Language Effects on Semantic Fluency Test Performance Among South African Adults

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Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature: Anathi B. Kwinana Date: 09 February 2020

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P.S. You're doing great sweety!

Abstract

Issues around the cultural fairness of cognitive tests and their administration are becoming increasingly important as the global spread of neuropsychological practice quickens. Most of these tests are developed and standardized in high-income countries of the global north, and so when used in low- and middle-income countries (LAMICs) of the global south they are susceptible to influence by non-organic factors. Of relevance for this thesis is that these factors include language of test administration (e.g., whether the test is administered in the participant's home language or language of education) and the language profile of the test-taker (e.g., whether the person is multilingual). Semantic fluency tests are a standard component of many neuropsychological test batteries (e.g., those used to detect various forms of dementia), and are commonly administered in LAMICs without due regard for language influences on performance. Hence, the aim of this research was to investigate the influence of language of test administration on semantic fluency test performance in a sample of multilingual students from an English-medium South African university. Participants were 75 balanced English-isiXhosa bilinguals who were administered single-language and forced-switching semantic fluency tests in both languages, as well as a free-switching semantic fluency test. Results showed that, across test conditions, participants generated more words when administered the tests in English than in isiXhosa. Analyses also showed that, during the isiXhosa but not English administration, participants performed better under free-switching than forced-switching or single-language conditions. The strongest conclusion one can draw from these observations is that test administrators must ensure that test takers are assessed in a language that allows them to demonstrate their optimal cognitive capacity, and that therefore a determination of language proficiency in each of the test-taker's languages is a necessary prerequisite for assessment. This step is especially important in countries, like South Africa, that are home to many multilingual individuals.

Keywords: bilingualism, code switching, cross-cultural neuropsychology, multilingualism, category fluency, semantic verbal fluency, South Africa.

Abbreviations

AD	Alzheimer’s Disease
BDI-II	Beck Depression Inventory-Second Revision
BAI	Beck Anxiety Inventory
BNT	Boston Naming Test
DSA	Department of Student Affairs
FTD	Frontotemporal Dementia
HVLT-R	Hopkins Verbal Learning Testing
ImPACT	Immediate Post-Concussion Assessment and Cognitive Testing
LEAP-Q	Language Experience and Proficiency Questionnaire
MDRS	Mattis Dementia Rating Scale
PD	Parkinson’s Disease
SRPP	Student Research Participation Program
WAIS-III	Weschler Adult Intelligence Scale-Third Revision

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CHAPTER 1

INTRODUCTION

Most cognitive tests were developed and standardised in the global north using English-speaking samples. Hence, it is important that neuropsychologists across the rest of the world attempt to ensure the cultural fairness of those tests when used in local populations. The concept of *cultural fairness* extends beyond simply ensuring that existing tests are translated, modified, and standardised for individuals who do not speak English, however (Fernández & Abe, 2018). For instance, there is a desperate need for neuropsychologists to address, in an ethical and competent manner, the numerous challenges that arise when attempting to conduct assessments in linguistically diverse populations (Lezak, Howieson, Bigler, & Tranel, 2012; Rivera Mindt et al., 2008; Scott et al., 2018).

South Africa is just one example of a country that features a linguistically diverse population. According to the South African Schools Act 84 of 1996, all primary and high school students must have formal classes in at least two of the country's 11 official languages. Therefore, most citizens of the country are at least partially multilingual (Nel & Kagee, 2013; Posel & Zeller, 2016). That said, many neuropsychologists (in South Africa and elsewhere) administer their assessment in the test-taker's *self-reported preferred language*. They do so despite more and more practice recommendations calling for language proficiency measures to be included when conducting cognitive tests (especially those with a verbal component) so that the administrator can make an informed decision about whether multilingual participants perform better in their *acquired language* (usually English) or their *home language* (Blumenfeld, Bobb, & Marian, 2016; Lezak et al., 2012; Rivera Mindt et al., 2008; Sanchez et al., 2013; Schwartz et al., 2014; Scott et al., 2018). Moreover, Lezak et al. (2012) insist that, unless the administered tests have very little language influence, neuropsychologists should also have native competence in the languages in which the test-taker reports being proficient to avoid misdiagnoses.

The main aim of the study presented here is to investigate the influence of home versus acquired language on semantic verbal fluency test performance in a sample of multilingual students from a English-medium university in Cape Town, South Africa. Although semantic fluency tests have conventionally been regarded as assessing a core executive function (viz., generativity), their very nature means that performance on them also taps into aspects of language functioning (Bialystok, Craik, & Luk, 2008b; Henry & Crawford, 2004). Moreover, a recent factor analytic study suggested that both semantic and phonemic fluency tests loaded more strongly onto a language than an executive function factor (Whiteside et al., 2016). The current study examines performance in isiXhosa as well as in English, and investigates specific differences in overall number of words generated under both code-switching and category-switching conditions.

The thesis is structured as follows. Chapter 2 is a brief review of the literature describing non-organic factors (e.g., age, level of education, language of test administration) that influence performance on semantic verbal fluency tests. The review also describes studies investigating (a) differences in semantic verbal fluency test performance between monolinguals and bilinguals, (b) the language usage of bilinguals during test administration, and (c) performance under code-switching conditions. Chapter 3 outlines the study’s aims and hypotheses, and Chapter 4 presents a concise report of the results of a pilot study designed to determine which semantic fluency categories were most suitable for use in the main study. Chapter 5 describes the main study’s methods, and Chapter 6 presents its results. Finally, Chapter 7 provides a general discussion of the findings, including consideration of the study’s limitations and some directions for future research.

CHAPTER 2

LITERATURE REVIEW

A compelling strand of research in cross-cultural neuropsychology focuses on understanding how, and why, non-organic factors influence cognitive test performance (Calvo & Bialystok, 2014). One such factor is language. Because most cognitive tests are verbally mediated, it is therefore no surprise that performance on them is influenced by language. This language influence encompasses more than simply the language in which the test is administered (i.e., the language of instructions, of stimuli, and of formal and informal conversation between test-taker and test administrator); it refers also to the languages spoken by the test taker, how proficient they are in each of those languages, and the number of syllables and letters of words in each language of testing (Agranovich & Puente, 2007; Carstairs, Myors, Shores, & Fogarty, 2006; Grieve & van Eeden, 2010; Lim et al., 2009; Rivera Mindt et al., 2008; Scott et al., 2018).

Knowing the language history of the test-taker is crucial to understanding variations in performance on cognitive tasks (Lezak et al., 2012; Strauss, Sherman, & Spreen, 2006). Bilingualism, for instance, is said to slow down vocabulary acquisition but speed up executive function development (Calvo & Bialystok, 2014). Because verbal fluency tests assess both language and executive function, knowing whether the test-taker is bilingual is important when interpreting performance. Furthermore, age of acquisition of each language, number of years speaking the second language, and degree of fluency in each language also play a role in bilingual cognitive performance (Gollan, Fennema-Notestine, Montoya, & Jernigan, 2007; Rosselli et al., 2000). Moreover, bilinguals, unlike monolinguals, are often faced with the challenge of filtering words in one language while retrieving words in another, which slows down their production and affects their performance (Sandoval, Gollan, Ferreira, & Salmon, 2010).

Grosjean (1998) argued that a major challenge for bilinguals in the context of neuropsychological assessment is that they learn and use their languages for different purposes, in different domains of life, and with different people. For instance, in South Africa and many other countries it is not atypical for individuals to use English (an acquired language for most) in the school or work environment and, as a complement, to use their native language at home. This Complementarity Principle affects bilinguals' performance on cognitive tests. Grosjean (1998) also argued that bilinguals' language competence changes over time, especially if the environment in which they operate changes and the need for using a specific language therefore becomes more or less imperative. In other words, the primacy of one language over another may change if one is activated at the cost of the other over a significant period of time.

Another language-related factor that influences cognitive test performance is the actual lexicon of the test-taker's primary language. For instance, some languages do not have words to describe certain objects (Robertson, Liner, & Heaton, 2009). This phenomenon is clear to see in many parts of Africa, where Westernisation and colonial influences hindered the development of local languages so that they did not grow to cater for newly developed, discovered, or introduced objects. Moreover, many individuals in the former colonies are forced to speak a universal (acquired) language in order to fit into their work or school environments, and so naturally it becomes easier for them to name objects in that language rather than learning the native word. For instance, isiXhosa home-language speakers may use English words to describe fruits and vegetables in daily life, even when speaking isiXhosa. This situation poses a challenge for verbally-based tests, such as those that require learning a list of words: One cannot simply translate the original English stimulus items into a local language and expect psychometric equivalency across test versions (Brickman, Cabo, & Manly, 2006; Scott et al., 2018; Sousa & Rojjanasrirat, 2011).

Hence, there is now a large body of literature, emerging from many different countries, describing the effects of language (broadly speaking) on cognitive test performance. Studies in that literature examine differences in performance between monolinguals and bilinguals, between those administered the test in their home language and those administered the test in an acquired language, and between test-takers from different language backgrounds (see, e.g., Acevedo et al., 2000; Agranovich & Puente, 2007; Ardila, Rosselli, Ortega, Lang, & Torres, 2017; Ardila et al., 2000; Bialystok, Craik, & Luk, 2008a; Blumenfeld et al., 2016; Gasquoine & Gonzalez, 2012; Grieve & van Eeden, 2010; Mungas, Reed, Haan, & González, 2005; Rivera Mindt et al., 2008; Rosselli et al., 2000; Van Wyk, 2014). I review some notable studies from that literature below.

Lyness, Hernandez, Chui, and Teng (2006) tested healthy Spanish- and English-speaking participants, matched for age, sex, and education, on the Mattis Dementia Rating Scale (MDRS; Mattis, 1988). Results showed that Spanish-speaking participants performed significantly more poorly than English-speaking participants on the overall MDRS score and on the attention, conceptualisation, and memory subscales. The authors attributed these differences in performance to differences in home language as well as cultural and educational experiences.

Lehman Blake, Ott, Villanyi, Kazhuro, and Schatz (2015) examined language of administration differences in English-Spanish bilinguals' performance on the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT; Lovell, Collins, Podell, Powell, & Maroon, 2000) battery, a collection of tests assessing verbal memory, visual memory, processing speed, and reaction time. Participants performed better on tests of verbal memory and processing speed when tested in English than when tested in Spanish, even when they reported that the latter was their first language.

Both of these studies illustrate a critical difficulty for cross-cultural neuropsychological assessment: Most commonly-used cognitive tests were created and standardised for English speakers and have not been appropriately adapted for those without English as a home language. Hence, language of test administration can have a significant influence on cognitive test performance and has the potential to contribute to, for instance, misdiagnosis of impairment.

Some studies have, however, presented evidence suggesting that the effects of administration language vary across tests. Cockcroft, Alloway, Copello, and Milligan (2015) compared Wechsler Adult Intelligence Scale-Third Revision (WAIS-III; Wechsler, 1997) performance of undergraduates from the United Kingdom (*n* = 349, age range 18-58 years, mainly monolingual English speakers) against that of undergraduates from South Africa (*n* = 107, age range 18-25 years, multilingual English second-language speakers). Although there were no significant differences in Working Memory Index scores, the UK group performed significantly better on the Verbal Comprehension and Perceptual Organisation subtests while the South African group performed significantly better on the Processing Speed subtests. Of note here, however, is that these language-specific results may have been confounded by between-group differences in age, socioeconomic status (higher in the UK group), and quality of education (better in the UK group).

In a study presenting similar patterns of results, Gasquoine, Croyle, Cavazos-Gonzalez, and Sandoval (2007a) reported that Spanish-English bilingual participants (*n* = 36, age range 20-65 year, education range 9-18 years) performed better on the Bateria Neuropsicologica (Ostrosky-Solís, Ardila, & Rosselli, 1999) Story Memory subtest when it was administered in Spanish, but better on the Digit Span subtest when it was administered in English. They attributed the former result to the fact that most participants reported Spanish as being their first acquired language and their home language, and the latter to across-language differences in the phonological length of words describing digits.

In contrast to those results, Scott et al. (2018) investigated differences in performance on the Hopkins Verbal Learning Test (HVLT-R; Ralph, David, Lowell, & Jason, 1998) between participants (aged 18-64 years) who preferred to be tested in their home language (isiXhosa; $n = 61$) versus those with the same home language but who preferred to be tested in an acquired language (English; $n = 51$). Despite words on the isiXhosa-modified HVLT-R (Joska et al., 2011) having significantly more syllables and letters than those on the original English version, analyses detected no statistically significant between-group differences in performance.

Another important language factor to consider in the cognitive assessment of multilingual participants is *code switching*. This term refers to an instance of a speaker alternating between two or more languages within a single conversation. In the context of neuropsychological assessment bilinguals typically activate both of their languages, and this activation is important to consider in terms of its effects on test performance. Sheppard, Kousaie, Monetta, and Taler (2016) compared the performance of English and French monolinguals against that of English-French bilinguals on the Boston Naming Test (BNT; Goodglass, Kaplan, & Weintraub, 1983) and found that monolingual French participants performed worse than the monolingual English and bilingual participants. Moreover, bilinguals performed better when allowed to code-switch freely than when generating words in English. The authors interpreted this pattern of results as indicating that, under code-switching conditions, bilinguals do not suffer delays due to the required inhibition of other activated languages.

