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Cross-Cultural Adaptation of the Multicultural Neuropsychological Scales (MUNS) for use in South Africa

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Abstract

Background and Objective: Most standardized neuropsychological tests were developed and normed in high-income countries of the global north, and hence are not suited for use in most low- or middle-income countries. We aimed to adapt the Multicultural Neuropsychological Scale (MUNS), a brief test battery designed to be suitable for assessment contexts across the globe, for use in South Africa (SA).

Method: After adapting/translating the MUNS into SA English and Afrikaans, we administered it to healthy SA university students: English speakers (n = 35) and Afrikaans speakers (n = 9). Analyses compared the MUNS performance of (a) the SA English and Afrikaans samples, and (b) the overall SA sample against that of samples from Argentina and the United States, which are described in previous studies.

Results: Analyses detected no significant performance differences between the SA English and Afrikaans samples. Between-country comparisons detected no significant performance differences on most outcome variables. Notably, however, the SA sample's overall MUNS score was higher than those of the Argentinian ($p < .001$, $\eta^2 = .11$) and American ($p = .053$, $\eta^2 = .04$) samples.

Conclusions: The SA-modified MUNS versions were tolerated well by our participants, with no significant between-language performance differences. Regarding between-country comparisons, inferential analyses, effect sizes, and direction of means suggest that South African participants were not disadvantaged by MUNS items or test structure. We conclude that the MUNS holds promise as a valuable assessment tool for use in SA English and Afrikaans speakers and should be translated into other South African languages.

Adaptation of the Multicultural Neuropsychological Scales (MUNS) for use in South Africa

As the global population becomes more culturally, linguistically, and socioeconomically diverse, and as there is a simultaneous rise in the worldwide demand for clinical tools, there are increasing calls for universally applicable cognitive tests (Dutt et al., 2022; Johnston, 2015). However, a growing body of research indicates that several sources of cross-cultural bias (e.g., construct bias, item bias) may influence neuropsychological test performance (Fernández & Abe, 2018; van de Vijver & Tanzer, 2004).

Hence, culturally appropriate tests must have particular characteristics that attempt to minimise these biases. For instance, they must measure a construct that is meaningful within the context in which they are used, and their items' semantic and linguistic content must be relevant to that context (Katzef et al., 2019; Kim & Na, 1999). However, almost all widely used cognitive test instruments have been developed, tested, and normed in North America, meaning they are likely to be inherently inappropriate for administration outside that continent without substantial adaptation and re-standardization (Robbins et al., 2013; Thomas et al., 2019).

Hence, neuropsychologists practising outside North America are faced with the challenge of finding valid and reliable tests for administration to individuals who differ from the sociodemographic (e.g., linguistic, racial, ethnic, cultural, socioeconomic, educational) characteristics of the standardisation samples used by the most widely marketed and heavily researched cognitive instruments (Díaz-Santos & Hough, 2015; Watts & Shuttleworth-Edwards, 2016). This challenge underpins the recent rapid growth of the field of cross-cultural neuropsychology (Dutt et al., 2022; Fernández et al., 2022). Although this growth has a global reach, its products are particularly pertinent to countries such as South Africa, which are characterised by populations whose extensive diversity extends through languages, education levels and qualities, ethnicity, and socioeconomic status (SES), and which face heavy clinical burdens twinned with low numbers of neuropsychological professionals (Johnston, 2015; Scott et al., 2020).

Against this background, the literature review below discusses and examines some major issues in contemporary cross-cultural neuropsychology. We start by considering global issues and then delve into issues relevant to the South African clinical context. We conclude by reviewing the literature on the Multicultural Neuropsychological Scale (MUNS;

Fernández et al., 2018), a neuropsychological assessment tool designed specifically to overcome the cross-cultural challenges described above.

Global Issues

Cultural biases inherent in North American-developed cognitive tests (which tend to form the core of the neuropsychologist's armamentarium, regardless of where the clinical practice or research study is located) are evident especially when those tests are used in Latin American, African, and Asian countries (Holding et al., 2018; Sakamoto, 2016), but are apparent even when used in English-speaking countries such as Australia and New Zealand (Barker-Collo, 2001; Cruice et al., 2000). Clearly, then, applying the same test to people from different cultures (even if they speak the same language but use different dialects) results in varied performances on standardised psychological tests.

A prime example of the global application of a North American-developed test is the worldwide use of the Boston Naming Test (BNT; Kaplan et al., 1978, 1983, 2001). The BNT is, in fact, the most widely administered neuropsychological test globally (Strauss et al., 2006), with its instructions having been translated into many languages (see, e.g., Bezdicek et al., 2021; Miotto et al., 2010; Patricacou et al., 2007; Peña-Casanova et al., 2009). Despite translation, the BNT's stimuli (pictures of everyday objects) are particularly biased toward Northern hemisphere and Western contexts and environments (Thomas et al., 2019). Similarly, the Trail Making Test (TMT; Reitan, 1971), another widely used cognitive test, uses Arabic numerals and letters of the Latin alphabet, both of which may be unfamiliar to people residing in countries that use different writing systems (Fernández, 2019).

The effects of these test-related biases are exacerbated by the fact that, although clinical neuropsychology is now a global enterprise, neuropsychological tests that are appropriate for the context of low- and middle- income countries are relatively scarce (LMICs; Fernández, 2019). Although efforts have been made to develop culture-fair and locally appropriate tests (e.g., tests in languages other than English; for a review, see Howieson, 2019), relatively few of these are readily available to (or used widely by) neuropsychologists practising in LMICs (Chan et al., 2016; Fernández et al., 2016; Sakamoto, 2016). This is primarily because local adaptation, standardisation, and norming of tests require large amounts of time, effort, and money (Fernández et al., 2018; Laher & Cockcroft, 2017). Moreover, the feasibility of adapting existing tests or developing new ones is further constrained by the lack of trained neuropsychologists in LMICs (Michael et al., 2021).

