	≥10	35.5		
			20	Illiterate	19.2		
36-45	20	≥10	34.2				

Note. Education represents years of formal schooling; Mean (M) and Standard Deviation represents score out of 36 using the RCFT scoring system (Meyers & Meyers, 1995).

¹ (as cited in Mitrushina et al., 2005)

In Table 11 the mean scores of both these studies have been collated. An Independent t-test analysis compared the two averages noting robust significant differences with all trials (Copy, IR and DR) for both age groupings (18-29 and 30-40) ($p = .000$, in all instances), in the direction of the scores for the present study being lower than the scores for the meta-analysis.

Table 11. RCF: t- test Comparison of Present Study Results and Meta- Analytical Normative Predictions for Two Adult Age Groupings

Trial	Age	M (SD)		<i>p</i>
		Sample	Meta-Analysis	
Copy	18 to 29; 25 to 29	22.24 (4.52)	34.99 (1.39)	.000*
	30 to 40; 35 to 39	21.72 (6.54)	34.69 (2.01)	.000*
Immediate Recall	18 to 29; 25 to 29	14.71 (4.48)	24.82 (5.49)	.000*
	30 to 40; 35 to 39	10.78 (4.64)	24.18 (6.55)	.000*
Delayed Recall	18 to 29; 25 to 29	15.03 (4.77)	24.87(6.67)	.000*
	30 to 40; 35 to 39	10.28 (5.37)	23.85 (6.67)	.000*

Note. Mean (M) represents score out of 36 using the RCFT scoring system (Meyers & Meyers, 1995). The Age column depicts the age ranges of the present study of 18-29 and 30-40, and the age ranges of 25-29 and 35-39 that are used for comparative purposes from the Meta-Analysis of RCFT data cited in Mitrushina et al., 2005.

3.3 Synthesis of Results

No significant age effect was noted for the Copy trial; however the younger group significantly outperformed that older group in both IR and DR trials. The results for the Copy, IR and DR trials showed no significant sex effect for any of the three trials, even when the sample was further stratified into the younger (18-29) and older (30-40) age groups. The most frequently used organisational strategy for all three trials was Type 1. Additionally, the sample employed a larger amount of strategies to approach the recall trials (IR and DR). The local sample was outperformed by the sample from all international studies cited, excluding a Columbian illiterate group's performance of the Copy trial (Ardila et al., 1989) where the scores were marginally less than those of the present study. Lastly, a between studies

normative comparison showed that the local sample was significantly outperformed in all three trials by the mean performance of Mitrushina et al's (2005) international meta-analysis.

Chapter 4

Discussion

The present study sets out to investigate the performance of a non-clinical Xhosa sample aged between 18 and 40 years old with a highest level of education of between Grade 11 and 12, on the Copy, Immediate Recall (IR) and Delayed Recall (DR) trials of the Rey Complex Figure Test. Importantly these individuals received a relatively poor quality of education from a disadvantaged DET type township school. The investigation thereby aimed to provide preliminary normative indications for this underrepresented population. In addition, the study set out to investigate the demographic influences of age and sex, as well as any sociocultural effects on test performance by the targeted group, in comparison with English first language westernized groups exposed to a more advantaged education. The sample was stratified into two age (18-29 and 30 – 40) and sex (Male and Female) groupings. On the basis of the literature review it was hypothesised that non-local westernized samples would outperform the local sample in all three trials. It was also proposed that the older age grouping would significantly depress local RCF scores as well as that no significant sex effect would be present for any of the RCF trials. Lastly, given the absence of prior cross-cultural research in this regard, it was considered uncertain whether organisational strategy between local and non-local samples would differ or remain the same.

The outcome of the research is further elucidated below in the order in which the hypotheses were posed.