In summary, the literature reviewed above suggests that, in order to ensure accurate interpretation of test performance, neuropsychologists must carefully review test-takers’ proficiency in their known languages prior to choosing the language of administration, especially on verbally-based tests. Moreover, it is important that neuropsychologists be keenly aware of how well the language of test administration matches test-takers' language history and profile (number of languages spoken, proficiency in those languages, etc.), and that they allow and account for code switching in multilingual participants. In a world characterised by increasing cultural and linguistic diversity, more needs to be done to ensure that cognitive measures and test administration keep pace. This thesis attempts to add to the body of knowledge regarding those topics and to further facilitate understanding of the effects of language of test administration on verbal cognitive tests. I pay particular attention to one of the most commonly used language-influenced tests, that assessing verbal fluency (Portocarrero, Burright, & Donovick, 2007).

Verbal Fluency Tests

Since their development and introduction into the psychological literature more than 70 years ago, verbal fluency tests have become one of the most important forms of cognitive assessment within both clinical neuropsychological practice and experimental neuropsychological research (Rosselli et al., 2002; Shao, Janse, Visser, & Meyer, 2014; Strauss et al., 2006). These tests include those measuring semantic (or category) fluency (e.g., the number of animals, fruits and vegetables, or girls' names the test-taker can name within a given time limit), phonemic (or letter) fluency (the number of words beginning with a given letter the test-taker can name within a given time limit), and action fluency (the number of verbs the test-taker can name within a given time limit). Verbal fluency tasks require the test taker to access the brain's semantic storage while engaging working memory and self-monitoring processes (e.g., so that task instructions are maintained, already-generated words are not repeated, and utterance of words that fall outside task boundaries is resisted) during word production (Bialystok et al., 2008a; Quaranta et al., 2016).

Poor performance on verbal fluency tests can be attributed to either organic or non-organic factors. Because of the former, these tests are used frequently in the assessment of neurodegeneration associated with, for instance, Alzheimer's disease (AD), Parkinson's disease (PD), or HIV infection (Shao et al., 2014; Snitz et al., 2009). It is only relatively recently, however, that the psychological literature has begun to examine the degree to which performance differences on verbal fluency tests might be attributable to non-organic factors (e.g., age, education, or language of test administration).

The balance of impairment attributable to organic versus non-organic factors might vary from person to person, and hence it is imperative for research to distinguish clearly (a) the roles of each of those factors in performance, and (b) which non-organic factors might play particular roles in the performance of specific individuals. To date, the only South African study investigating the role of non-organic factors in performance on verbal fluency tests focused entirely on phonemic (letter) fluency (Ferrett et al., 2014). However, semantic fluency tests are used more commonly than phonemic fluency tests; whereas administration of the latter differs substantially depending on which language group is being assessed, administration of the former can be identical regardless of which language group is being assessed (i.e., one can use the same categories for all different test-takers). Moreover, semantic fluency tests are more susceptible to cross-linguistic influence (Portocarrero et al., 2007; Rosselli et al., 2000). Hence, these tests are of particular interest to me and so I focus exclusively on them in this thesis.

Organic Influences on Semantic Verbal Fluency Performance

Because semantic verbal fluency tests assess generativity, one of the key components within the broad cognitive domain of executive functioning, it is not surprising that patients with frontal and temporal lobe damage perform poorly on them (see, e.g., Binney et al., 2018; Drane et al., 2006; Royall et al., 2002; Strauss et al., 2006; Vaughan, Coen, Kenny, &

Lawlor, 2016). There are, however, interesting variations in performance depending on which test is used and which group of patients is tested. For instance, patients diagnosed with dementia related to Parkinson's disease, AD, and the cognitive variants of frontotemporal dementia (FTD) all tend to perform poorly on semantic fluency tests, probably because those disease processes attack both the frontal (responsible for verb retrieval) and temporal (responsible for retrieval from semantic categories) cortices. In contrast, patients with normal pressure hydrocephalus, behavioural variants of FTD, and progressive nonfluent aphasia perform more poorly on action fluency tests than on semantic fluency tests, probably because the former taps into frontal-subcortical circuits while the latter taps into temporal regions more heavily (Davis et al., 2010; Royall et al., 2002).

Further illustrating this point, Braaten, Parsons, McCue, Sellers, and Burns (2006) reported that AD patients (n = 30) performed significantly more poorly on a semantic fluency test than participants with vascular dementia (n = 31) and FTD (n = 20). They attributed this performance difference to the prominent temporal lobe pathology that is characteristic of AD. This neuropathology tends to inhibit retrieval of semantic information (Binney et al., 2018; Vaughan et al., 2016).

Similarly, Pereira et al. (2009) examined the brain correlates of semantic fluency tests in parkinsonian patients and found that poor performance was associated with gray matter loss in frontal and temporal regions as well as in the cerebellum, which is responsible for language processing modulation (Kellett, Stevenson, & Gernsbacher, 2012). PD patients, therefore, struggle not only with accessing semantic information but also with identifying and correcting the language mistakes that they make (Starowicz-Filip et al., 2017). All of these cognitive processes are of great importance during semantic fluency test performance because the test-taker is required to generate words within a particular category while filtering out words outside that category.

Verbal fluency tests are often a core component of HIV neuropsychology batteries (Heaton et al., 2011; Robertson et al., 2009; Sacktor et al., 2009) primarily because performance on these tests has, in many previous studies, distinguished HIV-infected from HIV-uninfected samples (Iudicello et al., 2007; Millikin, Trépanier, & Rourke, 2004). For instance, Iudicello, Woods, Deutsch, Grant, and Group (2012), in a US-based study, reported that HIV-infected older adults (age ≥ 50 years) performed more poorly than HIV-infected younger adults (age < 40 years) and HIV-uninfected adults of all ages on semantic fluency tests. In contrast, a Master's thesis by Van Wyk (2014) reported no significant differences in performance on semantic fluency tests (animals, fruits and vegetables) between HIV-infected and HIV-uninfected South African adults. This latter study remains unpublished, however, and the finding has yet to be replicated despite the fact that the long-lasting effects of the HIV pandemic in this country mean South African clinical psychologists and neuropsychologists must be particularly conscious of psychometric means to distinguish between infected and uninfected individuals.

Non-Organic Influences on Semantic Fluency Performance

Age and education. A relatively consistent finding in this literature is that age is significantly negatively associated, and level of educational attainment is significantly positively associated, with performance on sematic fluency tests (Brickman et al., 2005; Esteves et al., 2015; Fichman et al., 2009; Strauss et al., 2006; Troyer, 2000; Zarino, Crespi, Launi, & Casarotti, 2014). For instance, in a large normative study (N = 1300) using cognitively intact individuals aged 16-95 years with 0-21 years of education, Tombaugh, Kozak, and Rees (1999) showed that both age (23.4%) and education (13.6%) accounted for a significant proportion of the variance in number of words generated to the category of animals. Similarly, Crossley, D'Arcy, and Rawson (1997) reported that older adults (> 65 years) who had completed 13 or more years of formal education generated significantly more animal names than those who had completed 6 or fewer years.

More recently, Zimmermann, Parente, Joanette, and Fonseca (2014) found, using a Brazilian sample of healthy individuals aged 19-75 years who were tested on the category of clothing items, that: (a) older adults (60-75 years; $n = 100$) performed more poorly than middle-aged (40-59; $n = 100$) and young adults (19-39; $n = 100$); (b) those with higher levels of education (≥ 7 years; $n = 150$) performed better than those with lower levels (2-6 years; $n = 150$); and (c) there was an age x education interaction suggesting that, among older adults, level of education was less predictive of performance than among younger adults.

This age x education interaction is not found consistently across studies, however (see, e.g., Brickman et al., 2005; van der Elst, van Boxtel, van Breukelen, & Jolles, 2006). In other words, higher levels of education are not necessarily a protective factor against age-related decline in performance on semantic fluency tests.

Language of test administration. Performance on semantic fluency tests often varies depending on the language in which the test is administered. For instance, Acevedo et al. (2000) examined differences in performance between 237 Spanish-speaking and 316 English-speaking older adults and found that the former performed better in the animal category, whereas the latter performed better in the fruit-and-vegetable category. The authors argued that this pattern of results may be attributed to differences in sociocultural exposure to elements of the superordinate category (e.g., wider nutritional preferences as well as familiarity with a wider variety of fruits in the US than in Latin American countries). However, in a sample of participants aged 50-84 years, Rosselli et al. (2000) found that monolinguals who took the test in Spanish ($n = 18$) performed better on the fruit category whereas monolinguals who took the test in English ($n = 45$) performed better on the animals category. The differences in results between these two studies are difficult to explain. They were published in the same year, and they studied similar samples (in both studies, the English-speaking participants were born and raised in the US while the Spanish-speaking participants were immigrants to the US). One potentially pertinent point is that Acevedo et al. (2000) did not have information on how long their Spanish-speaking participants had been living in the US, the years of education they had completed in the US, etc. In contrast, the Spanish-speaking participants in the study by Rosselli et al. (2000) immigrated to the US after the age of 50 and had only been living there for an average of 5 years.

Because brain structure and function often differs significantly between monolinguals and bilinguals (Anderson, Chung-Fat-Yim, Bellana, Luk, & Bialystok, 2018; Grundy, Anderson, & Bialystok, 2017), and because bilinguals' joint activation of languages means they have to use greater executive control while performing monolingually-administered semantic fluency tasks (specifically, to inhibit the non-target language during word generation; Bialystok, 2017), it is pertinent to include in this review studies comparing semantic fluency performance of monolinguals and bilinguals. Portocarrero et al. (2007) found that monolingual English-speaking college students (n = 39) performed better than bilingual college students (n = 39)[1] on both animals and kitchen items category fluency tests. Although the performance difference diminished when data from participants who had moved to the US before turning 10 years old were analysed separately, bilingual participants still performed more poorly than the monolingual participants. This difference is suggestive of a greater vocabulary capacity among monolinguals (i.e., they had had more exposure to English, especially when compared to the bilingual participants who were not born in the US).

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[1]This diverse group included individuals who spoke English, mostly as a second language, alongside either Russian, Korean, Chinese, Spanish, Japanese, Creole, Polish, or Portuguese.

In a similar study, Kormi-Nouri, Moradi, Moradi, Akbari-Zardkhaneh, and Zahedian (2012) compared the performance of 1600 Persian-speaking monolingual (*n* = 600) and Turkish- (*n* = 500), Kurdish-Persian bilingual (*n* = 500) primary school participants on 31 semantic fluency categories and found that monolinguals performed better than bilinguals. The authors noted that, despite bilinguals having superior executive control, their poor performance might be attributed to lexical activation of both their languages during performance and consequent interference on the monolingual administration. Of note here is that these authors did not take objective measures of the relative fluency of the bilingual participants in each of their languages; instead, they relied on reports of parents, teachers, and the participants themselves. Hence, it is possible that some participants were tested in their non-dominant language (Persian) and so might have produced different results had they been tested in their dominant language (see also Blumenfeld et al., 2016).

Friesen, Lin, Gigi, and Bialystok (2015) also reported performance differences between monolinguals and bilinguals, but noted that the magnitude of these differences was influenced by age and vocabulary capacity. Specifically, they found equivalent performance on an animal category fluency test in three of their groups (7-year-olds [*n* = 39], young adults [*n* = 40], and older adults [*n* = 41]), but superior performance by monolinguals in their 10-year-old group. They attributed this relatively poor performance of bilinguals to their limited vocabulary capacity; larger capacity is necessary for better performance on semantic fluency tests.

Results from the reviewed studies comparing monolinguals and bilinguals are consistent with the notion that bilingualism is associated with greater executive control but smaller vocabulary size in each language (Bialystok, 2017; Bialystok et al., 2008b; Luo, Luk, & Bialystok, 2010). Superior executive control assists better performance on phonemic fluency while greater vocabulary size and lexical retrieval capability is important for better performance on semantic fluency tests. Because bilingual participants often have a smaller vocabulary size in each of their languages relative to the single vocabulary size of monolinguals, it is challenging for them to perform as well as monolinguals on semantic fluency tests when administration is in a single language. Moreover, because bilinguals experience lexical activation of both their languages during test administration and then often fail to inhibit their dominant language, they perform poorly when the test requires them to generate words in a their second language. This important, yet largely disregarded, phenomenon of dual lexical activation is called code-switching.

Code switching appears commonly in the spoken conversation of multilingual individuals. Frequency of code switching depends on the individual's proficiency in both the imminent language and the one(s) to which they switch (Costa & Santesteban, 2004; Rodriguez-Fornells, Kramer, Lorenzo-Seva, Festman, & Münte, 2012). Although the ability to code switch is associated with mature executive control processes (Yim & Bialystok, 2012) , it is sometimes seen in children or in individuals with a limited vocabulary in the imminent language (i.e., those without a fully-fledged lexicon in one language might switch to a different language in order to describe a concept; Genesee, Paradis, & Crago, 2004; Grosjean, 1982). In spite of it being more common for individuals to switch from a less proficient language to a more proficient one, the inverse can happen because there is often a rigorous practicing of words when learning a new language (Heredia & Altarriba, 2001).