Consequently, many neuropsychologists working outside North America tend to use tests unsuitable for their population. This may result in false-positive diagnoses when interpreting the results of their test administrations (i.e., results that may pathologize and misdiagnose healthy individuals; Gasquoine, 2009).

South African Issues

The global issues described above are exacerbated in South Africa, a country that features the widest socioeconomic disparity in the world (Harmse, 2014) as well as enormous cultural, educational, and linguistic diversity alongside relatively scarce neuropsychological services and a relatively high prevalence of brain-related injuries and diseases (Joska et al., 2011; Lanesman & Schrieff, 2020).

Neuropsychological instruments that are accessible, appropriate, and valid for administration to the South African population are essential (see, e.g., Aghvinian et al., 2021; Ferrett et al., 2013; Watts & Shuttleworth-Edwards, 2016), yet few such measures have been developed, adapted, or normed in this country (Robbins et al., 2013; Thomas et al., 2019) – and even those are usually only available in English (although, see Scott et al., 2020).

This English-language availability exists even though the three most spoken languages in South Africa are isiZulu, isiXhosa, and Afrikaans (Statistics South Africa, 2018). A mismatch between the test-takers' home language and the test administration language can have profound effects on neuropsychological test performance (Scott et al., 2020; Young & Edwards, 2013).

Although research on this mismatch has been conducted in many different countries (see, e.g., Bethlehem et al., 2003; Carstairs et al., 2006; Gasquoine et al., 2007), South African studies on the topic are pertinent here. For instance, Mosdell et al. (2010) showed that an adaptation of the BNT into Afrikaans and isiXhosa improved the performance of participants with those home languages. In their study, an adaptation of the instrument included not only pure linguistic translation but also the removal or modification of items deemed inappropriate for the cultural context (e.g., a picture depicting an animal found only in North America was changed to a picture of one of South Africa's 'Big Five' animals; see also Thomas et al., 2019).

The Multicultural Neuropsychological Scale

Given the near-prohibitive costs associated with translating, adapting, and standardising existing tests for cross-cultural use, a growing number of neuropsychologists have advocated an alternative approach to ensuring that the tests used in LMICs are valid and reliable within the local context: developing instruments that, at inception, are cross-

culturally fair and globally acceptable, require little adaptation, and have little reliance on verbal stimuli, which are particularly sensitive to linguistic and cultural variations (Fernández & Abe, 2018). Hence, such instruments tend to feature many visual stimuli and to use everyday objects (e.g., coffee, hand) that are universally familiar (see, e.g., Goudsmit et al., 2017; Storey et al., 2004). The Multicultural Neuropsychological Scale (MUNS) (Fernández et al., 2018) is one such instrument.

The MUNS is a cognitive screening tool that assesses multiple areas of cognitive functioning (primarily memory, but also attention, constructional praxis, language, and executive functioning) and that is suited for administration to individuals aged ≥ 14 years (Fernández et al., 2018). It combines several existing tests into a single battery that uses universally familiar visual stimuli and few verbal items (all of which can be administered in many different cultural and linguistic contexts with minimal translation and adaptation).

The Current Study: Rationale, specific aims, and hypotheses

The sub-discipline of cross-cultural neuropsychology has devoted much attention to issues revolving around the need for test instruments to be culturally, linguistically, and otherwise suitable for administration in all clinical contexts, regions, and countries. The challenge of developing culture- and language-fair cognitive tests is especially difficult in LMICs such as South Africa, which has an ethnically, linguistically, and educational diverse population, limited resources, and an overburdened healthcare system.

Several South African studies have demonstrated the feasibility and importance of adapting tests to the local context. There is still, however, a paucity of South Africa-based research on cross-culturally fair and universally applicable neuropsychological test batteries. Such test batteries allow for quicker and cheaper adaptation to the local contexts and languages. The MUNS may be a test battery that is able to add to the selection of available tests.

However, previous research on this instrument has only been conducted in Argentina and the United States (Fernández et al., 2022). Hence, the current study aimed to investigate whether the original English and a newly-translated Afrikaans version of the MUNS are appropriate cross-cultural neuropsychological assessment tools for use in South Africa. Afrikaans is the most spoken language in the Western Cape province (Statistics South Africa, 2018), the region in which the study was conducted. Thus, the translation of this cross-cultural test is of use, especially to those who would otherwise receive the test in English.

To achieve our research aim, we recruited samples of English- and Afrikaans-speaking young adults and administered our English and Afrikaans versions of the MUNS to

them. Participants were university students (i.e., of high educational attainment) so as to reduce the impact of potentially confounding variables (such as years of education) in investigating the following research questions:

(1) Are there significant MUNS performance differences between the South African English and Afrikaans samples?

(2) Are there significant MUNS performance differences between the South African samples and the Argentinian sample?

(3) Are there significant performance differences between the South African samples and the US sample?

Method

Design and Setting

The study used a cross-sectional design. All study protocols were completed in quiet, distraction-free research laboratories housed within the University of Cape Town (UCT) Department of Psychology. Ethical approval for the study procedures was granted by the UCT Department of Psychology Research Ethics Committee (reference: PSY2022-031).

Participants

Sampling

We recruited 44 undergraduate UCT students (35 home-language English speakers; 9 home-language Afrikaans speakers) by means of both purposive and snowball sampling. Research invitations were published on the UCT Department of Psychology's dedicated online Student Research Participation Programme (SRPP) site, as well as on the Department of Student Affairs (DSA) research recruitment site (see Appendix A and Appendix B).