4.1 Comparison of Present Study and Other Published Normative Indications

For the purposes of the present study it was hypothesized that demographically equivalent non-local populations would outperform the local sample in all three RCF trials (Copy, IR and DR). A table collating relevant non-local norms was compiled allowing the descriptive evaluation of the local performance to take place (see Table 10 in Section 3.2). All three hypotheses were confirmed as the local sample showed an overall lowered score for all three trials. Importantly the local sample was outperformed by all demographically equivalent non-local samples cited, excluding that of a Columbian study by Ardila et al. (1989). In this instance the present study's Copy scores were only marginally higher than that of an illiterate

sample with no formal education. In all other instances a t-test analysis of local and the meta-analysis statistically verified that the above mentioned differences, in favour of non-local populations, were robustly significant ($p = .000$ in all instances).

Seminal normative textbooks (Lezak et al., 2004; Mitrushina et al., 2005; Strauss et al., 2006) and standardisation studies (Fastenau et al., 1999; Meyers & Meyers, 1995; Knight, 2003) remain doubtful whether education significantly influences RCF performances. Nonetheless, cross-cultural studies report significant education effects present in selected populations (Ardila & Rosselli, 2007; Ardila et al., 1989; Berry et al., 1991; Ponton et al., 1996; Rosselli & Ardila, 2003). In attempting to explain the local sample's performance it is important to note that their scores were compared to non-local samples of equivalent level of education. These two samples' performances should conventionally be considered equally influenced by formal education. Both local and non-local samples have also surpassed the education "threshold" proposed by Mitrushina et al. (2005). The extent of the observed differences in performance of all three trials ($p = .000$ in all instances), however, strongly suggests the influence of extraneous cultural factors. Remarkably, the non-local studies used in the comparison do not take into account any cultural factors such as quality of education. Education was conceptualised as qualitatively homogenous within these studies and defined purely in terms of years attended or levels achieved. In line with local normative research, the present study's findings appear to challenge these conventional normative considerations. Several South African studies have observed significant culture effects in both verbal and non-verbal neuropsychological test performance of local sample's similarly influenced by a substandard quality of education (Andrews et al., 2012; Fike et al., 2012; Shuttleworth-Edwards, Kemp et al., 2004). Placing the present study's findings alongside these conventional normative assumptions of educational homogeneity within the South African context may not apply as neatly as within the Euro-American context. These findings seem to suggest that South African clinicians cannot justly equate local and non-local highest levels of education as qualitatively homogenous.

4.1.1 Copy Trial

As indicated above, the hypothesis was confirmed that the local sample would be outperformed within the RCF Copy trial by demographically similar non-local samples. The examination of the respective cognitive domains, elicited by each RCF trial, may help explain the influence of a poor quality of education from the neuropsychological perspective. The

local Copy performance here suggests indicates impoverished attention, visuoconstructional and organisational functioning when compared to the available normative data. Complex visuoconstructional tasks, such as the Copy trial, functionally require individuals to react corporally to spatial demands in an intentional and organised manner, which requires equal measures of visuomotor coordination and visuospatial organisation (Knight, 2003). Proficiency in such tasks therefore requires a degree of repeated exposure or practice (Ardila et al., 1989). If exposure is limited, the test taker's performance would naturally reflect this inexperience. This being said exposure to similar tasks, requiring complex visuoconstructional ability, is found predominantly within the educational context (Castro-Caldas, 2007). The influence of formal education upon visuoconstructional, executive functioning and memory has as a result been extensively studied (Ardila et al., 1989; Castro-Caldas, 2007; Ponton et al., 1996; Rosselli, & Ardila, 2003; Uzzell et al., 2007). Cross cultural researchers argue that formal education equips participants for such tasks by providing exposure to similar tasks as well as equipping individuals with learnt strategies to approach future tasks.

Accordingly, in light of the above researchers' assertions, the depressed local Copy scores may not reflect a deficit in "absolute terms" (Meyers & Meyers, 1995, p.39), but may more readily indicate a dearth in sufficient exposure, "test-wiseness" (Nell, 2000, p.64) or acculturation to the testing environment (Manly et al., 1998). Although such exposure was not completely absent within the local sample, the relatively poor quality of education would have provided comparatively fewer opportunities to practice or rehearse tasks requiring complex visuoconstructional functioning. Seen in a different way, the richer quality of education received by non-local samples provided these test takers more exposure to complex visuoconstructional tasks which allowed them to develop the skills demanded by the RCF Copy trial.