Additionally, code switching appears more likely to occur in environments that encourage the use of multiple languages interchangeably. In such environments, individuals familiar with all (or some) of those languages are likely to have high activation of them simultaneously, and therefore to code switch (Poplack, 2001). The importance of environment is further illustrated by the fact that, although people are more likely to code switch when speaking to another bilingual, their degree of code switching depends on how natural and acceptable it is to do it in different contexts, settings, and groups (Rodriguez-Fornells et al., 2012).

More importantly from a neuroscience perspective, code switching has cognitive costs that are marked by a processing speed delay associated with the switching from one language to the other (Yim & Bialystok, 2012). This cost is illustrated by participants who are forced to alternate between languages often producing words at a slower rate. For instance, Woumans, Ceuleers, Van der Linden, Szmalec, and Duyck (2015) showed that balanced Dutch-French bilinguals (n = 31), unbalanced Dutch-French bilinguals (n = 34), and Dutch-French interpreters (n = 28; groups matched for age, sex, and general intellectual functioning) all performed better on semantic verbal fluency tests when assessed in a single language (either Dutch or French) than when they were forced to code-switch.

In the only South African study that examined effects of code switching on verbal fluency test performance, Bethlehem, de Picciotto, and Watt (2003) found that English-isiZulu bilingual adults (N = 35) generated relatively equal number of words when they were allowed to code switch versus when they were not (i.e., when they were instructed to generate words only in English or only in isiZulu). Among the many methodological weaknesses of that study, however, is the fact that the animals category test was administered throughout, leaving performance at risk of being contaminated by carryover effects.

CHAPTER 3

RATIONALE, AIMS AND HYPOTHESES

Although the test-taker's language history (e.g., whether they are bi/multilingual, and their proficiency in each of their languages) is of obvious importance in all assessment contexts and for all neuropsychologists, most of the literature on this topic has emerged from the global north. Specifically, due to the rapidly increasing Spanish-speaking population in the United States, a large literature has developed around neuropsychological assessment of Latinx individuals in that country because of the need for such assessment to be structured appropriately for those individuals (Ardila et al., 2017; Mack et al., 2005; Rosselli et al., 2000). There is a relative paucity of literature on the effects of language of test administration in African clinical contexts. More such studies are needed because, across the continent, most individuals are, at least, bilingual, and many are multilingual (Ansaldo, Marcotte, Scherer, & Raboyeau, 2008; Foxcroft, 2011).

As the review in the previous chapter indicates, it is important to carefully investigate effects of language variables (e.g., number of acquired languages, language of test administration and relative capability in that language) on semantic fluency test performance. Such investigation is especially important in South Africa because only 9.6% of the population considers English to be their first language (Statistics South Africa, 2012). Hence, it is imperative that well-grounded empirical research investigates whether language-modified versions of semantic verbal fluency tests are valid and reliable neuropsychological measures, and can detect impairment similarly to the way in which the original (English) versions do.

The study described in this Master's thesis therefore aims a concentrated focus on the effects of language of test administration on semantic fluency performance. In the study, cognitively intact and bilingual South African undergraduate students (i.e., fluent in both

English and isiXhosa) completed a set of semantic fluency tests in both those languages. This set included (1) an *animals* category test, administered in both languages; (2) a *fruit-and-vegetables* category test, administered in both languages; (3) a test that forced task switching between the categories of *supermarket items* and *musical instruments*, administered in both languages; and (4) a test that allowed free code switching while generating items from the category of *household items*. This design allowed the following specific hypotheses to be tested:

Participants will generate more words when administered the animals and the fruit-and-vegetables category tests in English than in isiXhosa. I make this prediction because it is likely that most participants will have received much of their formal secondary education, and all of their tertiary education, in English (Posel & Zeller, 2016). Hence, they are likely to have a larger pool of English words upon which to draw. Furthermore, it is likely that the English language contains more words describing animals, and fruits and vegetables, than isiXhosa.

Participants will perform better when code switching freely than when they are forced to switch between categories. I make this prediction because forced task switching is more demanding and effortful due to the linked switching costs, and therefore requires more executive control engagement (Gollan & Ferreira, 2009; Meuter & Allport, 1999)

CHAPTER 4

PILOT STUDY

This pilot study sought to provide data indicating which semantic categories would be most appropriate for testing healthy young adult South Africans in both English and isiXhosa. Typically, neuropsychologists use the categories of animals, fruits and vegetables, musical instruments, household items, supermarket items, classroom items, and/or parts of the body when assessing semantic fluency (Strauss et al., 2006). Most research studies focus on the performance on English-speaking participants in the categories of animals and fruits and vegetables, however, with not much work (and, especially, very little cross-cultural and cross-linguistic work) on other categories. Hence, the aim here was to determine which two of four categories (supermarket items, musical instruments, classroom items, and parts of the body) would be most appropriate for use in the main study's forced switching tasks (i.e., the semantic fluency tests, administered separately in isiXhosa and English to all participants, that required them to alternately generate words from two different categories). I aimed to choose the two categories on which the participants performed best (i.e., on which they demonstrated that they had the largest vocabulary or pool of semantic knowledge).

Methods

Design and setting. The study used a cross-sectional quasi-experimental within-groups design. All procedures were administered individually in a quiet, private room inside a psychology research laboratory.

Participants. I used convenience sampling to recruit volunteers. A total of 14 healthy young adults volunteered to participate, each signing up for an hour-long time slot. I excluded data from four of the original volunteers: three because, at ages, 17, 26, and 29, they were outside the age range (18–25 years) stipulated by the main study, and one because she tended to generate more words in isiZulu than isiXhosa on the semantic fluency tests administered in the latter language.

The remaining 10 participants (3 men, 7 women) were aged between 21 and 25 years, had completed between 15 and 17 years of education, and were fluent in both English and isiXhosa. None of them reported a history of endocrinological or neurological disorder or neurocognitive impairment. All except one, who had been diagnosed with anxiety and depression, reported no history of psychiatric disorder. The diagnosed individual was not excluded from participation because she was prescribed anti-depressant medication and scored within the eligibility range on the depression and anxiety screening measures.

Measures.

Sociodemographic and medical questionnaire. This study-specific self-report questionnaire (Appendix A) asked participants to provide biographical information (e.g., age, sex, and level of education) and a brief medical history. This information allowed me to screen for participation eligibility and to acquire information about sociodemographic characteristics with the potential to influence cognitive test performance.

Language proficiency. The Language Experience and Proficiency Questionnaire (LEAP-Q) was developed at the Northwestern Bilingualism and Psycholinguistics Research Lab to fill the need for a research instrument assessing relative language proficiency in bilinguals (Kaushanskaya, Blumenfeld, & Marian, 2019; Marian, Blumenfeld, & Kaushanskaya, 2007). It has been widely used for more than a decade, and has been translated into more than 20 languages. The LEAP-Q asks respondents to answer questions about language competence (e.g., proficiency in each language spoken, order of dominance, preferred language), the age at which each language was acquired, methods of language acquisition, and patterns of current language use (Marian et al., 2007). The first part of the instrument (Part A) asks questions relating to all the languages in which the respondent is fluent. The second part (Part B) asks questions relating to each language separately.

The LEAP-Q appears to be a valid instrument for assessing language proficiency. For instance, the developers report there are strong correlations between LEAP-Q scores and the performance of bilingual individuals on objective standardized measures of reading fluency, productive vocabulary, oral comprehension, and grammaticality judgment (Marian et al., 2007).

In this study, I used a South African adaptation of that self-report questionnaire (Siebert, 2018; Appendix B) to help determine participants' proficiency in and experience with the languages in which they reported fluency and to assess the degree of fluency in each of those languages. Specifically, participants were asked to first complete Part A, and to then complete Part B for all of the languages in which they reported fluency on Part A.

Depression and anxiety screening. The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996; Appendix C) and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988; Appendix D) are both 21-item self-report questionnaires that measure, respectively, severity of depression and severity of anxiety symptoms over the 2 weeks prior to responding. On each questionnaire, each item is a statement that requires response using a 4-point Likert-type scale. Individuals who scored > 30 on the BDI-II (i.e., in the range conventionally described as 'severely depressed') or who scored > 35 on the BAI (i.e., in the range conventionally described as 'severely anxious') were not eligible for participation in either this pilot study or the main study.

Regarding psychometric properties, the BDI-II has excellent 1-week test-retest reliability (r =. 93) and excellent internal consistency (α = .92 for outpatients and .93 for a nonclinical sample), with total-item correlations ranging from .39 to .70 (Beck et al., 1996). The BAI has good 1-week test-retest reliability (r = .75) and excellent internal consistency (α

= .92), with the total-item correlations ranging from .30 to .71 (Beck et al., 1988). Both instruments are used widely by South African clinicians and researchers to determine the severity of depression and anxiety in a wide variety of samples (see, eg., Bantjes, Kagee, McGowan, & Steel, 2016; Le Roux & Kemp, 2009; Nel & Kagee, 2013; Somhlaba & Wait, 2009; Strauss et al., 2006).

Semantic fluency tests. Participants were administered, in the order that follows, tests with these category cues: (1) supermarket items, (2) musical instruments, (3) classroom items, and (4) parts of the body. Each test was administered in both English and isiXhosa (all tests in one language, then in the other), following standard protocols.

For each category test, I recorded each word onto a scoring sheet and summed the number of correct words. I also recorded each instance of a repetition/perseveration (i.e., producing a word said before instead of generating a new word), intrusion (i.e., generating a word unrelated to the category, e.g., generating the word *coffee* on the musical instruments task), and a word from another language (e.g., generating an English word when the test is being administered in isiXhosa). The scoring sheet was divided each 60-s time frame into four 15-s intervals so that pace of generation could be captured.

Procedure. Immediately after arrival at the laboratory, the participant completed the informed consent procedures and was then administered the sociodemographic and medical questionnaire, the adapted LEAP-Q, the BDI-II, and the BAI. As each questionnaire was completed, I read and scored the responses so that those participants who did not meet the eligibility criteria could be excused immediately. Those who were eligible to continue were administered the four semantic fluency tests. Language of test administration was counterbalanced so that every odd-numbered participant was tested in English first and then isiXhosa and every even-numbered participant was tested in the opposite order.

At the conclusion of the test procedures, I fully debriefed the participant, reimbursed them ZAR25, thanked them for participating, and dismissed them. Each test session lasted between 45 and 60 minutes.

Data management and statistical analysis. In both this pilot study and the main study described in subsequent chapters, I used SPSS (version 25.0) to complete all data analyses, with the threshold for statistical significance set at $\alpha = .05$. Unless otherwise stated, assumptions underlying the various types of parametric tests were upheld.

First, I generated a complete set of descriptive statistics that allowed me to examine the normality of data distributions and to test assumptions underlying subsequent inferential statistical analyses. Second, for the primary analysis two repeated-measures ANOVAs (one for the English administration, and a separate one for the isiXhosa administration) compared relative performance on each semantic fluency test. Follow-up paired-sample *t*-tests explored the precise location of significant differences detected by the omnibus analysis.

Results

Sample characteristics. The final sample of 10 participants (7 women, 3 men) had a mean age of 23.10±1.60 years and had completed a mean of 15.50±0.71 years of education. All reported isiXhosa as the first language they acquired, except for one who acquired Sesotho first and then isiXhosa. Participants reported fluency in an average of four languages. Seven reported isiXhosa as their dominant language, while the rest reported English as their dominant language. However, data from the adapted LEAP-Q suggested that participants reported a significantly higher level of reading proficiency (but not speaking or understanding proficiency) in English than they did in isiXhosa (see Table 1). This pattern of data probably results from the fact they were being educated at an English-medium university.

Table 1

Self-reported Language Proficiency: Adapted LEAP-Q data for the current sample (N = 10)

Proficiency variable	isiXhosa	English	*t*	*p*	ESE
Speaking	8.20 (1.14)	8.60 (1.08)	-0.65	.534	0.36
Understanding	8.50 (0.85)	8.80 (1.03)	-0.58	.576	0.32
Reading	6.70 (1.64)	9.30 (1.06)	-3.34	.009**	1.88

Note. Data in the second and third columns are means, with standard deviations in parentheses. For all variables, possible scores range from 0–10. Adapted LEAP-Q = Language Experience and Proficiency Questionnaire, adapted for South African samples; ESE = effect size estimate (in this case, Cohen's *d*).
*$p < .05$. **$p < .01$. ***$p < .001$.

Relatedly, 7 of the 10 participants reported that English was their medium of instruction in primary school, and 8 of 10 reported the same for high school. For primary school, 1 participant reported that isiXhosa was their medium of instruction, 1 reported English and isiXhosa, and 1 reported English and Afrikaans. For high school, 1 participant reported that isiXhosa was their medium of instruction and 1 reported English and isiXhosa,

Regarding psychiatric status, the sample's mean BAI score was 8.10 (*SD* = 8.57, range = 0–22), a value that lies within the range described as "mild anxiety" (Beck et al., 1988). Similarly, the mean BDI-II score was 9.20 (*SD* = 4.76, range = 0–15), a value that lies within the range described as "mild mood disturbances" (Beck et al., 1996).

Primary analyses. As Table 2 shows, a set of paired-samples t-tests detected, for each of the four semantic categories, significant performance differences (associated with large effect sizes) when the participants were tested in English versus when they were tested in isiXhosa. In each case, the participants generated more words in the former language than in the latter.