Eligibility Criteria

Our sample was restricted to undergraduate university students aged between 18 and 25 years. Those in the English-speaking group reported having English as a home language, had received instruction in that language during secondary school, and/or had taken English as a first-language subject through their matric year. Those in the Afrikaans-speaking group reported having Afrikaans as a home language, had received instruction in that language during secondary school, and/or had taken Afrikaans as a first-language subject through their matric year. We used data from a South African-adapted version of the Language Experience and Proficiency Questionnaire (LEAP-Q; Marian et al., 2007; Siebert, 2017, 2018) to confirm, prior to MUNS administration, that each participant was fluent in either English or Afrikaans.

Individuals reporting any history of neurological or endocrinological illness (e.g., epilepsy, traumatic brain injury, stroke, diabetes, Addison's disease) or of any clinically diagnosed psychiatric condition (e.g., major depressive disorder, generalised anxiety disorder, schizophrenia) were excluded from participation. We also excluded individuals currently prescribed any chronic medication for the treatment of a medical or psychiatric condition. Neuropsychological test performance is influenced negatively by the presence of these illnesses, disorders, and medications (Lee et al., 2013; Lezak et al., 2012; Miller & Maricle, 2019).

Measures and Materials

Sociodemographic Questionnaire

A study-specific self-report questionnaire (Appendix C) acquired basic information regarding participants' sociodemographic characteristics (e.g., age, sex), handedness, and their linguistic profile (e.g., language of educational instruction during secondary school), and helped determine their study eligibility (e.g., by asking questions about medical and psychiatric history).

Adapted Language Experience and Proficiency Questionnaire (LEAP-Q)

This self-report questionnaire (Marian et al., 2007; Appendix D) provided detailed information about individuals' linguistic history and profile. It asked, for instance, about language dominance and language preference in various social situations. The developers report that the LEAP-Q has satisfactory psychometric properties, with high internal consistency ($\alpha = .85$) as well as good internal and criterion-based validity. Moreover, adaptations of the LEAP-Q into 16 other languages retain the same construct validity as the original instrument (Bilingualism and Psycholinguistics Research Group, 2017). Importantly, the instrument has yielded internally consistent factors that represent the relevant language abilities underlying several South African languages (Cockcroft & Laher, 2018).

In the current study, we used a South-African adapted version of the instrument that focuses specifically on the participant's experiences with and uses of, English and Afrikaans (Siebert, 2017, 2018).

Multicultural Neuropsychological Scale (MUNS)

This neuropsychological test battery (Fernández et al., 2018) comprises seven subtests that assess performance in five cognitive domains: constructional praxis (one subtest), attention (two subtests), language (one subtest), memory (one visual and two verbal subtests), and executive functioning (one subtest). The MUNS is available in both high- and low-education versions. The former version (which was administered in this study) contains four

additional words in the Word List subtest and four additional facts about the characters in the Personage subtest. Each subtest is described in detail in Appendix E. Total administration time is 30–50 minutes.

An overall score for the battery is obtained by summing the scores of the seven subtests. In Fernández et al. (2018, 2022), the Arrows and the Dots and Lines subtest, as well as the recognition trial for the Word Learning subtest, were removed because those researchers observed no significant performance differences between their control and clinical groups. Removing those outcomes results in the MUNS having a total possible range of scores between 10 and 463 points, with an optimal cut-off score of 282 points; lower scores may indicate some level of cognitive impairment. Fernández et al. (2022) reported that (a) the instrument differentiated between cognitively impaired and healthy participants with a specificity of 51% and sensitivity of 88%, and (b) test reliability, using a standardized regression-based method, was satisfactory.

An experienced bilingual academic translator (R. Kozain) translated the MUNS from English into Afrikaans. The initial translation was checked and vetted by other members of the research team who are fluent in Afrikaans (H. Gouse, G. Moffatt, B. Philander, K. Thomas).

Regarding cultural modifications to individual subtests, we replaced the original image in the Personage subtest with images of South African men. The original photograph was a copyright-free image (acquired online) of a white man aged in his 50s. Because this single photograph does not reflect the racial/ethnic diversity of the South African population, and because online photographs available for use were primarily representative of North American or European men (i.e., did not resemble members of most Southern African ethnic groups), we decided to change the photographic stimulus. Hence, after gaining the appropriate consent (see Appendix F), we took head and shoulder photographs of four South African men (all aged between 50 and 59, consistent with the age range in the original). The men were either ethnically Black, White, Indian, or Coloured, and so may represent some of the different South African ethnic groups. In the adapted Personage subtest, the pictured individual is given a fictitious name that may provide the participant with context and a sense of familiarity, again to ensure consistency with the original.

Procedure

We distributed the research advertisements and invitations as described above (see Appendix A and B). UCT students interested in participating signalled this intent by signing up for an available session through the dedicated Vula site described above.

At the appointed time, the potential participant met the researchers in a quiet, private research room in the UCT Department of Psychology. After the informed consent document was completed (Appendix G and Appendix H), the participant was formally enrolled and a researcher administered the demographic questionnaire and the adapted LEAP-Q in. The researchers conducted the administration procedure fully in English as participants were multilingual. If a participant proved to be ineligible after that screening, they were thanked and allowed to leave. Those participants eligible to continue were administered the MUNS, with the order of subtest administration following convention: Personage (learning), Word Learning (learning and immediate recall), Visual Memory (learning and immediate recall), Arrows, Party, Dots and Lines, Personage (delayed free recall, delayed cued recall), Word Learning (delayed free recall, recognition), Visual Memory (delayed recall), and Animal Fluency. Participants in the English group were administered the culturally modified South African English version of the MUNS battery. Participants in the Afrikaans group were administered the translated and culturally modified South African Afrikaans version of the instrument.