4.1.2 Recall Trials

It was hypothesised and confirmed that demographically similar non-local populations would perform significantly better in both RCF recall trials (IR and DR). Considering these findings, it must be remembered that the acculturation provided by the education environment contributes to performance of different neuropsychological tests in varying degrees (Uzzell et al., 2007). Current research suggests that particular cognitive modalities are more readily influenced than others. Research notes that complex visuoconstructional

tasks appear significantly influenced by socio-cultural factors, such as quality of education (Ardila et al., 1989; Berry et al., 1991; Boone et al., 2007; Ponton et al., 1996; Rosselli, & Ardila, 2003). This being said the culture effect present in tests eliciting memory functioning remains contentious and less clear. Correspondingly, Shuttleworth-Edwards, Donnelly et al (2004) investigated a South African population with a history of substandard education similar to that of the present study's sample. They found that this quality of education did not significantly influence performance of the Digit Symbol Incidental Learning subtest used in their study. Incidental visual memory functioning within their sample therefore mirrored that of available non-local normative data. It stands to reason then that within demographically similar local populations, incidental visual learning functioning may remain relatively unaffected by the acculturation provided by education. As both the Digit Symbol Incidental Learning subtest and Rey Complex Figure test recall trials (IR and DR) elicit incidental visual memory functioning, these findings may help shed light upon crucial aspects of the presents study.

The present sample's Copy scores showed clear indications of impoverished visuoconstructional and organisational functioning. Functionally, this deficit implies that the local sample successfully attended to and reproduced significantly less visual information than non-local populations. After the completion of the Copy trial therefore less visual information was available to the local participant for the incidental learning process (Lezak et al., 2004). As test takers are only able to recall visual information that has been successfully encoded or stored; the present study's IR and DR performance was significantly lower than non-local normative information. Considering Shuttleworth-Edwards, Donnelly et al (2004) findings then, the lowered IR and DR scores were most likely not the result of diminished incidental visual memory functioning, i.e. the encoding, storage and retrieval processes, but rather a residual deficit in visuoconstructional ability. Although the present sample may be able to encode, store and retrieve visual information as effectively as non-local population, their impoverished visuoconstructional ability provided less visual information for this process.

4.2 Within Study Indications

4.2.1 Age Indications

From the literature review it was hypothesised that age should significantly influence performance on all three trials (Copy, IR and DR). Unlike available normative data on

westernized populations however, the local sample showed only a marginal difference between the age groupings performance within the Copy trial ($p = .792$). A small inclination for the younger group to outperform the older group was noted. The local sample here thus mirrored non-local studies only in direction and not in the extent of the difference. In contrast, as was hypothesised a significant age effect was observed for both the IR in the direction of younger participants outperforming older participants ($p = .019$) and DR ($p = .011$) trials. These recall results emulates the findings of young age advantage revealed in available normative data on non-local populations (Ardilla, Rosselli, & Rosa, 1989; Chiulli et al., 1995; Fastenua et al., 1999; Ostrosky-Solis et al., 1998; Meyers & Meyers, 1995; Mitrushina et al., 2005).

As discussed earlier, a robust relationship exists between education and visuoconstructional tasks involving organisational functioning (Ardila et al., 1989; Berry et al., 1991; Boone et al., 2007; Ponton et al., 1996; Rosselli, & Ardila, 2003). The magnitude of this culture effect, produced by a relatively poor quality of education, is observed within the Copy performance of both age groupings (18-29, 30-40). The extent of the large deficit in complex visuoconstructional functioning is such that the expected age effect, typically present in normative studies of non-local westernised populations, appears to have been somewhat obscured. In other words, the slight difference observed, where the older (30 -40) group was marginally outperformed by the younger (18-29) group ($p = .792$), points towards the somewhat veiled presence of the conventional age effect with the local sample. Ardila et al. (1989) observed a similar phenomenon within a Columbian population's RCF Copy performance. As with the local sample, their study found that the conventional age effect becomes indistinguishable from the education effect in populations where education is compromised or lacking. Adrila et al. used these findings to re-assert the influence of education upon complex visuoconstructional tasks, concluding that the skills needed to successfully complete such tasks are "learned and highly trained" (p. 463).