Table 2
Across-Language Differences: Performance on the four semantic fluency tests (N = 10)

	Language of test administration								
	isiXhosa			English					
Semantic category	*M*	*SD*	Range	*M*	*SD*	Range	*t*	*p*	ESE
Supermarket items	10.30	3.09	5-15	15.90	2.81	12-21	4.84	.001**	1.90
Musical instruments	2.90	2.08	0-7	8.60	1.43	7-11	6.37	< .001***	3.19
Classroom items	8.80	3.01	6-15	13.70	2.21	11-17	4.54	.001**	1.85
Parts of the body	14.40	1.96	12-19	18.80	2.53	16-23	6.92	< .001***	1.95

Note. ESE = effect size estimate (Cohen's *d*).
$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

For data collected from the isiXhosa test administration, repeated-measures ANOVA detected significant between-test performance differences, $F(3, 27) = 49.44$, $p < 0.001$, $\eta_p^2 = .85$. A series of follow-up planned contrasts indicated consistent and significant pairwise differences, with the order of means being Musical Instruments < Classroom Items < Supermarket Items < Parts of the Body (see Table 3 and Figure 1).

For data collected from the English test administration, repeated-measures ANOVA detected significant between-test performance differences, $F (3, 27) = 37.52$, $p < 0.001$, $\eta_p^2 =.81$. Similar to the analysis of data from the isiXhosa administration, a series of follow-up planned contrasts indicated reasonably consistent and significant pairwise differences, with the order of means being Musical Instruments < Classroom Items ≤ Supermarket Items < Parts of the Body (see Table 3 and Figure 1). The only distinction between the two sets of analyses, then, is that on the English administration there was no significant difference between the number of words generated to the categories of classroom items and supermarket items (although, on average, participants generated more words to the latter category cue than to the former), whereas on the isiXhosa administration there was a significant difference between those two.

Table 3

Pairwise comparisons: Performance differences on semantic fluency tests administered in isiXhosa and English (N = 10)

		95% CI			
Administration language / Category comparison	*t*	*p*	ESE	LL	UL
isiXhosa					
Supermarket items vs. Musical instruments	7.64	< .001***	2.42	5.21	9.59
Supermarket items vs. Classroom items	3.00	.015**	0.95	0.37	2.63
Supermarket items vs. Parts of the body	-3.57	.006**	1.13	-6.70	-1.50
Musical instruments vs. Classroom items	-6.74	< .001***	2.13	-7.88	-3.92
Musical instruments vs. Parts of the body	-12.99	< .001***	4.10	-13.51	-9.50
Classroom items vs. Parts of the body	-4.65	.001**	1.67	-8.32	-2.88
English					
Supermarket items vs. Musical instruments	7.22	< .001***	2.35	5.01	9.59
Supermarket items vs. Classroom items	2.11	.064	0.67	-0.16	4.56
Supermarket items vs. Parts of the body	-2.64	.027*	0.83	-5.39	-0.41
Musical instruments vs. Classroom items	-5.19	.001**	2.48	-7.32	-2.88
Musical instruments vs. Parts of the body	-12.98	< .001***	4.10	-11.78	-8.42
Classroom items vs. Parts of the body	5.02	.001**	1.59	-7.40	-2.80

Note. ESE = effect size estimate (Cohen's *d*); CI = confidence interval for mean difference between category scores; LL = lower limit; UL = upper limit.

**p* < .05. ***p* < .01. ****p* < .00

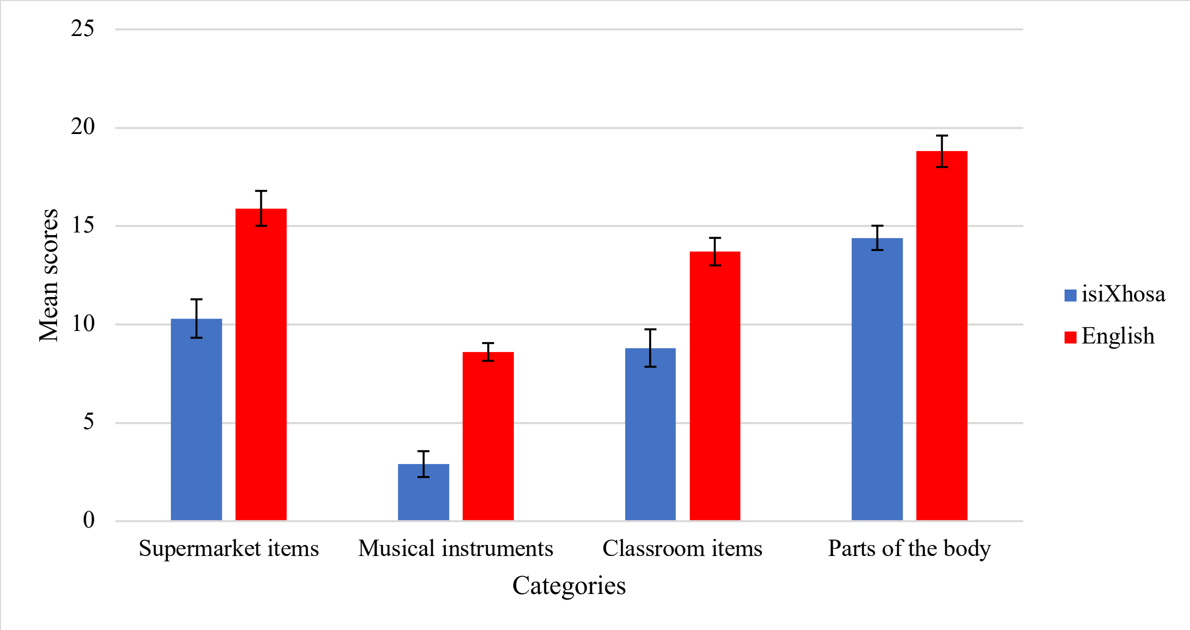

Figure 1. Average semantic fluency test performance in four different category tests using two different languages of administration ($N = 10$). Error bars indicate standard error of the mean.

Secondary analyses. Because previously published studies suggest that sociodemographic variables (age, education, sex, language) can influence semantic fluency test performance, it was of interest to explore the potential for such influence in the current datasets. One must, of course, interpret these analyses with caution given the small sample size. sought to confirm that none of the sociodemographic variables (age, education and sex, language profile) were significantly correlated to the categories.

Analyses detected no significant associations between semantic fluency test performance and either participant age or participant education, and no significant sex- or language-based performance differences (see Tables 5, 6, and 7).

Table 4

Correlation Matrix: Associations between sociodemographic variables and semantic fluency test performance (N = 75)

	Semantic fluency test							
	Language of test administration							
	isiXhosa				English			
Sociodemographic variable	C1	C2	C3	C4	C1	C2	C3	C4
Age	-.02	.20	-.19	-.34	.35	-.08	.07	-.46
	(.519)	(.571)	(.960)	(.344)	(.322)	(.831)	(.840)	(.178)
Education[a]	-.38	.04	-.26	-.32	.08	< .001	-.25	-.37
	(.277)	(.917)	(.467)	(.365)	(.818)	(1.00)	(.490)	(.289)

Note. Data presented are Pearson correlation coefficients (*r*), with *p*-values in parentheses. C1 = Category 1, supermarket items; C2 = Category 2, musical instruments; C3 = Category 3, classroom items; C4 = Category 4, parts of the body. [a]Number of years of successfully completed education.

Table 5

Independent-samples t-tests: Between-sex differences in semantic fluency performance (N = 10)

	Participant Sex								
	Women (n = 7)		Men (n = 3)					95% CI	
Administration Language / Category Test	*M*	*SD*	*M*	*SD*	*t*	*p*	ESE	LL	UL
isiXhosa									
Supermarket items	9.14	2.80	13.00	2.00	2.14	.065	1.59	-0.31	8.02
Musical instruments	2.71	2.14	3.33	2.31	0.41	.692	0.40	-2.85	4.09
Classroom items	7.71	2.36	11.33	3.22	2.02	.078	1.28	-0.52	7.76
Parts of the body	14.57	2.07	14.00	2.00	-0.40	.697	0.28	-3.84	2.70
English									
Supermarket items	15.14	2.55	17.67	3.06	1.36	.210	0.90	-1.74	6.79
Musical instruments	8.71	1.50	8.33	1.53	-0.37	.723	0.25	-2.77	2.01
Classroom items	13.14	2.27	15.00	1.73	1.25	.245	0.92	-1.56	5.27
Parts of the body	18.71	2.69	19.00	2.65	0.16	.881	0.11	-3.98	4.55

Note. ESE = effect size estimate (Cohen's *d*); CI = confidence interval; LL = lower limit; UL = upper limit.

size estimate (Cohen's *d*); CI = confidence interval; LL = lower limit; UL = upper limit.

Table 6

Independent-samples t-test: Differences in semantic fluency performance by self-reported dominant language (N = 10)

	Dominant Language								
	isiXhosa (n = 7)		English (n = 3)					95% CI	
Administration Language / Category Test	*M*	*SD*	*M*	*SD*	*t*	*p*	ESE	LL	UL
isiXhosa									
Supermarket items	9.86	3.67	11.33	0.58	1.03	.337	0.56	-1.94	4.89
Musical instruments	2.57	1.81	3.67	2.89	0.74	.478	0.46	-2.30	4.49
Classroom items	8.71	3.68	9.00	0.00	0.21	.844	0.11	-3.12	3.69
Parts of the body	14.57	2.37	14.00	0.00	-0.40	.697	0.34	-3.84	2.70
English									
Supermarket items	15.29	2.63	17.33	3.22	1.07	.318	0.69	-2.39	6.48
Musical instruments	8.57	1.51	8.67	1.53	0.09	.930	0.07	-2.32	2.51
Classroom items	14.14	2.41	12.67	1.53	-0.96	.364	0.73	-5.01	2.06
Parts of the body	18.43	2.37	19.67	3.22	0.69	.511	0.44	-2.91	5.39

Note. ESE = effect size estimate (Cohen's *d*); CI = confidence interval; LL = lower limit; UL = upper limit.

Discussion

The purpose of this pilot study was to compare performance (in isiXhosa and English, separately) of healthy young bilingual South Africans on four semantic fluency tests (supermarket items, musical instruments, classroom items, and parts of the body), and to thus gather data on which of those categories would be most appropriate for use in cognitive testing of individuals from that population. Results suggested that, on both isiXhosa and English administrations, participants performed best of the parts of the body category and next best on the supermarket items category. Hence, I chose those categories for use in the main study alongside three other commonly used categories that needed no further exploration (animals, fruits and vegetables, household items).

The between-category performance differences were consistent across languages. However, we can only speculate as to reasons why participants may have generated more words in, for instance, the parts of the body category than the musical instruments category. It might have been that stimuli provoking exploration of some categories (e.g., body parts) were more readily available in the test setting, or that participants might simply have had a larger pool of available words in some categories than others, perhaps due to differences in sociocultural exposure (Acevedo et al., 2000). Regardless of what these reasons are, it is of interest that some semantic fluency tests are 'easier' than others.

Of further interest is that, although most participants reported that isiXhosa was their dominant language, they (a) also reported that they had significantly better reading proficiency in English, and (b) generated significantly more words during the English administration than during the isiXhosa administration, regardless of which category cue was being employed. Although these data analyses are not central to the purpose of this pilot study, it is encouraging that they are consistent with those presented in several previously published studies in suggesting that healthy young adult bilinguals tend to perform better on semantic fluency tests administered in their language of secondary/tertiary education than in their other language, even if the latter is their home language (see, e.g., Blumenfeld et al., 2016; Salvatierra, Rosselli, Acevedo, & Duara, 2007; Yim & Bialystok, 2012).

Finally, another useful aspect of conducting the pilot study was that it allowed me to gauge the tolerance of participants to the measures and procedures I proposed to use in the main study and to make modifications, if necessary, to optimize the data collection process. One important piece of feedback received from the pilot study participants was that completion of the LEAP-Q was onerous if they were expected to complete Part B for all of the languages in which they reported fluency on Part A. Hence, because the current study focuses only on isiXhosa-English bilinguals, I decided to have participants complete Part B for those two languages only.

CHAPTER 5

MAIN STUDY - METHODS

Design and Setting

This study used a cross-sectional quasi-experimental within-groups design. All study procedures were administered in a private and quiet research laboratory within the UCT Department of Psychology.

Participants

Recruitment was via the UCT Department of Psychology's Student Research Participation Program (SRPP) and the Department of Student Affairs (DSA) research invitation email distribution list. Ninety student volunteers (73 recruited via SRPP and 17 recruited via DSA) responded positively to the study invitation. Individuals who met the following criteria were eligible to participate: (1) age between 18 and 25 years, (2) at least 12 years of completed education (i.e., graduated high school), (3) fluent in both English and isiXhosa, and (4) willing to give consent and to participate. Those who reported experiencing significant anxiety or depression, a history of traumatic brain injury, previous or current psychotic, endocrinological, or neurological disorder, cognitive impairment, or who were on medication for a chronic medical condition, were not eligible to participate. I set these criteria in place because the study's results are meant to be generalized to the population of healthy young adults, and because I did not want the results to be confounded by widely varying levels of education or by past or current medical, psychiatric, or neurological illness.