Each participant was led individually through the study procedure by either GM or BP, both of whom are bilingual English-Afrikaans speakers. Both researchers have undergone extensive administration and scoring training with a researcher from the Fernández group. The average administration time per participant ranged between 30 and 40 minutes, the same as in Fernández et al. (2022).

Upon completion of the battery, participants received a verbal debriefing. This debriefing gave them information about the study's goals and the nature of the data collected, as well as the publication and other goals of the research. They were also sent an electronic debriefing form via email (see Appendix I) and given an opportunity to ask any questions.

UCT students who signed up via the SRPP programme were awarded 3 SRPP points. Students excluded after the screening process were awarded 1 SRPP point. Students who signed up via DSA were entered into a raffle for a chance to win a Takealot voucher worth R300. Two such prizes were awarded after a random drawing.

All participant information was stored in a password-protected laptop and locker, with access strictly restricted to members of the research team.

Data Management and Statistical Analyses

We analysed the data using R Studio version 4.1.2 and MSExcel, with the threshold for statistical significance (α) set at .05 as per statistical convention.

Generating Descriptive Statistics

Before beginning inferential analyses, we generated a complete set of descriptive statistics that provided information regarding the sample characteristics. This step allowed us to check the relevant assumptions (e.g., of normality and homogeneity of variance) underlying each subsequent analysis, and to identify any outliers in the distribution. When assumptions underlying parametric statistical tests were violated, we used non-parametric tests (e.g., the Kruskal-Wallis *H* test; Kruskal & Wallis, 1952) instead. We estimated effect sizes using eta-squared, and interpreted them following convention (i.e., small = .20; moderate = .50; large = .80; Cohen, 1988).

Investigating Aim 1

Because the sample sizes of the South African English and Afrikaans groups were so disparate, we used the Kruskal-Wallis *H* test to analyse between-group performance differences on the overall MUNS score and the score on each individual subtest. We used raw scores for each outcome variable.

Investigating Aim 2

Using the raw data from the Argentinian sample described in Fernández et al. (2022) and raw data from the current sample of South African participants, we used a series of independent-sample *t*-tests (or, where appropriate, Kruskal-Wallis *H* tests) to analyse between-group performance differences on the overall MUNS score and the score on each individual subtest.

Investigating Aim 3

Using the raw data from the US sample also described in Fernández et al. (2022) and raw data from the current sample of South African participants, we used a series of independent-sample *t*-tests (or, where appropriate, Kruskal-Wallis *H* tests) to analyse between-group performance differences on the overall MUNS score and the score on each individual subtest.

Results

Sample Sociodemographic Characteristics

The South African sample (N = 44) had an age range of 19–23 years (M = 20.91, SD = 1.20) and education range of 12–17 years (M = 14.23, SD = 1.14). Thirty-one participants (71% of the sample) were female. Although all participants reported being multilingual, information obtained from the sociodemographic questionnaire and the LEAP-Q helped determine that 35 were English-dominant and 9 Afrikaans-dominant. Regarding handedness, 39 people (88.64%) were right-handed, two people (4.5%) left-handed, and three (6.8%)

ambidextrous. Fernández et al. (2022) reported a similar handedness distribution (86%, 5%, and 9%).

Table 1 summarises the key sociodemographic characteristics for each subgroup of the current study and for the Argentinian and US samples used by Fernández et al. (2022). Analyses detected no significant between-group differences with regard to (a) years of education, $p = .83$, $\eta^2 = .02$, and (b) sex distribution, $p = .84$, Cramer's $V = .05$. However, both the Argentinian and US samples were significantly younger than the overall South African sample: Argentina versus South Africa, $H(1) = 9.81$, $p = .007$, $\eta^2 = .08$, and US versus South Africa, $H(1) = 20.53$, $p < .001$, $\eta^2 = .27$.

Table 1

Sociodemographic Characteristics: Samples from South Africa, Argentina, and the United States (N = 125)

	Country / Language of MUNS Administration			
Variable	Argentina – Spanish (*n* = 55)	US – English (*n* = 26)	SA – English (*n* = 35)	SA – Afrikaans (*n* = 9)
Age (*M*, *SD*) [a]	19.98 (1.38)	19.35 (1.2)	20.89 (1.38)	21.00 (1.50)
Education (*M*, *SD*) [b]	13.67 (1.35)	14.19 (0.9)	14.26 (1.12)	14.11 (1.27)
Female (*f*, %)	40 (73%)	20 (77%)	25 (71%)	6 (67%)

Note. Data from the Argentinian and US samples are from Fernández et al. (2022), and are used with permission from those authors. MUNS = Multicultural Neuropsychological Scale; US = United States; SA = South Africa.

[a] Years.

[b] Number of years completed successfully.

Aim 1: Comparing the Two South African Samples

Analyses detected no significant between-group differences on any individual subtest score or on the MUNS Total Score (see Table 2). All between-group comparisons were associated with small effect sizes (all η^2 values were < .20). The score range for the MUNS Total Score was 261–391 for the SA English sample and 278–397 for the Afrikaans sample.