Unlike the Copy trial however significant age effects were observed for both recall trials (IR and DR). It is important to consider that both these trials elicit incidental visual memory functioning. Whilst local research suggests that quality of education may only marginally affects incidental visual memory functioning (Shuttleworth-Edward, Donnelly et al., 2004), the influence of age upon memory is cross culturally well established (Ardila & Rosselli, 1989; Badderley et al., 2004; Lezak et al., 2004; Ostrosky-Solis et al., 1998). Hartman and Potter (1998) notes that as participant's age increases, more "minor inaccuracies" (p. 513) are

made in the RCF recall trials. They assert that this increase inclination for error reflects the deleterious influence of age upon the incidental memory process, particularly the encoding and retrieval processes. The marginally difference in Copy scores ($p = .792$) indicate that after the completion of this initial trial both age groupings attended to similar amounts of visual information. In spite of this, as Hartman and Potter (1998) observed, as participants' age increases less of the visual information attended to is successfully encoded and stored. The younger age grouping (18-29) was thereby able to manage this visual information significantly more efficiently than the older age grouping (30 – 40).

4.2.2 Sex Indications

From the body of research reviewed it was hypothesised that no sex effect would be present in the local sample's performance for any of the RCF trials. The results confirm this hypothesis, showing only minor differences of $p = .251$ for the Copy trial, $p = .992$ for the IR and $p = .752$ for the DR trial. The findings therefore mirror non-local normative studies (Boone et al., 1993; Fastenua et al., 1999; Meyers & Meyers, 1995; Mitrushina et al., 2005). It was noted that the female group marginally outperformed the men ($p = .251$) in the Copy trial, whereas the reverse was noted in the IR ($p = .922$) and DR ($p = .752$) trials. As the visual information retrieved in the recall trials is incidentally encoded from the Copy trial (Hartman & Potter, 1998), this fluctuating pattern does not correspond to the usual RCF performance. Ordinarily Copy performance is a good indication of Recall performance (Lezak et al., 2004). If a legitimate sex effect was present in the present study it would remain consistent through all three trials. Strauss, Sherman, and Spreen (2006) contends that in studies where significant sex effects have been reported, the discrepancy may be better accounted for by differences in IQ, handedness or academic concentration. The minor differences observed in local performance are, as Strauss et al. proposes, more readily indicative of extraneous factors.

4.2.3 Organisational Strategy Indications

Lastly, due to the limited information available concerning the effect of quality of education upon organisational procedures, two hypotheses were proposed. As the present study investigates a non-clinical local sample, on the one hand it was hypothesised that performance would emulate the non-local test takers' approach, also in respect of a nonclinical population, to all three trials (Copy, IR and DR), thereby most frequently employing procedure Type I and II. Alternatively, as literature indicates that quality of education may deleteriously affect procedural (i.e. non-verbal) cognitive abilities, it was

hypothesised that the local sample would follow a more disorganized procedure within all three trials. In accordance with non-local normative data as well as Osterrieth's (1944) original study the local sample's performance confirmed the former hypothesis. However, in respect of the recall trials, the alternative hypothesis was also partially supported, in that it was also observed that the local sample used a wider variety of strategies in the Immediate and Delayed Recall trial, i.e. Type 1 to 6 compared to the Copy Trial within which only Type 1 to 4 was used. As multiple cognitive modalities are accessed, neuropsychologically complex tasks have a greater chance of eliciting deficits (Groth-Marnat, 2000). The organisational strategy used is equally indicative of the quality of encoding and retrieval process that has taken place (Strauss et al., 2006). The wider range of organisational strategies employed within the recall trials on the local sample asserts to the neuropsychological complexity of these recall trials, that has resulted in less optimal organizational strategies being employed by those with relatively impoverished educational exposure.