Consequently, 15 of the 90 initial respondents were excluded from participation: one was in the third trimester of a pregnancy, two had BDI-II scores > 30, four did not attend the second session and eight were not fluent in isiXhosa.[2] Hence, the final sample of participants who provided the data analysed in this study comprised 75 university students (17 men, 58 women).

Power analysis. I used G*Power software (Faul, Erdfelder, Buchner, & Lang, 2009) to conduct a post-hoc power analysis. Using parameters of analysis = two-tailed paired-samples t-test, $\alpha = .05$, N = 75, and estimated effect size (Cohen's *d*) = 1.18, the software calculated an achieved a power ($1 - \beta$) of 1.0.

Procedure and Measures

Individuals indicated their interest in the study and signed up for a participation slot via email correspondence with the research team. They were required to avail themselves for two test sessions separated by 1–4 days, depending on what was convenient for their schedules and whether their initial test session was on a Friday. 46 participants completed their test sessions on consecutive days; 8 completed them 2 days apart; 16 completed them 3 days apart; and 5 completed them 4 days apart ($M = 41.37 \pm 25.11$ hours).

Each participant was tested individually, the first session lasted 45–60 minutes while the second session lasted 10–15 minutes.

Day 1. Immediately after arriving at the laboratory, the participant completed informed consent procedures. Thereafter, I administered a sociodemographic and medical questionnaire, the adapted LEAP-Q, and depression and anxiety screening tools (BDI-II and BAI, respectively). These measures were identical to those used in the pilot study. I read the responses to the questionnaires as they were completed, and immediately excused those who did not meet the eligibility criteria.

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[2] I ascertained this lack of fluency from their adapted LEAP-Q data and/or from their performance on the semantic fluency tests, where they generated more words in isiZulu than in isiXhosa.

The participants who maintained eligibility were then administered four semantic verbal fluency tests, in this order: (1) an animals category test, (2) a fruit-and-vegetables category test, (3) a test that forced switching between the categories of supermarket items and parts of the body (i.e., participants were instructed to alternate between generating words from the first and second categories), and (4) a test that allowed free code switching (i.e., switching between English and isiXhosa) while generating items from the category of household items. For each of these tests, I recorded each word onto a scoring sheet and then calculated the number of correct words, repetitions (the repetition of a word said previously instead of generating a new word), intrusions (generating a word unrelated to the category, e.g., generating the word *coffee* on the animal fluency task), and other rule violations (e.g., for the animals fluency test, words generated in English when the instruction was to generate them in isiXhosa). The scoring sheet divided each 60-s time frame into four 15-s intervals so that pace of generation could also be captured.

Language of administration for fluency tests (1) – (3) were counterbalanced so that if the participant was instructed to generate words in English in Day 1 of testing then they were instructed to generate words in isiXhosa on Day 2, and vice-versa. Participants were not allowed to code switch during those three fluency tests; if they did, the switch was coded as a rule violation.

At the conclusion of these test procedures, I confirmed scheduling of the Day 2 appointment.

Day 2. After welcoming the participant back to the laboratory, I administered the first three semantic verbal fluency tests in the same order and in an identical manner (except for language of administration) as on Day 1. At the conclusion of these test procedures, I debriefed the participant was fully debriefed, thanked them for participating, and dismissed them from the study.

Ethical Considerations

Consent and confidentiality. Each potential participant read and signed an informed consent document (see Appendix E). That document explained what was measured in the study, how it was measured, what was expected of participants, that participation was completely voluntary, and that participants were allowed to withdraw at any time without incurring any penalties (e.g., losing course credit). To ensure anonymity of data, each participant was assigned a unique identifying code, with the key known only to me and held in a secure database. All identifying information relating to the participants was kept confidential and was accessible only to those involved directly in the study.

Risks and benefits. Participation did not place any individual at risk of experiencing any physical, psychological, or psychosocial distress. However, participants were informed that should they experience any such distress, they would be referred to the UCT Student Wellness Centre or to another appropriate healthcare centre. Participants recruited via SRPP received course credit in exchange for participation. Those recruited via DSA were entered into a raffle, with prizes of three mall gift vouchers worth ZAR750, ZAR500, and ZAR250.

Debriefing. Each participant received a comprehensive verbal debriefing at the end of the study. I also gave each participant a hard-copy debriefing document that explained the purpose of the study, confirmed how they would be compensated, and listed the steps that would be taken should any distress arise from participation (see Appendix F).

Data Management and Statistical Analyses

The analyses proceeded across four steps. First, I generated a complete set of descriptive statistics that allowed me to examine the normality of data distributions and to test the assumptions underlying subsequent inferential statistical analyses. Second, three paired-sample *t*-tests evaluated Hypothesis 1 (i.e., that on each of the first three semantic fluency tests, participants would perform better when asked to generate words in English than in isiXhosa). Third, two repeated-measures ANOVAs evaluated Hypothesis 2 (i.e., that, for each language of administration, participants would perform best when allowed to code switch freely and worst when forced to alternate categories).

CHAPTER 6

MAIN STUDY - RESULTS

Sample Characteristics

The final sample of 75 participants had a mean age of 19.27 years (*SD* = 1.38, range = 18–24) and had completed an average of 12.95 years of education (*SD* = 1.18, range = 12–17). Forty-seven participants reported isiXhosa as their dominant language while 28 reported English as their dominant language. Across the sample, participants reported fluency in an average of three languages (range = 2–5). All except four had acquired isiXhosa as their first language (isiZulu = 2; Sepedi = Afrikaans = 1).

Regarding educational language history, most participants (*n* = 52; 69.33%) reported having attended an English medium of instruction primary school. An even greater number (*n* = 62; 82.67%) reported having attended an English medium of instruction high school. At primary school level, the medium of instruction was isiXhosa for 13 participants (17.33%), isiXhosa and English for 8 participants (10.67%), Afrikaans for 1 participant (1.33%), and both Afrikaans and English for 1 participant (1.33%). At high school level, the medium of instruction was isiXhosa for 6 participants (8.00%), isiXhosa and English for 6 participants (8.00%), and both Afrikaans and English for 1 participant (1.33%).

Regarding self-reported language proficiency, the Adapted LEAP-Q data suggested that, on average and in terms of speaking and understanding isiXhosa and English, participants were balanced bilinguals (see Table 7). However, they self-reported that their reading proficiency in English was significantly stronger than that in isiXhosa. A further demonstration of the balanced bilingualism and relatively high language proficiency of this sample is that, if one considers an Adapted LEAP-Q score of ≥ 7 out of 10 as indicating a high level of language proficiency along a particular dimension, 3 participants (4% of the sample) did not meet that cut-off with regard to speaking isiXhosa; 3 (4%) did not meet it with regard to understanding isiXhosa; 18 (24%) did not meet it with regard to reading isiXhosa; 6 (8%) did not meet it with regard to speaking English; 2 (2.7%) did not meet it with regard to understanding English; and all participants met it with regard to reading English.

Table 7

Self-reported Language Proficiency: Adapted LEAP-Q data for the current sample (N = 75)

Proficiency variable	isiXhosa	English	*t*	*p*	ESE
Speaking	8.51 (1.21)	8.37 (1.12)	0.66	.510	0.12
Understanding	8.91 (1.19)	8.72 (1.06)	1.10	.274	0.17
Reading	7.81 (2.14)	9.09 (0.84)	-4.60	< .001***	0.79

Note. Data in the second and third columns are means, with standard deviations in parentheses. For all variables, possible scores range from 0–10. Adapted LEAP-Q = Language Experience and Proficiency Questionnaire, adapted for South African samples; ESE = effect size estimate (in this case, Cohen's *d*); CI = confidence interval; LL = lower limit; UL = upper limit.
$*p < .05$. $**p < .01$. $***p < .001$.

Regarding psychiatric status, the sample's mean BDI-II score was 12.20 (*SD* = 7.09 range = 0–31). This value lies in the range conventionally described as "mild mood disturbance" (Beck et al., 1996). Similarly, the mean BAI score was 10.89 (*SD* = 8.34, range = 0–30), a value conventionally described as being in the "low anxiety" range (Beck et al., 1988). Of the 75 participants, one reported being diagnosed with depression and previously being on anti-depressant medication for 4–6 months, while two reported having been diagnosed with anxiety and depression diagnosis but never having taken psychoactive medication. These participants were not excluded from the study because their BDI and BAI scores were within the acceptable limits.

Hypothesis 1

This hypothesis was confirmed. Analyses detected, for each semantic category separately, a significant performance difference when participants were administered the test in English than when they were administered the test in isiXhosa. In each case, participants generated significantly more words in English (see Table 8 and Figure 2). Of note is that the greatest performance difference was in the fruits-and-vegetables category, with participants generating almost double the words (80%) in English than in isiXhosa (a large effect size). The performance difference was smallest when participants were required to alternate between naming supermarket items and parts of the body (a moderate effect size).

Of further note is that participants made relatively few errors (repetitions, intrusions, words from another language) when completing the set of semantic fluency tests (see Table 9). These errors tended to be distributed quite evenly across the English-administered and isiXhosa-administered tests, with two stark exceptions. First, on the animals and fruits-and-vegetables category tests, participants tended to repeat exemplars more often on the English administration than on the isiXhosa administration (perhaps because, as noted above, they were able to simply generate more words during the English administration). Second, on the fruits-and-vegetables category test and the forced-switching condition, participants generated many words from an incorrect language during the isiXhosa administration, but made few such errors during the English administration. This contrast is explained by the fact that, during the isiXhosa administration, participants tended to generate English (and sometimes isiZulu) words when their initial pool of isiXhosa exemplars ran dry.

Hypothesis 2

For data collected from the English administration, analyses detected a significant between-test performance difference, $F(3, 222) = 4.37$, $p = .005$, $\eta_p^2 = .06$. A series of follow-up planned contrasts indicated that the location of pairwise differences did not confirm the hypothesis. Instead, participants performed significantly better on the animals category test than on the (a) fruits-and-vegetables category test, $t(74) = 3.07$, $p = .003$, Cohen's $d = 0.35$, (b) forced-switching test, $t(74) = 2.25$, $p = .027$, $d = 0.26$, and (c) free-switching test, $t(74) = 3.25$, $p = .002$, $d = 0.36$. All other paired-sample *t*-tests were non-significant, ts < 0.99, ps $> .33$.

For data collected from the isiXhosa administration, analyses detected a significant between-test performance difference, $F(3, 222) = 80.46$, $p < .001$, $\eta_p^2 = .52$. However, a series of follow-up planned contrasts indicated that the location of pairwise differences partially confirmed the hypothesis. As predicted, participants performed significantly better on the free-switching test than on the (a) animals category test, $t(74) = 8.14$, $p < .001$, $d = 1.09$, (b) fruits-and-vegetables category test, $t(74) = 13.36$, $p < .001$, $d = 1.92$, and (c) the forced-switching test, $t(74) = 4.82$, $p < .001$, $d = 0.57$. However, in contrast to the a priori prediction, participants performed significantly better on the forced-switching test than on the (a) animals category test, $t(74) = 4.21$, $p < .001$, $d = 0.51$, and (b) fruits-and-vegetables category test, $t(74) = 11.80$, $p < .001$, $d = 1.32$.

Table 8

Across-Language Differences: Performance on three semantic fluency tests (N = 75)

	Language of test administration								
	isiXhosa			English					
Semantic category	*M*	*SD*	Range	*M*	*SD*	Range	*t*	*p*	ESE
Animals	12.35	3.77	6-21	18.47	5.06	10-38	10.32	< .001***	1.37
Fruits and vegetables	9.43	3.26	3-19	16.97	3.37	10-24	14.22	< .001***	2.27
Forced switching: Supermarket items / Parts of the body	14.35	4.13	4-26	17.23	4.40	9-30	9.49	< .001***	0.67

	M	*SD*	Range	----	----	----
Free switching: Household items	16.77	4.30	8-27	----	----	----

Note. ESE = effect size estimate (Cohen's *d*).