Table 2

MUNS Performance by the South African Samples: Descriptive Statistics and Between-Group Comparisons (N = 44)

	Language of MUNS Administration						
	English	Afrikaans					
MUNS Outcome Variable	(*n* = 35)	(*n* = 9)	*H*	*p*	ESE	95% CI English	95% CI Afrikaans
Word List							
Immediate recall	58.69 (11.52)	65.22 (11.88)	1.29	.26	<.001	54.87, 62.50	57.46, 72.99
Delayed recall	9.89 (2.34)	10.22 (1.86)	.15	.70	.02	9.11, 10.66	9.01, 11.43
Recognition trial	12.74 (1.56)	12.67 (1.12)	3.00	.08	.05	12.23, 13.26	11.94, 13.40
Personage	32.23 (9.64)	37.44 (6.77)	1.91	.17	.02	29.04, 35.42	33.02, 41.86
Animals	34.63 (11.16)	30.22 (9.20)	.92	.34	.00	30.93, 38.33	24.21, 36.23
Visual Memory							
Immediate recall	37.69 (6.48)	35.11 (9.37)	.53	.47	.01	35.54, 39.83	28.99, 41.24
Delayed recall	16.91 (5.19)	15.44 (7.00)	.35	.56	.02	15.19, 18.63	10.87, 20.02
Party	137.43 (21.70)	142.33 (9.17)	.12	.72	.02	130.24, 144.62	136.35, 148.32
Arrows	26.66 (3.10)	28.56 (2.24)	.43	.51	.01	25.63, 27.68	27.09, 30.02
Total Score	332.71 (35.50)	343.56 (41.64)	.34	.56	.02	320.88, 344.38	315.97, 370.48

Note. In the second and third columns, means are presented with standard deviations in parentheses. Note that the MUNS Total Score variable excludes performance on the Dots and Lines, Word List Recognition, and Arrows subtests. MUNS = Multicultural Neuropsychological Scale; ESE = effect size estimate (in this case, η^2); CI = confidence intervals.

Aim 2: Comparing the South African Sample against the Argentinian Sample

Because the analyses described above detected no significant MUNS performance differences between the South African English and Afrikaans samples, we collapsed the data from those two groups when conducting the comparison against the Argentinian sample. (We did the same for the comparison against the US sample, which is documented in the next subsection.) This assured us of greater power for the inferential analyses and allowed us to circumvent potential problems when comparing groups of widely unequal sizes.

Table 3 presents descriptive statistics for the groups being compared here. Regarding MUNS Total Score, analyses detected a significant between-group difference in favour of the South African group, $H(1) = 12.05$, $p < .001$, $\eta^2 = .11$. Scores for the Argentinian sample ranged from 211 to 386, whereas those for the South African group ranged from 261 to 397 (see Figure 1). Analyses also detected significant between-group differences with regard to scores on the following subtests: Recognition, $H(1) = 8.05$, $p = .004$, $\eta^2 = .07$; Arrows, $H(1) = 13.20$, $p < .001$, $\eta^2 = .13$; and Party, $H(1) = 5.09$, $p = .02$, $\eta^2 = .04$. For all other subtests, p-values were >.05 and η^2 values were < .20.

Table 3

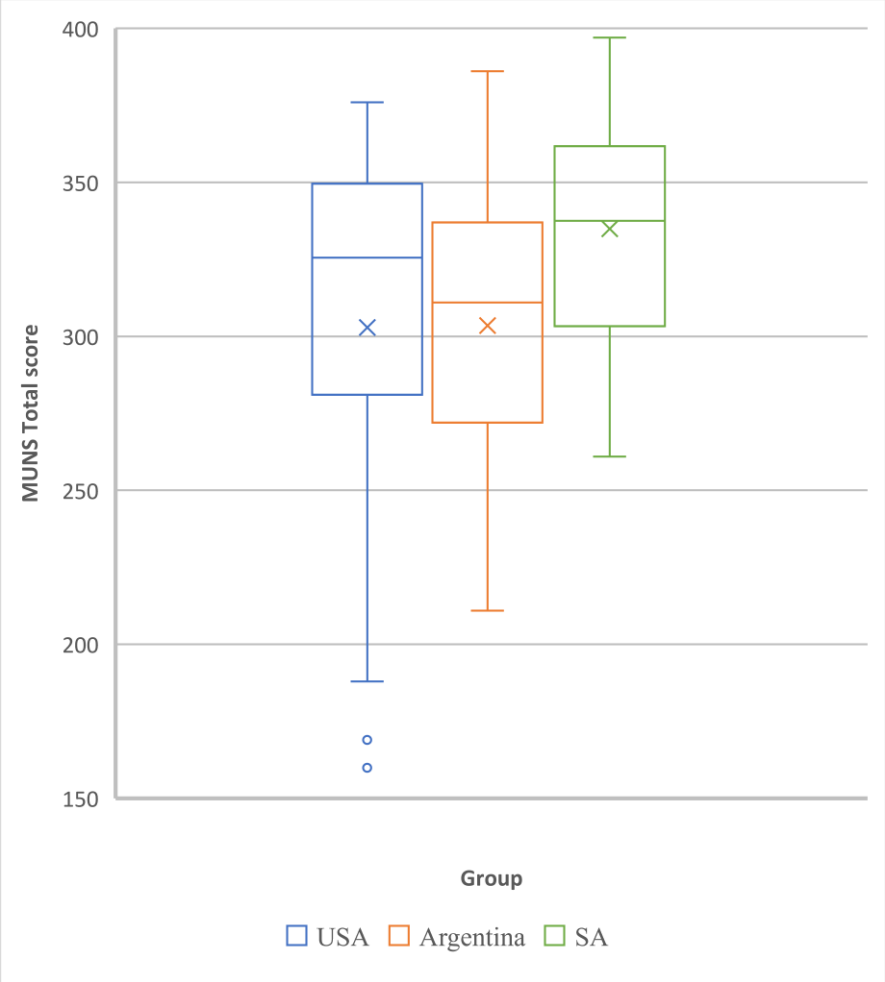
MUNS Performance in Three Different Countries: Descriptive Statistics (N = 125)