4.3 Synthesis of Findings and Conclusions

With the exception of the marginal influence of age upon local Copy performance, all the hypotheses posed for the present study were supported. The local sample's mean performance was descriptively and statistically compared to demographically equivalent non-local normative studies. Notably, the local sample performed significantly lower than all available non-local norms, excluding the Copy performance of an illiterate Columbian sample. Furthermore, the local sample performed significantly lower than the normative data provide by meta-analysis from Mitrushina et al.'s (2005). Within-sample statistical comparisons indicated that participant's age only marginally influenced Copy performance, whereas significant age effects were present for IR and DR trials. No significant sex effect for the Copy, IR or DR trials. Finally, the alternate hypotheses for organizational strategy were both to some extent supported, in that for the Copy trial the more sophisticated Type I and Type II strategies were mainly employed, whereas for the recall trials there was a wider range of strategies from Type I through to Type VI, i.e., including some more disorganized modes of task performance.

These findings were made sense of neuropsychologically as the influence of education upon primarily complex visuoconstructional functioning. It was noted that although highest level of education may allude to a level of functioning, within previously disadvantaged

populations this should be considered tentatively. The present study noted that if the RCF performances of its sample were to be assessed using available non-local norms (Meyers & Meyers, 1995; Mitrushina et al., 2005) the average performance for both age groupings would fall into the lower 10 percentile. Their performance would consequently be misclassified as showing severe visuoconstructional and incidental visual memory deficit (Lezak et al., 2004). As these inferences influence the diagnosis, treatment and prognosis of individuals, a false positive assessment of deficit may have considerable consequences for the local test-taker. Within the forensic setting for instance this erroneous inference may determine whether a defendant is fit to stand trial or whether the individual is eligible for road accident compensation (Nell, 1999). Scientifically accurate and culturally fair assessment is consequently paramount.

The culture effect produced by a substandard quality of education may be considered in two ways. Firstly, as academic standard were compromised, it possibly allowed individuals to progress to an education levels surpassing the intellectual functioning. In countries where the education quality is more homogenous, these individual would have left school at a much earlier level or grade, as they would be unable to cope intellectually with the curriculum. Alternatively, quality of education may more readily reflect Manly et al.'s (1998) notion of acculturation to the testing environment or what Nell (2000) refers to as "test-wiseness". A below standard quality of education provide participants with limited exposure to the testing environment. Participants do not become equally accustomed to, or well versed in, the demand asked of them by neuropsychological tests. Individuals may have the latent intellectual potential to perform at a same level as non-local samples, but as the acculturation provided by education is lacking, scores are lowered. Seen in this manner any observed discrepancy would reflect the participant's level of "test wiseness" and not actual intellectual functioning. Both the explanations may help account for the significantly large difference observed between local and non-local RCF performance.

4.4 Strengths and Limitations

Mitrushina et al. (2005) have proposed a "method of evaluating the normative reports" (p. 253). The authors contend that the minimal requirements for adequate normative studies is i) a sample size of 50 participants or more, ii) detailed information about the sample should be provided; iii) the sample should indicate age grouping; iv) also the sample's education level should be indicated, v) as well as their intellectual function as expressed by IQ; vi) lastly, the

sample sex composition should be explicitly stated. Mitrushina et al. add that both the scoring system used and descriptive statistics of the sample's performance should be presented. If these proposed evaluation criteria are applied, the present study can be considered to have performed adequately. The present study fulfils most of the criteria, as it is well-stratified for age, sex, level and quality of education as well as language.