**p* < .05. ***p* < .01. ****p* < .001.

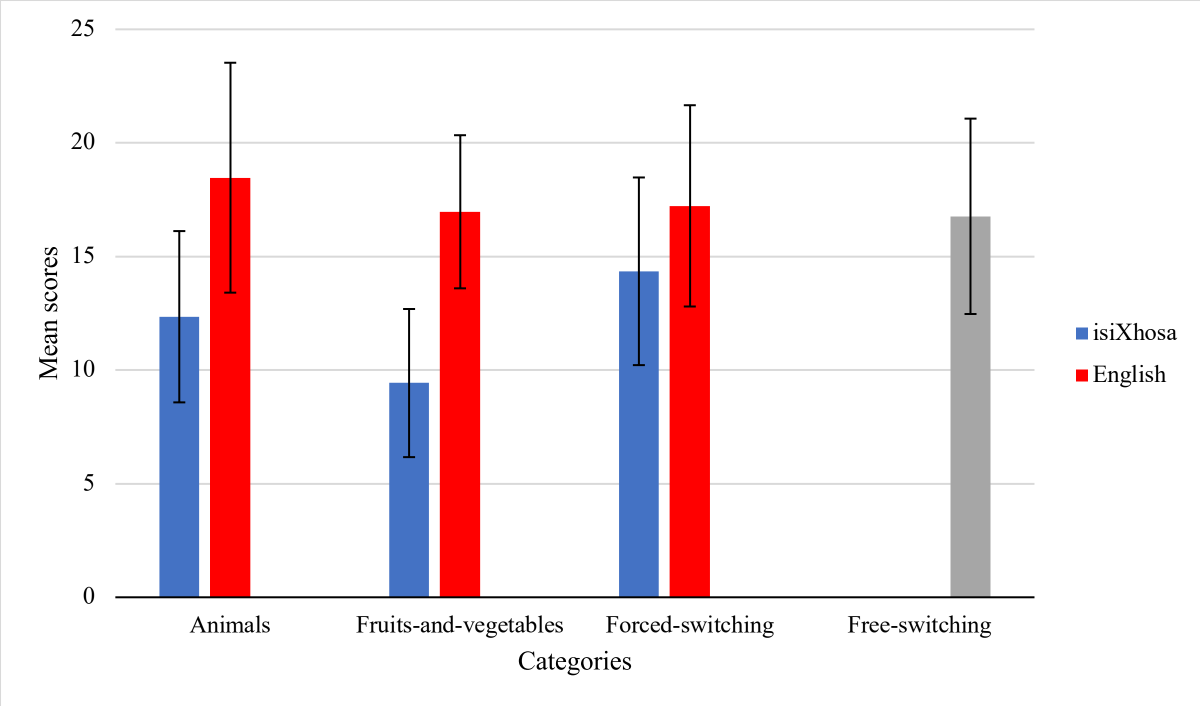

Figure 2. Performance by the current sample on the set of semantic fluency tests (*N* = 75). Error bars indicate standard error of the mean.

Table 9

Total Number of Errors Committed during Administration of the Semantic Fluency Tests (N = 75)

	Language of administration	
Semantic category / Type of error	isiXhosa	English
Animals		
Repetitions	20	48
Intrusions	3	10
Words in another language	3	3
Fruits and vegetables		
Repetitions	17	40
Intrusions	4	8
Words in another language	52	0
Forced switching		
Repetitions	12	14
Intrusions	0	4
Words in another language	31	3
Free switching		
Repetitions	25	
Intrusions	7	

Secondary Analyses

These analyses sought to confirm that sociodemographic variables (specifically, age, education, sex, and language profile) had no significant influence on semantic fluency performance in the current sample.

Analyses detected no significant association between participant age, or participant years of completed education, and semantic fluency performance (see Table 10). There were, however, several significant correlations between self-reported language proficiency and semantic fluency performance. As the Table shows, all of those correlations except two (that between isiXhosa speaking proficiency and number of fruits and vegetables generated during the English administration, and that between English understanding proficiency and number of fruits and vegetables generated during the isiXhosa administration) were in the expected direction (i.e., they suggested that greater proficiency in a language was associated with better performance when the test was administered in that language).

Table 10

Correlation Matrix: Associations between semantic fluency performance and participant age and education (N = 75)

	Semantic fluency test						
	Language of test administration						
	isiXhosa			English			
Sociodemographic variable	C1	C2	ForSw	C1	C2	ForSw	FreSw
Age	.18	.07	.10	.04	.11	.02	.05
	(.134)	(.564)	(.394)	(.733)	(.35)	(.84)	(.648)
Education	.14	.02	.01	-.10	.02	-.08	-.01
	(.239)	(.865)	(.955)	(.418)	(.842)	(.508)	(.912)
Adapted LEAP-Q							
isiXhosa proficiency							
Speaking	.01	**.25**	.14	-.20	**-.25**	-.06	-.07
	(.863)	**(.029*)**	(.231)	(.079)	**(.029*)**	(.627)	(.545)
Understanding	**.23**	.140	.166	-.05	-.11	.08	.12
	(.043*)	(.232)	(.153)	(.691)	(.368)	(.488)	(.326)
Reading	**.28**	**.25**	.043	-.182	-.087	-.076	-.091
	(.017*)	**(.031*)**	(.716)	(.118)	(.457)	(.519)	(.435)
English proficiency							
Speaking	-.10	-.17	.06	**.34**	.12	.19	.19
	(.418)	(.137)	(.632)	**(.003**)**	(.303)	(.104)	(.106)
Understanding	-.094	**-.27**	-.03	**.26**	.12	.10	.13
	(.423)	**(.021*)**	(.778)	**(.022*)**	(.309)	(.379)	(.284)
Reading	.02	-.19	.08	**.29**	.11	.17	.11
	(.868)	(.107)	(.495)	**(.013*)**	(.344)	(.148)	(.345)

Note. Data presented are Pearson correlation coefficients (*r*), with *p*-values in parentheses. C1 = Category 1, animals; C2 = Category 2, fruits and vegetables; ForSw = forced switching between categories of supermarket items and parts of the body; FreSw = free code switching within the category of household items. Statistically significant associations are marked in boldface font.

*$p < .05$. **$p < .01$. ***$p < .001$.

Analyses detected no significant between-sex differences except on the isiXhosa administration of the animals category test (see Table 11). Regarding self-reported dominant language, analyses detected no significant between-group differences (see Table 12).

Table 11

Independent-samples t-test: Between-sex differences in semantic fluency performance (N = 75)

Administration Language / Category Test	Participant Sex								
	Women (n = 58)		Men (n = 17)					95% CI	
	M	*SD*	*M*	*SD*	t^a	*p*	ESE	LL	UL
isiXhosa									
Animals	11.88	3.99	13.94	2.30	-2.69	.010*	0.63	-3.60	-0.520
Fruits and Vegetables	9.47	3.52	9.29	2.23	0.24	.811	0.06	-1.26	1.61
Forced switching: Supermarket items / Parts of the body	14.41	4.11	14.12	4.31	0.25	.803	0.07	-2.13	2.72
English									
Animals	18.29	5.17	19.06	4.79	-0.57	.574	0.15	-3.52	1.99
Fruits and Vegetables	17.14	3.45	16.41	3.10	0.83	.415	0.22	-1.07	2.52
Forced switching: Supermarket items / Parts of the body	17.41	4.56	16.59	4.00	0.72	.475	0.19	-1.51	3.16
Free switching: Household items	16.66	4.42	17.18	3.96	-0.47	.646	0.12	-2.82	1.77

Note. ESE = effect size estimate (Cohen's *d*); CI = confidence interval; LL = lower limit; UL = upper limit. [a]Estimated using the value with equal variances not assumed in light of the disparity in sample sizes.

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

$p < .01$. $^{***}p < .001$.

Table 12

Independent-samples t-test: Differences in semantic fluency performance by self-reported dominant language (N = 75)

	Dominant Language								
	isiXhosa (n = 47)		English (n = 28)					95% CI	
Administration Language / Category Test	*M*	*SD*	*M*	*SD*	t^a	*p*	ESE	LL	UL
isiXhosa									
Animals	12.81	3.85	11.57	3.54	1.42	.162	0.34	-0.51	2.30
Fruits and Vegetables	9.83	3.25	8.75	3.20	1.40	.166	0.33	-0.46	2.62
Forced switching: Supermarket items / Parts of the body	14.66	4.05	13.82	4.30	0.84	.407	0.20	-1.17	2.85
English									
Animals	18.47	4.74	18.46	5.66	0.003	.998	0.001	-2.56	2.56
Fruits and Vegetables	16.85	3.11	17.18	3.81	-0.39	.702	0.09	-2.04	1.38
Forced switching: Supermarket items / Parts of the body	17.53	4.55	16.71	4.24	0.79	.435	0.19	-1.26	2.90
Free switching: Household items	17.26	4.44	15.96	4.01	1.30	.200	0.31	-0.70	3.28

Note. CI = confidence interval; LL = lower limit; UL = upper limit; ESE = effect size estimate (Cohen's *d*). [a]Estimated using the value with equal variances not assumed in light of the sample-size disparity.

$*p < .05$. $**p < .01$. $***p < .001$.

CHAPTER 7

GENERAL DISCUSSION

Semantic fluency tests are a standard component of neuropsychological test batteries because they allow efficient assessment of multiple cognitive domains (e.g., language and executive functioning) and can detect impairment related to neuropsychiatric and neurodegenerative conditions (Binney et al., 2018; Braaten et al., 2006; Iudicello et al., 2007; Millikin, Trepanier, & Rourke, 2004; Vaughan et al., 2016). However, performance on these tests is susceptible to influence by non-organic factors that vary across individuals (e.g., sex, educational attainment). This thesis was particularly interested in examining the influence that language (broadly speaking, the test-taker's home language, medium of scholastic instruction, and status as being multilingual or not, as well as the language of test administration) has on semantic fluency test performance.

South Africa is a linguistically diverse nation. The government recognizes 11 official languages, and the frequency with which each is spoken varies regionally (Statistics South Africa, 2012). Many children are already multilingual by the time they begin school; either way, lessons teaching a second (and sometimes a third) language begin in the first grade (Hornberger & Vaish, 2009; Posel & Zeller, 2016). Hence, most citizens of the country are multilingual, and it is imperative for clinical psychologists, industrial and organizational psychologists, neuropsychologists, educational psychologists, and others who administer cognitive assessments to understand the influence of language (defined as in the paragraph above) on test performance. A large body of literature, containing studies conducted in many different countries, confirms that language of test administration is an important influence on test performance when that language is not the same as the test-taker's home language or as their primary language of educational instruction (Ardila et al., 2017; Carstairs et al., 2006; Gasquoine, Croyle, Cavazos-Gonzalez, & Sandoval, 2007b; Kwinana & Methola, 2017;

Lyness et al., 2006). Moreover, monolingual individuals tend to perform better than bilinguals on certain cognitive tests (e.g., those assessing semantic fluency), whereas the opposite trend is true for other tests (e.g., those assessing phonemic fluency; Bialystok et al., 2008b; Luo et al., 2010; Rosselli et al., 2000).

In South African clinical practice, test administrators usually enquire of the test-taker what their language of preference is, and then administer the standard elements of test batteries monolingually, in that language (if the tests are available in that language, of course). This practice is similar in many other countries. Only relatively infrequently do clinicians include actual proficiency measures in their batteries and then use those results to determine the language of test administration for each individual test-taker.

The current study adds to the relatively small literature examining the influence of language variables on the cognitive test performance of multilingual African individuals. I focused on verbal semantic fluency tests performance because they are used more commonly than phonemic fluency tests; whereas administration of the latter differs substantially depending on which language group is being assessed, administration of the former can be identical regardless of which language group is being assessed (i.e., one can use the same categories for all different test-takers). However, semantic fluency tests are more susceptible to cross-linguistic interference (Portocarrero et al., 2007; Rosselli et al., 2000). The cross-sectional quasi-experimental design allowed examination of semantic fluency performance, across four different test conditions, among young university students fluent in both isiXhosa and English. Unlike many other studies in this literature, including one from our own laboratory (Carstairs et al., 2006; Cockcroft et al., 2015; Kwinana & Methola, 2017; Scott et al., 2018), the participants were balanced bilinguals who were administered the test procedures in both isiXhosa and English, thus allowing direct within-group comparison of how language of test administration affects semantic fluency test performance. Another novel element of this study was that I took detailed self-reported measures of proficiency in each of the test languages.

The study's first hypothesis was that participants will generate more words when administered the animals and the fruit-and-vegetables category tests in English than in isiXhosa. I made this prediction because it is likely that most participants will have received much of their formal secondary education, and all of their tertiary education, in English (Posel & Zeller, 2016). Hence, they are likely to have a larger pool of English words upon which to draw. Furthermore, it is likely that the English language contains more words describing animals, and fruits and vegetables, than isiXhosa. This hypothesis was confirmed: On average, and for all of the animals, fruits and vegetables, and forced-switching (supermarket items and parts of the body, alternating) conditions, participants generated more words when tested in English than when tested in isiXhosa. This result is consistent with that reported by, for instance, Blumenfeld et al. (2016) who found that their sample of English-Spanish bilinguals performed better in the former than the latter language. Of interest in comparing the results of that study to this one is that, in the Blumenfeld et al. study, all participants reported English as being their dominant language whereas more than 60% of the participants in the current study reported isiXhosa as being their dominant language. However, all of the current participants were students at an English-medium university, almost 90% of them had completed their high school education at an English-medium school, and they self-reported greater proficiency in reading English than in reading isiXhosa. Given this background, it is reasonable to speculate that these participants would have had a greater vocabulary size in English than in isiXhosa, particularly with regard to formal concepts. Consistent with this interpretation is the fact that 84% of the participants (n = 63) reported at the end of the test session that, generally, they preferred their testing to be conducted in English.

The study's second hypothesis was that, for each language of administration, participants would perform best when allowed to code switch freely and worst when forced to alternate categories. I made this prediction because forced switching is more demanding and has a larger cognitive cost than free switching (de Bruin, Samuel, & Duñabeitia, 2018; Jevtović, Duñabeitia, & de Bruin, 2019). Analyses of data from the English test administration did not confirm this hypothesis: There were no significant performance differences under free-switching versus forced-switching conditions. This result stands in contrast to the prediction that participants would generate fewer words under forced-switching conditions than under free-switching conditions because the latter requires greater cognitive control. In particular, inhibitory control mechanisms must be employed effectively in order to suppress exemplars from one category while generating exemplars from the other category (Jevtović et al., 2019). However, the current observations do not necessarily require one to discard cognitive control theory. These results might simply have arisen because this sample of participants had a smaller vocabulary size in the free-switching category (household items) than they had in both the categories of the forced-switching condition (supermarket items / parts of the body). If this was the case, performance across the two conditions would be comparable even if the forced-switching condition was more cognitively demanding. Future studies might attempt to explore this line of investigation further, perhaps by using between-subjects designs to compare performance across the two conditions.