	Country of Administration		
	Argentina	US	South Africa
MUNS Outcome variable	(*n* = 55)	(*n* = 26)	(*n* = 44)
Word List			
Immediate recall	57.96 (10.86)	58.54 (13.36)	60.02 (11.76)
Delayed recall	10.02 (2.56)	9.54 (2.86)	9.95 (2.23)
Recognition trial	11.13 (3.74)	12.15 (2.34)	12.73 (1.47)
Personage	29.69 (3.74)	29.15 (2.34)	33.30 (9.30)
Animals	30.73 (8.86)	33.54 (7.25)	33.86 (10.83)
Visual Memory			
Immediate recall	35.04 (6.88)	35.04 (7.06)	37.16 (7.12)
Delayed recall	16.67 (5.25)	15.96 (8.87)	16.61 (5.55)
Party	123.42 (10.40)	121.12 (11.95)	138.43 (19.80)
Arrows	24.73 (3.06)	29.35 (2.21)	27.05 (3.02)
Total Score	303.53 (43.47)	302.88 (43.76)	334.93 (36.58)

Note. In the second, third, and fourth columns, means are presented with standard deviations in parentheses. MUNS = Multicultural Neuropsychological Scale.

Figure 1

Boxplot: MUNS Performance in Three Different Countries (N = 125)



Note. The symbol 'X' indicates the group mean. Error bars represent the 95% confidence intervals. Sample sizes were United States (US) = 26, Argentina = 55, South Africa (SA) = 44. The US dataset contained two values (MUNS Total Score = 160 and 169) that were statistical outliers because they fell outside of the 95% confidence interval; these values are marked by open circles. MUNS = Multicultural Neuropsychological Scale.

Aim 3: Comparing the South African Sample against the US Sample

Table 3 again presents descriptive statistics for the groups being compared here. Regarding MUNS Total Score, analyses detected a strong trend toward a significant between-group difference, $H(1) = 3.69$, $p = .053$, $\eta^2 = .04$. Scores for the US sample ranged from 160 to 376, whereas those for the South African group ranged from 261 to 397 (see Figure 1). Analyses detected significant between-group differences with regard to scores on the following subtests: Arrows, $H(1) = 10.15$, $p < .001$, $\eta^2 = .13$; and Personage, $t(1) = -1.96$, $p = .04$, $\eta^2 = .04$. For all other subtests, p-values were > .054 and η^2 values were < .03.

Discussion

This study investigated whether an adapted and translated version of the Multicultural Neuropsychological Scale (MUNS), a cognitive test battery designed to be culturally fair and therefore suitable for clinical assessment contexts across the globe, could be appropriate for use in South Africa. Previous MUNS validation studies have been conducted in Argentina and the United States (Fernández et al., 2018, 2022).

South Africa is characterised by an overburdened and low-resource healthcare system (Watts & Shuttleworth-Edwards, 2016). The country has a relatively small number of fully trained and registered clinical neuropsychologists, and neuropsychological tests appropriate for local linguistic and sociocultural contexts are not readily available (Johnston, 2015). Hence, it is imperative that culturally fair and easily adaptable instruments such as the MUNS are determined to be suited for use in this country.

To achieve the aims of our study, the original English version of the MUNS was translated into Afrikaans by an experienced bilingual translator. This translation was vetted by other English-Afrikaans bilingual members of the research team. These individuals also adapted both the English and Afrikaans versions of the MUNS to suit the South African context (e.g., by changing the single facial image used for the Personage subtest to five images that would better represent South Africa's ethnic diversity). We then administered these South-African modified versions of the MUNS to a sample of healthy university students (n = 35 in English, n = 9 in Afrikaans). Before this administration proceeded, we took care to establish the participant's fluency in either English or Afrikaans (i.e., we used a standardized self-report instrument, the Language Experience and Proficiency Questionnaire [LEAP-Q; Marian et al., 2007], as well as information from a study-specific sociodemographic questionnaire, to enquire about the participant's linguist profile and experience with both English and Afrikaans).

Our first set of analyses detected no significant differences between the South African English and Afrikaans groups in terms of their MUNS performance (total score as well as scores on each individual subtest). This suggests that the MUNS can easily be adapted into more of South Africa's 11 official languages, and clinicians could have access to an appropriate and informative screening tool. This effectively reduces the burden of having to adapt biased instruments which often requires substantial time and financial resources and time.

Our next two sets of analyses compared the MUNS performance of the overall South African sample (N = 44; we felt justified in combining the English and Afrikaans groups given the results of the first set of analyses) to those of, respectively, the Argentinean (N = 55) and US (N = 26) samples described by Fernández et al., 2022. Of note here is that the three samples were well matched in terms of education and distribution of sex and of handedness. Although both the Argentinian and US samples were statistically significantly younger than the South African sample, the mean difference in age did not exceed 2 years and all participants were young adults. Hence, we are confident that between-group sociodemographic differences did not confound our results and should not cloud our interpretations of those results.

Perhaps the most notable results among the set of between-country comparisons are that, on average, (a) the South African sample's total MUNS score was statistically significantly higher than that of the Argentinian sample, and (b) the difference between the South African samples total MUNS score and that of the US sample approached statistical significance, with the direction of means again favouring the South African sample. We make two comments on this pattern of data. First, it suggests that the MUNS items and test structure do not disadvantage South African participants – the items and test structure of other standardized cognitive batteries do (see, e.g., Mosdell et al., 2010; Thomas et al., 2019). Second, the effect sizes associated with those between-country comparisons are quite small (neither exceeded $\eta^2 = .12$), and hence the statistical significance (or trend toward such) of the differences between the groups should not be overinterpreted.