On the negative side, it is evident that the study sample was relatively small with $N = 30$. However, the research set out only to provide preliminary normative indications, and on that basis the number of participants utilized can also be considered adequate although not achieving the full number of $N = 50$ or more as recommended by Mitrushina et al. Moreover, it is commonly considered by the authors of neuropsychological normative texts that normative indications derived on numerically small but well stratified samples is preferable for clinical purposes than poorly stratified data for a particular clinical evaluation derived on large samples (Mitrushina et al., 2005; Strauss, Spreen et al., 2006). Further, on the negative side, the present study did not have information about the participant's general intellectual functioning (IQ). If this information was available, clearer inferences could be made about the observed difference between non-local and local performance. One weakness of the present study is that it relied solely upon self-report questionnaires to obtain biographical information about the participant. Candidates may have omitted information which presents them in a negative light. A willingness to be included in the study may have motivated candidates to provide incorrect personal information. If this were the case, individual performance might have been influenced by a factor noted in the exclusion criteria. However due to time constraints and limited resources it was not feasible to obtain additional collateral information to corroborate the participant's accounts, and it would be very unusual in a research context such as this to have the resources to acquire detailed collateral information.

This being said, the fulfilment of the majority of the criteria set out by Mitrushina et al. attest to the overall strength of the study's methodology. Accordingly, attesting to the considered legitimacy of the present study, albeit derived on relatively small sample size, is that the data from two alternative neuropsychological instruments within the test battery derived from the same sample have produced peer reviewed articles (Andrews et al., 2012 and Fike et al., 2012).

4.5 Recommendations for Future Research

Firstly, as noted by Mitrushina and colleagues' (2005) "method of evaluating the normative reports" (p. 253), a larger sample size would allow for confirmation of the normative indications, such as overall culture effect and Copy age effect to be made. Their criteria also highlighted the need for approximate IQ to be attained for participant. Further studies may also benefit from a sample with a larger range of highest level of education. For practical reasons the present study focused upon participants with a level of education between Grade 11 and 12. However, due to socio-economic reasons many previously disadvantaged individuals left school at a lower level. Culturally fair normative indications for this demographic will be an invaluable resource for neuropsychological assessments. It may also be beneficial if future studies incorporate participants of different geographical areas in South Africa. This more extensive approach would allow for comparisons to be made of geographical areas. Further studies may equally find it valuable to include participants who speak indigenous languages other than IsiXhosa, as their first language.

This study might have also have benefited from a RCF recognition trial being administered (Meyers & Meyers, 1995). The recognition trial does not rely on participant's ability to draw a figure, therefore visuoconstructional functioning, however participants have to correctly identify design elements with the complex figure. If a recognition trial was added a clearer indication of the culture effect on incidental visual memory could be made, without influencing the sample's visuoconstructional deficit. Lastly, future studies should code and individually store each trial for all participants. This would provide rich individual qualitative information from which themes within the samples may be deduced.

4.6 Final Word

Specifically, the present study provides invaluable preliminary normative indications on the commonly employed Rey Complex Figure Test for a population least adequately represented by available non-local normative data, and thereby has fulfilled its primary aim. More generally, the study serves to highlight the significant influence socio-cultural factors, such as quality of education, may have upon normative considerations. It asserts that culturally appropriate normative indications are indispensable within contemporary South African psychological assessments. Finally, while the study was considered to have substantial methodological strengths, a number of limitations within the study were acknowledged and the need for considered further normative research was emphasised.

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General Behavioural Observations

GENERAL BEHAVIOURAL OBSERVATIONS

Participant: _____

Tester: _____

Language ability (including English fluency and articulation)

Physical appearance

Visual/auditory/motor problems (were problems corrected? E.g. with glasses, hearing aids)

Attention and concentration

1 GENERAL BEHAVIOURAL OBSERVATIONS

Attitude towards testing (e.g. rapport established, eager to speak, working habits, interest, motivation, reaction to success/failure)

Affect/Mood

Unusual behaviours/verbalisations (e.g. perseverations, stereotypic movements, bizarre and atypical verbalisations)

Other notes

APPENDIX A

APPENDIX B

Biographical Questionnaire

General Information Questionnaire:

**Please Note: All information that you write on this report is strictly
CONFIDENTIAL**

**and will ONLY be used for the research project. It will NOT be passed onto any
employers.**

Your ANONYMITY will be maintained.