Of minor interest within the set of analyses relating to the English administration is that participants generated significantly more words under a single-language condition (i.e., for the animals category) than under both free-switching (household items category) and forced-switching (supermarket items and parts of the body categories) conditions. This result is similar to that reported by Woumans et al. (2015), although their study was a between-groups design comparing monolinguals (all of whom were administered the single-language task in French) to balanced and unbalanced bilinguals (all of whom were administered the forced-switching task in Dutch and French). Additionally, their participants were all administered the same three categories (animals, vegetables, and professions). Hence, they avoided the confound that muddies interpretation of the current result: In this study's sample, participants may have been drawing from a relatively large pool of English animal names and relatively smaller pools of exemplars from the other categories.

Analyses of data from the isiXhosa administration partially confirmed Hypothesis 2. As predicted, participants performed significantly better on the free-switching test than on the forced-switching test. This finding is consistent with theories regarding the relative cognitive cost of performing under the former condition versus the latter (de Bruin et al., 2018; Gollan, Kleinman, & Wierenga, 2014). It is also with prior observations within this study that participants tended to be more fluent in English than in isiXhosa (see results related to Hypothesis 1). A finer-grained analysis of performance on the free-switching tasks indicated that participants generated significantly more words in English (M = 12.47±6.06) than in isiXhosa (M = 4.15±4.19), $t(74) = 7.66$, $p < .001$. Hence, it appears that under free-switching conditions they could simply draw on their relatively larger English vocabulary to generate words, whereas under forced-switching conditions they were limited to drawing from their relatively smaller isiXhosa vocabulary.

Of minor interest within the set of analyses relating to the isiXhosa administration is that, in contrast to the English administration, participants generated significantly more words under the forced-switching condition (supermarket items and parts of the body categories) than under both the single-language conditions (animals and fruits-and-vegetables categories). This finding is inconsistent with predictions derived from theories regarding the cognitive costs associated with forced switching (Gollan & Ferreira, 2009; Meuter & Allport, 1999) and stands in contrast to previous findings in this literature (see, e.g., Gollan, Montoya,

& Werner, 2002; Yim & Bialystok, 2012). For instance, Bethlehem et al. (2003) found no statistically significant difference when comparing the free-switching versus single-language semantic fluency performance of Zulu-English bilinguals. However, that study's results are likely confounded by the fact that participants were administered the same animals category task under all three conditions (Zulu-English free switching, Zulu-only, English-only). One way to account for the current results is that participants, because of their educational and language backgrounds, likely learned the names of animals, fruits, and vegetables in English rather than isiXhosa (i.e., they likely learned those names in school rather than at home). Hence, the cognitive costs associated with switching categories are balanced by the costs associated with being forced to generate words in what is, effectively, one's second language.

Secondary analyses of the data focused on the influence sociodemographic variables (age, education, sex, self-reported dominant language, and self-reported proficiency in isiXhosa and English) had on test performance. Regarding participant age and education, these analyses detected no significant effects on semantic fluency test performance. These results stand in contrast to those from many previously published studies suggesting that younger age and higher levels of education are associated with better performance (Brickman et al., 2005; Esteves et al., 2015; Troyer, 2000; Zarino et al., 2014). It is likely that the current pattern of non-significant findings arose because the range of both age (18–24 years) and education (all high school graduates with at least a partial year of university education; 12–17 years) was relatively restricted in the current sample. In contrast, Zimmermann et al. (2014) detected significant age-related performance differences in a study design that compared younger adults (19–39 years) to middle-aged (40–59) and older adults (60–75). Similarly, Crossley et al. (1997) detected significant education-related performance differences in a study design that compared those with relatively low levels of academic achievement (0–6) to those with relatively high levels (13+).

Regarding participant sex, analyses detected no significant effects on semantic fluency test performance with one exception (men performed better on the isiXhosa administration of the animals category test). Previous literature on sex differences in performance on this type of cognitive assessment is mixed. Some studies (Acevedo et al., 2000; Bolla, Gray, Resnick, Galante, & Kawas, 1998) report that women tend to generate more words than men, whereas others (Brucki & Rocha, 2004; Hurks et al., 2006; Munro et al., 2012) report that men and women tend to generate relatively equal numbers of words. One possible reason why sex differences are observed inconsistently is that there is an age x gender interaction effect on semantic fluency performance, so that performance differences are observed in older but not younger adults. This interaction is sometimes attributed to sexual dimorphism across the lifespan (Munro et al., 2012). Hence, studies like this one, where the sample has a small range of age and education, are unlikely to observe sex differences in semantic fluency performance.

Regarding self-reported dominant language, analyses detected no significant influence on semantic fluency test performance (i.e., there were no statistically significant between-group [self-reported isiXhosa dominant versus self-reported English dominant] differences on any of the category tests, regardless of the language of test administration). This pattern of performance is reflective of the notion that the current sample of participants consisted of balanced bilinguals.

Further evidence supporting this notion emerges from the Adapted LEAP-Q data. Self-reports on that instrument suggested that, on average, participants regarded themselves as being equally proficient in terms of speaking and understanding isiXhosa and English. In each case, the mean score was more than 8/10, indicating that they regarded themselves as highly capable in both languages. In terms of reading, however, they regarded themselves as being much stronger in English (an average score exceeding 9/10) than in isiXhosa (an average score not reaching 8/10). This significant difference likely arises from the fact that they are students at an English-medium university and are young adults in a country where most books, magazines, and newspapers are published in English.

Some background as to why the publishing condition exists is warranted here. During the apartheid era, all South Africans received their primary education in either English or Afrikaans; indigenous languages such as isiXhosa were spoken outside of the school/work environment (Prah, 2007). Consequently, individuals were not formally taught to read or write in indigenous languages until relatively recently (post-1994, and the new democratic dispensation). Even after this curriculum change, however, indigenous languages are still only included as additional (i.e., not required) school subjects. Furthermore, there is a relative paucity of literature written in indigenous languages, making them largely oral.

Taking all of these factors into account, it is clear why most South Africans are likely to be far more fluent in the reading of English than they are in any indigenous language, even if the latter is their home language. The current Adapted LEAP-Q data are consistent with that likelihood. New assessment tools (or normative data for existing tools) designed for bilingual or multilingual individuals must take into account these relative deficits in the reading and writing fluency of indigenous languages.

Unsurprisingly, analyses detected a relatively consistent pattern of significant positive associations between (a) self-reported isiXhosa proficiency and performance on isiXhosa-administered animals and fruits-and-vegetables category tests, and (b) self-reported English proficiency and performance on the English-administered animals category test. Although other expected associations (e.g., between self-reported English proficiency and performance on the other English-administered category tests) did not cross the threshold for statistical significance, they were in the expected direction. A larger sample size may have amplified those effects.

Of minor interest among these correlational analyses was that there appeared to be a significant suppressing effect of other-language proficiency on some semantic fluency tests. Specifically, greater self-reported proficiency in speaking isiXhosa was associated with poorer performance on the English-administered fruits-and vegetables category test, and greater self-reported proficiency in understanding English was associated with poorer performance on the isiXhosa-administered fruits-and vegetables category test. This suppressing effect was not found consistently, however, and is not reported elsewhere in the literature. Hence, although it is possible that these are spurious correlations, the general pattern of data is that greater self-reported proficiency in one language was negatively associated with test performance in the other language (see Table 9). This trend in the data is worth exploring in future studies as it might be a marker of cognitive costs associated with balanced bilingualism.

Limitations and Directions for Future Research

Any conclusions or inferences one might draw from the current findings must be tempered by consideration of the following limitations. First, although self-reports on the adapted LEAP-Q suggest that participants in the current sample were balanced bilinguals, I did not take objective measures of language proficiency. Stronger conclusions would be warranted if one could state with more certainty that participants were balanced bilinguals (e.g., by following methods described in Scaltritti, Peressotti, and Miozzo (2017) and administering sentence translation [understanding proficiency], word-picture matching task and spontaneous speech [speaking proficiency]; (see also Rosselli, Ardila, Lalwani, & Vélez-Uribe, 2016; Tao, Taft, & Gollan, 2015). Relatedly, despite research arguing that the total number of languages in which participants report knowledge affects cognitive test performance (Kavé, Eyal, Shorek, & Cohen-Mansfield, 2008), the current study focused only on proficiency in English and isiXhosa despite the fact that 47 participants reported having at least some knowledge in at least one other additional language. Hence, future research in this area should account for the influence of total number of languages known, and proficiency in each, on semantic fluency test performance.

Second, variation in the geographic location in which participants received both their initial exposure and the majority of their exposure to isiXhosa may have influenced the results. Almost all of the participants were from either the Eastern Cape or the Western Cape province of South Africa. Typically, individuals from these two regions learn slightly different versions of isiXhosa. Those from the Eastern Cape tend to learn a more traditional and rural version, whereas those from the Western Cape tend to be exposed to a more English-influenced, contemporary, and urban version. An example of how this difference may have been reflected in the current study is that, during the isiXhosa-administered fruits-and-vegetables category test, some participants used the traditional word for grapes (*uMdiliya*) whereas others used the borrowed word *iGrapes*. Unfortunately, I did not collect detailed enough information on where the participant's initial exposure to isiXhosa was and where they would consider most of their isiXhosa learning to have taken place (large numbers of families migrate from the Eastern Cape to the Western Cape, and so being born in the Eastern Cape is not necessarily a guarantee of learning the more traditional version of the language). Future research on languages with such regional variations should certainly consider this factor more intensively.

Third, participation in the current study was restricted to university students aged between 18 and 25 years and fluent in isiXhosa and English. I put those age and education criteria in place to ensure that I was studying individuals with the optimal potential for unconfounded performance – Tombaugh et al. (1999) found, in their large normative study, that the best verbal fluency scores were delivered by individuals aged 16–49 years with 12–21 years of education. I put the language criterion in place because isiXhosa and English are two of the three most widely spoken languages in the Western Cape province of South Africa, and I was interested in contributing directly to local clinical and research efforts. However, South Africa has 11 official languages and only 16% of the population speaks isiXhosa (Statistics South Africa, 2012). Hence, future studies attempting to replicate the current results could ensure better generalizability by loosening the eligibility criteria related to age, education, and language. Moreover, comparisons of older and younger South African adults would be of interest because of stark cohort differences in educational and social media experiences. Similarly, comparisons of other regionally dominant languages (e.g., isiZulu versus English in KwaZulu-Natal) would be of interest because one might predict similar patterns of performance as detected here.

Fourth, the current study had only a limited scope of investigation with regard to code switching. Although this behaviour is studied extensively in psycholinguistics and cognitive psychology, among other sub-disciplines, it is not a regular focus of attention in neuropsychological research. Future studies might build on the current research and that of Yim and Bialystok (2012) in investigating, for instance, the influence of the test administrator's bilingualism and use/non-use of both languages during administration on the test-taker's code-switching.

In terms of an overall direction for future research in this area, there is no doubt that the creation of locally appropriate South African normative data for commonly used neuropsychological tests would take years because it is important that these norms reflect the linguistic (and other) diversity of the population. Regarding that linguistic diversity, the complication is not only that the country has 11 official languages, with dialects varying by geographic locations, or that most, if not all, citizens are at least partially bilingual. Rather, an additional complication is that several indigenous languages in South Africa share a common ancestry (e.g., Nguni languages: isiXhosa, isiZulu, Ndebele, siSwati) and therefore, to some extent, a shared vocabulary (Mafela, 2010). Hence, studies comparing these might produce different results to the usual comparison of an indigenous language to English.

Summary and Conclusion

The overarching aim of the current study was to investigate, in a sample of healthy isiXhosa-English bilingual university students, the influence of language factors on semantic fluency test performance. The major results were that (a) participants performed better when the language of test administration was English than when it was isiXhosa, and (b) participants performed better on a free code-switching test than a forced category-switching test when the language of administration was isiXhosa, but not when it was English. These results are consistent with those presented in previously published studies in this literature, and also partially confirm theories regarding cognitive costs incurred by different rules governing semantic category retrieval processes. Perhaps more importantly from a clinical perspective is that the results highlight the effects that language of test administration has on cognitive test performance, even when the test-taker is a balanced bilingual (as the average participant in this study was).

Overall, then, this study complements a growing neuropsychological literature that emphasizes cultural and linguistic fairness in test administration (see, e.g., Fernández & Abe, 2018; Siebert, 2018; Zieff, 2017). This study, and others in that canon, make it clear that individuals should be tested in the language(s) that will allow them to demonstrate their breadth of knowledge and their optimal cognitive capacities, and not simply in the language that they prefer to be tested in. At the very least, this means that language of test administration should be determined after gathering both objective and subjective data on proficiency in each of the test-taker's languages. Finally, and perhaps more prosaically, the data presented here can be used to drive the creation of preliminary South African normative data for semantic fluency tests.