Further regarding between-country differences in MUNS performance, analyses detected significant differences between the South African and Argentinian samples on three of the seven subtests (Recognition trial of the Word List subtest, Arrows, and Party) and between the South African and US samples on two subtests (Arrows and Personage). We make the same two comments on this pattern of data as we did above. First, because the average scores for South African sample on those subtests were higher than those of the Argentinian and US samples, it seems clear that the local participants were not disadvantaged by the items and test structure. Second, the effect sizes associated with those significant between-country differences were all in the range conventionally described as small (that is to say, none of them exceeded $\eta^2 = .14$, and the smallest was $\eta^2 = .004$). Hence, we again urge caution in overinterpreting those results.

Another note regarding subtest performance is that two of the subtests on which statistically significant differences were detected (viz., Arrows, Recognition) were among those identified by Fernández et al. (2022) as not performing as intended (i.e., not discriminating cognitively impaired from unimpaired participants). Hence, those authors recommended that scores on those two subtests, along with the score on the Dots and Lines subtest, be excluded from contributing to the total MUNS score. (We followed that recommendation in this study.) Fernández et al. (2022) also observed significant differences in Arrows performance between the Argentinian and US samples, and suggested that the problem reflected in the scores lies within the subtest's psychometric properties rather than any issues related to cultural fairness. Hence, it should not be surprising that we also found significant differences when comparing the Arrows performance of our South African sample against that of the Argentinian and US samples.

The fact that most of our analyses investigating between-country differences in MUNS subtest performance detected non-significant results highlights the potential of the instrument as a culturally fair neuropsychological scale that utilises universal and ecologically valid stimuli. For instance, the visual memory task uses stimuli such as a flower, a leaf, a hand, and a building – all objects commonly found around the world. Similarly, the verbal memory task includes words such as wind, cloud, hand, and knee, all of which are taken from Swadesh list, which is a catalogue of words used almost universally (Swadesh, 1971). The executive functioning subtest also uses universally known stimuli (e.g., food, cake, cutlery) as well as an activity (organising a party) with which most people would be familiar. Furthermore, this subtest does not make reference to a specific currency, but instead uses the more-or-less universally applicable concept of coins.

There are several other attractive features of the MUNS. First, unlike many widely used cognitive batteries, it is not overly reliant on verbal tasks (Blumenau & Broom, 2011). Because these tasks can be a major source of bias (Kempler et al., 1998), reducing reliance on them effectively nullifies the impact that linguistic, educational, and broadly sociocultural factors might have on task performance (Laher & Cockcroft, 2017).

Second, translation and adaptation of the MUNS is not difficult. The language used to provide task instructions is clear, uncomplicated, jargon-free, and easy to understand. This allows for fast translation. The universally recognizable stimuli make adaptation similarly quick: All we had to do was change the names and pictures in the Personage subtest. Hence, the financial, professional, and personnel resources that usually have to be devoted to translating and adapting neuropsychological tests are minimized in the case of the MUNS.

Third, the MUNS may provide more information than commonly used brief cognitive screening tools. It assesses performance in, and provides independent scores for, five distinct cognitive domains (attention, constructional praxis, language, memory, and executive functioning) that are frequently affected by brain trauma or neurologic disease (Lezak et al., 2012). This feature is of particular importance to clinical contexts such as those present in low- and middle-income countries (LMICs) such as South Africa, which have a high burden of brain-related injuries and diseases (Joska et al., 2011; Lanesman & Schrieff, 2020; Schrieff-Elson & Thomas, 2016).

Fourth, Fernández et al. (2022), in the only study to date that has used the MUNS with a clinical population, observed that the instrument has higher sensitivity than specificity. This psychometric characteristic means that the MUNS is more likely to produce false positives (i.e., suggesting clinically significant pathology in the absence of true pathology) than false negatives (i.e., suggesting an absence of clinically significant pathology when true pathology is present). In the low-resource, high-burden clinical environments characteristics of LMICs such as South Africa, health professionals work with patients displaying wide ranges of cognitive impairment, from mild to severe. Hence, this high sensitivity / low specificity characteristic of the MUNS is preferable to, for instance, the opposite case: It reduces the probability that a cognitively impaired individual will not get the necessary assessment and, subsequently, the appropriate treatment.

Fifth, although the MUNS cannot be described as a brief screening tool, its administration time is not excessively long (on average, the battery can be completed in 30–40 mins). This feature benefits both the patient, who will not be fatigued by completing the MUNS, and the clinician, who can use the MUNS to obtain relatively detailed information about the patient's cognitive profile in a short time. Moreover, the time-efficiency of the MUNS makes it suitable for use in LMICs, where lengthy and comprehensive neuropsychological testing sessions are often not possible in the context of low resources and high disease burdens.

Sixth, although the current study tested only high-education individuals, the MUNS is designed to be appropriate for both low- and high-education individuals. (As noted above, there are two education-alternative versions available.) Again, this feature makes the instrument particularly suitable for use in LMICs, where wide disparities in educational attainment (and in quality of education) are likely to be present and to influence performance on standardized cognitive tests (Aghvinian et al., 2021; James et al., 2015).

Seventh, the MUNS is somewhat unique in that it was intentionally designed to be suitable for administration to individuals aged 15 years and older (i.e., for adolescents, young adults, middle-aged adults, and older adults). Most other cross-culturally suitable batteries are intended for use with specific age-banded populations, such as older adults (aged > 65 years) in the case of the Rowland Universal Dementia Scale (Storey et al., 2004).