Demographic Information:

Name: _____

Gender _____

Age: _____

Date of Birth: _____

Place of Birth (City & Country): _____

Occupation (Employment at present time): _____

E-mail Address: _____

Contact Number: _____

First Language: _____

Education History:

1. Name, location and dates of **High School (s) (Secondary School)** attended:

1: Name: _____ **3. Name:** _____
Location: _____ Location: _____
Dates: _____ Dates: _____

2. Name: _____ **4. Name:** _____
Location: _____ Location: _____
Dates: _____ Dates: _____

3. **Highest Level of Education** (Highest Grade Reached):

Tick appropriate level.

3.1. **Grade 10:** _____ **Grade 11:** _____ **Grade 12:** _____

3.2. **YEAR** that you finished school? _____

3.3. If you **TICKED Grade 10** or **Grade 11**, what was the reason you left before completing Grade 12?

3.4. What **symbol** (eg, D, E, F) did you get for **English** at School?

Socio-Economic Information:

Please answer this section **WHEN YOU WERE AT SCHOOL**, not at **PRESENT**

Please answer **YES** or **No/**

1. When you were still at SCHOOL, did you have:

1a: Electricity at home? _____

1b: Running water? _____

1c: Did you have your own room? _____

1d: Did you have at least 2 meals per day? _____

1 e: Did you have your own toys worth in total over R50? _____

1 f: What was the attitude of your parents towards your schooling?

Positive, negative or neutral? _____

General Information:

1. a. Did you **fail or repeat** any **grades** at school? _____

b. If **YES, which grade** and **how many times** did you fail or repeat? _____

2. Have you ever been diagnosed with a **learning problem** (e.g. dyslexia), or received treatment for a learning problem? Please give details.

3. Have you ever been admitted to a **psychiatric (mental) hospital** or unit? Please give details.

4. Are you currently taking any **medications** (tablets, injection) for a **psychological** or **psychiatric disorder** (mental illness)? Please give details.

5. Have you ever taken any **medications** (tablets, injection) for a **psychological** or **psychiatric disorder** (mental illness) in the **PAST?** Please give details.

6. Do you suffer or have you ever suffered from any **serious illnesses?** Please give details.

7. Have you ever suffered any form of **head injury** (eg. hit your head after falling off a bicycle, injured your head in a car accident or during sports)? Please give details, including whether or not you **lost consciousness** and for **how long** you lost consciousness (minutes or hours).

8. Do you know if there were any **complications** (things went wrong) during your mother's **pregnancy** and/or **your birth?** Please give details.

9. Do you **drink alcohol** at all? Please give specific details of **how much** you drink and **how often** (eg. 3 beers every day or 8 beers once a week etc.).

10. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

11. Is there any other **educational** or **medical** information that you think might have a detrimental (negatively or badly) affect your performance on a cognitive test? Specify.

APPENDIX C

Pre-Test Screening Questionnaire

Encourage participant to answer as accurately as possible. Tick the option that applies and elaborate when requested. If some questions do not apply to the participant or she/he does not know the answer, record N/A if not applicable, or UK if unknown. Assure participants that information obtained will be kept in the strictest confidence.

Tester: _____

Biographical information

Name:			
Gender:	M	F	
Age:	Date of Birth:		
Handedness:	Right	Left	
First Language:			
English Proficiency:	Poor 1	Average 2	Good 3 Excellent 4
Elaborate:			
Test Date:			

General

1. Have you had something eat this morning?
 - Yes
 - No
2. Have you slept well?
 - Yes
 - No
3. Do you wear glasses?
 - Yes
 - No
4. Do you experience any problems with your eyes?
 - Yes
 - No

5. Do you have a problem with hearing?

- Yes
- No

6. Have you ever broken an arm?

- Yes
- No

7. If yes, which one?

- Right
- Left

Remedial treatment for learning disabilities

Did you experience any difficulties or problems with learning at school?

- No
- Yes

If yes, elaborate

Did you receive any extra help for those problems or difficulties from someone other than your teacher like an Occupational Therapist, Psychologist, Doctor etc?