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APPENDIX A

Sociodemographic and Medical Questionnaire

Sociodemographic and Medical Questionnaire
ACSENT Laboratory
University of Cape Town

Participant ID:

1. Demographics

Age: ________ Sex: ____________ Race: __________

2. Education

2.1.1. What degree are you registered for?

☐ Bachelors degree (BA, BCom, BSocSc, etc.)

☐ Honours degree

☐ Masters degree (MA, MSocSc, etc.)

☐ PhD

☐ Other, please specify: ______________________________

2.1.2 What are your majors? ____________________________

2.1.3. What year of your degree programme are you registered for?

2.3. These questions pertain to your primary school:

2.4.1 Was it in a rural or urban setting? ____________________

2.4.2 What was the name of the school? ____________________

2.4.3 Was it a public or a private school? ___________________

2.4.4 What was the language of instruction? ________________

2.5 These questions pertain to your high school:

2.5.1 Was it in a rural or urban setting? _____________________

2.5.2 What was the name of the school? ____________________

2.5.3 Was it a public or a private school? ___________________

2.5.4 What was the language of instruction? ________________

3. General Information

3.1 What area did you live in while growing up? ____________

3.2. Parents occupation:

3.2.1. Mother: _________________

3.2.2. Father: __________________

3.3. Have you ever been or are you currently diagnosed with a psychological, psychiatric, neurological or learning disorder? If yes, please specify: __________________

3.3. Have you ever been unconscious for more than 15 minutes or had a brain injury? _______________________________

3.3 Are you currently taking any psychiatric/chronic medications? If yes, please specify: ______________________

APPENDIX B

Adapted Language Experience and Proficiency Questionnaire (LEAP-Q) – Part A and B

Adapted Language Experience and Proficiency Questionnaire (LEAP-Q) Part A

Participant ID:

1. Please list all the languages you know **in order of how strongly they form a part of you**:
   1. _________ 2. _________ 3. _________ 4. _________ 5. _________

2. Please list all the languages you know **in the order in which you learnt them** (your native language first):
   1._________ 2. _________ 3. _________ 4._________ 5._________

3. Please list what percentage of the time you are **currently** and **on average** exposed to each language (*Your percentages should add up to 100%):*

Language:					
Percentage:					

4. When choosing to read a text available in all your languages, in what percentage of cases would you choose to read it in each of your languages? Assume the original was written in another language, which is unknown to you (*Your percentages should add up to 100%):*

Language:					
Percentage:					

5. When choosing to speak with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report the percentage of total time (*Your percentages should add up to 100%):*

Language:					
Percentage:					

6. Please name the cultures with which you identify. On a scale **from zero to ten**, please rate the extent to which you identify with each culture. (Examples of possible cultures are *Black, South African, Christian, etc.):*

Culture:					
Rank:					

Based on: Marian, Blumenfeld, & Kaushanskaya (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech, Language, and Hearing Research, 50*(4), 940-96.

Adapted Language Experience and Proficiency Questionnaire (LEAP-Q)
Part B (to be filled in separately for each language)

Participant ID:	Language:

1. Age when you… …this language.

began acquiring	became fluent in	began reading in	became fluent reading in

2. Please list the number of years and months you spent in each language environment.

	years	months
A province where this language is spoken:		
A family where this language is spoken:		
A school/workplace where this language is spoken:		

3. On a scale from 0 to 10, please select your level of **proficiency** in speaking, understanding, and reading this language *(circle the appropriate number):*

	None					*Adequate*				*Perfect*	
Speaking:	0	1	2	3	4	5	6	7	8	9	10
Understanding:	0	1	2	3	4	5	6	7	8	9	10
Reading:	0	1	2	3	4	5	6	7	8	9	10

4. On a scale from 0 to 10, please select how much the following factors contributed to you learning this language (*circle the appropriate number):*

Not a contributor *Moderate* *Most important*

Interacting with friends:

0 1 2 3 4 5 6 7 8 9 10

Interacting with family:

0 1 2 3 4 5 6 7 8 9 10

Reading:

0 1 2 3 4 5 6 7 8 9 10

Language tapes/self-instruction:

0 1 2 3 4 5 6 7 8 9 10

Watching TV:

0 1 2 3 4 5 6 7 8 9 10

Listening to the radio:

0 1 2 3 4 5 6 7 8 9 10

Direct teaching in the classroom:

0 1 2 3 4 5 6 7 8 9 10

5. Please rate to what extent you are currently exposed to this language in the following contexts:

Never *Half of the time* *Always*

Interacting with friends:
0 1 2 3 4 5 6 7 8 9 10

Interacting with family:
0 1 2 3 4 5 6 7 8 9 10

Watching TV:
0 1 2 3 4 5 6 7 8 9 10

Listening to radio/music:
0 1 2 3 4 5 6 7 8 9 10

Reading:
0 1 2 3 4 5 6 7 8 9 10

Language-lab/self-instruction:
0 1 2 3 4 5 6 7 8 9 10

6. In your perception, how much of a foreign accent do you have in this language:

None *Moderate* *Pervasive*

0 1 2 3 4 5 6 7 8 9 10

7. Please rate how frequently others identify you as a non-native speaker *based on your accent* in this language:

Never *Half of the time* *Always*

0 1 2 3 4 5 6 7 8 9 10

Based on: Marian, Blumenfeld, & Kaushanskaya (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech, Language, and Hearing Research, 50*(4), 940-967.

Participant ID: Language:

1. Age when you began acquiring this language: __________
2. On a scale from 0 to 10, please select your level of **proficiency** in speaking, understanding, and reading this language *(circle the appropriate number):*

	None					*Adequate*			*Perfect*		
Speaking:	0	1	2	3	4	5	6	7	8	9	10
Understanding:	0	1	2	3	4	5	6	7	8	9	10
Reading:	0	1	2	3	4	5	6	7	8	9	10

Language:

1. Age when you began acquiring this language: __________
2. On a scale from 0 to 10, please select your level of **proficiency** in speaking, understanding, and reading this language *(circle the appropriate number):*

	None					*Adequate*			*Perfect*		
Speaking:	0	1	2	3	4	5	6	7	8	9	10
Understanding:	0	1	2	3	4	5	6	7	8	9	10
Reading:	0	1	2	3	4	5	6	7	8	9	10

Language:

1. Age when you began acquiring this language: __________
2. On a scale from 0 to 10, please select your level of **proficiency** in speaking, understanding, and reading this language *(circle the appropriate number):*

	None					*Adequate*			*Perfect*		
Speaking:	0	1	2	3	4	5	6	7	8	9	10
Understanding:	0	1	2	3	4	5	6	7	8	9	10
Reading:	0	1	2	3	4	5	6	7	8	9	10

APPENDIX C

Beck Depression Inventory-Second Revision (BDI-II)

BDI-II®

Date:

Name: ________________________ Marital Status: ________ Age: ______ Sex: _____

Occupation: ________________________ Education: ________________________

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness

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

2. Pessimism

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

3. Past Failure

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

4. Loss of Pleasure

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

5. Guilty Feelings

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

6. Punishment Feelings

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike

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

8. Self-Criticalness

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

9. Suicidal Thoughts or Wishes

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

10. Crying

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

_____ Subtotal Page 1

Continued on Back

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11. Agitation

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

12. Loss of Interest

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

13. Indecisiveness

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

14. Worthlessness

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

15. Loss of Energy

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

16. Changes in Sleeping Pattern

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

17. Irritability

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

18. Changes in Appetite

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

19. Concentration Difficulty

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

20. Tiredness or Fatigue

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

21. Loss of Interest in Sex

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

_____ Subtotal Page 2
_____ Subtotal Page 1
_____ Total Score

APPENDIX D

Beck Anxiety Inventory (BAI)

BAI®

NAME ______________________ DATE ______________________

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by each symptom during the PAST WEEK, INCLUDING TODAY, by placing an X in the corresponding space in the column next to each symptom.

	NOT AT ALL	MILDLY It did not bother me much.	MODERATELY It was very unpleasant, but I could stand it.	SEVERELY I could barely stand it.
1. Numbness or tingling.				
2. Feeling hot.				
3. Wobbliness in legs.				
4. Unable to relax.				
5. Fear of the worst happening.				
6. Dizzy or lightheaded.				
7. Heart pounding or racing.				
8. Unsteady.				
9. Terrified.				
10. Nervous.				
11. Feelings of choking.				
12. Hands trembling.				
13. Shaky.				
14. Fear of losing control.				
15. Difficulty breathing.				
16. Fear of dying.				
17. Scared.				
18. Indigestion or discomfort in abdomen.				
19. Faint.				
20. Face flushed.				
21. Sweating (not due to heat).				

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APPENDIX E

Informed Consent form

Informed Consent to Participate in Research

This form provides you with information about the study and seeks your authorization for you to participate in the study. The Principal Investigator (the person in charge of this research) or a representative of the Principal Investigator will also describe this study to you and answer all of your questions. Your participation is entirely voluntary. Before you decide whether or not to take part, read the information below and ask questions about anything you do not understand. By participating in this study, you will not be penalized or lose any benefits to which you would otherwise be entitled.

Name of Participant ("Study Subject")

____

Title of Research Study

Performance by South African Adults on Semantic Fluency Tests

Principal Investigator

Anathi B. Kwinana

Department of Psychology

University of Cape Town

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Supervisor

Ass/Prof. Kevin G. F. Thomas

Department of Psychology

University of Cape Town

Kevin.thomas@uct.ac.za

What is the purpose of this research study?

The purpose of this research study is to investigate performance on semantic fluency test.

What will be done if you take part in this research study?

You will be required to avail yourself for two test sessions over a span of 3 days. You will be tested individually and first test session will last approximately 45-60 minutes, while the second will last 10-15 minutes.

Day 1. Immediately after arrival at the laboratory, you will read and sign an informed consent document and will be allowed to ask any questions about the study procedures. You will then be administered questionnaires to determine study eligibility. Finally, you will be administered the semantic fluency tests in either English or isiXhosa. At the conclusion of the test procedures, you will be required to confirm the scheduling of the Day 2 appointment.

Day 2. You will be administered the animal and fruit-and-vegetables semantic fluency tests, with procedures (except language of test administration) identical to Day 1.

Confidentiality.

You will be assigned a unique identifying code, with the key known only to the researcher and held in a secure database separate from the main database, in order to ensure anonymity. All identifying information relating to the you will be kept confidential and will be accessible only to those directly involved in the study.

Risks and benefits.

Your participation will not place you at risk of experiencing any physical, psychological, or psychosocial distress. However, should you experience any such distress, you will be referred to the UCT Student Wellness Centre or to another appropriate healthcare centre. You will be compensated by way of SRPP points that will allow you to obtain your Duly Performed certificate for the course in which you are enrolled.

Debriefing.

You will be debriefed individually and comprehensively at the end of the study.

Signatures

As a representative of this study, I have explained to the participant the purpose, the procedures, the possible benefits, and the risks of this research study; and the alternatives to being in the study

____ ______________________

Signature of Person obtaining consent Consent Date

You have been informed about this study's purpose, procedures, and risks. You have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time. You voluntarily agree to participate in this study. You hereby authorize the collection, use and sharing of your protected health information. By signing this form, you are not waiving any of your legal rights.

____ ______________________

Signature of Person consenting Consent Date

Please indicate below if you would like to be notified of future research projects conducted by our research group:

______________ (initial) Yes, I would like to be added to your research participation pool and be notified of research projects in which I might participate in the future.

Method of contact:

Phone number: ________________________________

E-mail address: ________________________________

Mailing address: _______________________________

APPENDIX F

Debriefing form

This form provides you with information about the study in which you have just participated and explains in full the methods of collection of data for this research study. The Principal Investigator (the person in charge of this research) or a representative of the Principal Investigator will also explain this study to you in full and answer all of your questions.

Name of Participant ("Study Subject")

____

Title of Research Study

Performance by South African Adults on Semantic Fluency Tests

Principal Investigator

Anathi B. Kwinana

Department of Psychology

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Supervisor

Ass/Prof. Kevin G. F. Thomas

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What was the purpose of this research study?

The purpose of this research study was to investigate performance on semantic fluency test.

What was during the research study?

You were required to avail yourself for two test sessions over a span of 4 days. You were tested individually and the first test session lasted approximately 45-60 while the second session lasted 10-15 minutes.

Day 1. Immediately after arrival at the laboratory, you read and sign an informed consent document and were allowed to ask any questions about the study procedures. You were then administered questionnaires to determine study eligibility. Finally, you were administered semantic fluency tests in either English or isiXhosa. At the conclusion of the test procedures, you were required to confirm the scheduling of the Day 2 appointment.

Day 2. You were administered the animal and fruit-and-vegetables semantic fluency tests, with procedures (except language of test administration) identical to Day 1.

Is there anything required of you?

Please do not disclose anything that happened during this research session to anyone else, as this may bias future participants and their performance. If you are still feeling stressed at the end of the research study, please contact us and we will provide you with the contact details of a clinical psychologist who could provide you with post-session counselling.

Signatures

As a representative of this study, I have explained to the participant, in detail, the purpose, and the procedures.

____ ________________________

Signature of Person Debriefing | Consent Date

I have been informed, in detail, about this study's purpose, procedures, and deceptions. I have been given the opportunity to ask questions before I sign. By signing this form, I am not waiving any of my legal rights.

____ ______________________

Signature of Person Debriefed Consent Date