- No
- Yes

Neurological

1. Have you had any head injuries or any other problem that might have effected your brain?

- No
- Yes

2. If yes,

(To researcher, if yes, indicate number of previous head injuries sustained by participants and type of head injury. (eg: MVA, fall, assault, gunshot wound etc,)

Pathology Type	1	2	3
Date (month/year)			
Type			
Hospitalized (Yes/No)			
Length of Unconsciousness			
Duration of stay in hospital			

3. When you left the hospital, did you have to continue to see the doctor as an outpatient?

- Yes

If yes, for how long? _____

- No

4. Are you experiencing any problems related to this injury currently?

- No
- Yes

If yes, please give further information

Education

1. What was the last grade you **passed**? (NB, not just started)

- Grade 10
- Grade 11
- Grade 12

2. Did you fail or repeat any grades at school?

- Yes
- No

3. If YES, which grade and how many times did you fail or repeat?

- Once
- Twice
- 3 times or more

4. What was the reason you failed/repeated?

- Financial
- Family responsibilities
- Lack of interest
- Political unrest/Strike, School closing
- Poor academic performance

Other:

Substance Use

1. How often do you have a drink containing alcohol?

- Never
- Monthly or less
- Once a week
- 2 or 3 times a week
- 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day of drinking?

- 1 or 2
- 3 or 4
- 5 or 6
- 7 to 9
- 10 or more

3. How long have you been drinking in this way?

- Within the past 6 months
- From 6 months to 5 years
- More than 5 years

4. How often have you needed a drink in the morning to get yourself going after a heavy drinking session?

- Never
- Within the past 6 months
- From 6 months to 5 years
- More than 5 years

5. Are there financial, legal or family problems related to your drinking?

- No
- Yes, but not in the past year
- Yes, during the past year

6. Has a relative, friend, doctor or health worker been concerned about your drinking or suggested you cut down?

- No
- Yes, but not in the past year
- Yes, during the past year

7. Have you ever gone to anyone for help about your drinking?

If **YES**, who? _____

- Within the past 6 months
- From 6 months to 5 years
- More than 5 years

8. Have you ever been admitted to hospital for substance use?

If **YES**,

- Within the past 6 months
- From 6 months to 5 years
- More than 5 years

OPTIONAL as directed by information contained on questionnaire

9. Have you ever used any **drugs** (eg. dagga, mandrax, ecstasy, glue or paint thinners)? Please give specific details of **frequency** (how much) of use and when you **began** using (eg. a packet of dagga every day since you were 15 etc.).

APPENDIX D

Consent Form

RHODES UNIVERSITY
DEPARTMENT OF PSYCHOLOGY
PARTICIPANT CONSENT FORM

I, _____ have been informed of the nature of the research in which I will participate. I understand that two intern clinical psychologists from Rhodes University, Karen Anne Hope Andrews and Andrea Jane Wong, will be administering some neuropsychological tests on me, and I hereby agree to participate in this project.

I understand that:

- 1) The above-mentioned intern clinical psychologists are conducting research as a requirement for a Masters degree in clinical psychology at Rhodes University. Their aim is to provide preliminary normative data on various neuropsychological tests for black South African people who speak an indigenous South African language as their first language.
- 2) The research will involve willing, black, indigenous South African language speakers with a Grade 10 – 12 education, from a former Department of Education and Training (DET)-type school.
- 3) Participants will be assessed using various commonly used neuropsychological tests.
- 4) Participation in the research is completely voluntary and I have the right to withdraw from the study at any stage.
- 5) The information collected on individual participants will be strictly confidential, with no personal information being disclosed. Access to this data will be restricted to members of the research team.
- 6) No individual test results will be given to me or to any other person outside of the research team. The information collected will be used for research purposes only by the researchers and will not be made available to my employers under any circumstances.
- 7) Data arising out of this project may be used anonymously for thesis and publication purposes.

Signed

Date

Name

Email

Address

Contact Telephone Number(s)