Limitations

The following characteristics of the study design and methodology limit the inferences one might make on the basis of the findings.

First, the sample size was quite small. In particular, the sample of Afrikaans speakers (n = 9) did not reach the desired size. Hence, our statistical analyses may have been underpowered. In minor mitigation, however, is the fact that previous MUNS studies (e.g., Fernández et al., 2018, 2022) have used samples not much bigger than that used here.

Second, we recruited all participants from the UCT student population (i.e., from a population that is young and highly educated). Hence, this study cannot answer the questions of whether the MUNS is suited for use in non-student or older adult South African populations, or whether the current results can be generalized to those populations. Relatedly, our eligibility criteria specified that the sample could only include people without a history of any neurological or endocrinological illness or any clinically diagnosed psychiatric condition. Although these sampling and recruitment decisions served their purpose in minimising the effects of potentially confounding variables (e.g., age, education, severe depression), future MUNS research in South Africa should expand the sampling frame to include a more diverse group of individuals so that, for instance, studies might explore the validity of the instrument for detecting cognitive impairment in neurological patients.

Third, we only used self-report measures of language fluency. Although we have no reason to suspect that our participants provided inaccurate information regarding their linguistic profiles, self-report questionnaires are susceptible to numerous sources of bias (Rust & Golombok, 2014). Future cross-cultural research on the MUNS should gather objective information about language profiles (e.g., by obtaining school reports, or by administering standardized verbal fluency tests).

Summary and Conclusions

This study adds to the growing body of research regarding neuropsychological tests that are appropriate for use in LMICs, generally, and in South Africa, specifically. It is the first to investigate the use of the Multicultural Neuropsychological Scale (MUNS) in Africa –

previous MUNS research has only been conducted in the country where it was developed (Argentina) and the United States.

Our first major finding was the MUNS was relatively easy to translate into Afrikaans and that its stimuli required only minor modification before being suited for administration to South African participants. Our second major finding was that the two local samples we tested (English and Afrikaans speakers) performed equivalently on South African-adapted / translated MUNS versions. Hence, we suggest that our Afrikaans translation of the instrument is of similar difficulty as our South African-adapted English version. Our third major finding was that the between-country differences found between SA and Argentina as well as between SA and the US all had effect sizes in the range conventionally considered small. This means with a larger sample; this should be diminished.

Taken together, these findings provide evidence that the MUNS, which was developed using culturally neutral stimuli and which was designed specifically for cross-cultural use in diverse settings, might be easily adapted for use in South African clinical settings and might be a valuable tool for health professionals operating in those settings. Although more formal psychometric properties (especially diagnostic validity) of the instrument remain to be established, the data presented here suggest that the MUNS has the potential to be extremely useful in countries such as South Africa, where high cultural, linguistic, educational, and socioeconomic diversity coupled with low resources and a scarcity of neuropsychological services do not easily allow for lengthy adaptations of otherwise intrinsically biased neuropsychological batteries.

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Appendix A

SRPP Advertisement

Looking for Students to Participate in Research Study (3 SRPP Points)

Hello!

You are invited to participate in a research study investigating performance on a new set of tests used to assess cognitive function (such as memory, attention and language) never before used in South Africa.

To participate in this study, you must:

1. **Be a fluent Afrikaans or English speaker**
2. **Be between the ages of 18 and 25**
3. **Not have a history of any psychological, psychiatric, neurological, and/or endocrinological disorders**
4. **Not be currently taking any psychiatric /chronic medication.**

If you choose to participate in this study, you will be required to complete an informed consent form and answer a selection of questions regarding your personal details such as age, home language and level of study. A language fluency screening tool will then be administered. If you are found to be neither English nor Afrikaans fluent, you will receive **1 SRPP point** for your participation. If you are found to be fluent and choose to participate in this study, you will be administered a short series of tests assessing cognitive functions (such as memory, attention and language) in-person. The entire session should take 30-50 minutes to complete, and you will receive **3 SRPP points** for your participation in the full study. Please note that all identifying and personal data of yours will not be disclosed to anyone other than the principal researchers and their supervisors. Moreover, any data collected from you will be physically secured and stored on a password-protected laptop.

If you wish to participate in this study, you may click the link below to and sign up for a session on the VULA site:

LINK: insert link for VULA sign up

Venue: **ACSENT Laboratory, Psychology Department, Upper Campus**

Questions

Any questions or concerns regarding the study can be directed to the principal researchers (MFFGEO001@myuct.ac.za and PHLBRO005@myuct.ac.za). Any study-related questions or issues should be directed to the Research Ethics Committee of the Department of Psychology at the University of Cape Town (Mrs Rosalind Adams – 0216503417 or Rosalind.Adams@uct.ac.za).

Appendix B

Research Invitation (Department of Student Affairs)

Looking for Students to Participate in Research Study – Win a Takealot Voucher!

Hello!

You are invited to participate in a research study investigating performance on a new set of tests used to assess cognitive function (such as memory, attention and language) never before used in South Africa.

To participate in this study, you must:

1. **Be a fluent Afrikaans or English speaker**
2. **Be between the ages of 18 and 25**
3. **Not have a history of any psychological, psychiatric, neurological, and/or endocrinological disorders**
4. **Not be currently taking any psychiatric /chronic medication .**

If you choose to participate in this study, you will be required to complete an informed consent form and answer a selection of questions regarding your personal details such as age, home language and level of study. A language fluency screening tool will then be administered. If you are found to be fluent and choose to participate in the study, you will be administered a short series of tests assessing cognitive functions (such as memory, attention and language) in-person. The entire session should take 30-50 minutes to complete. **Full participation in the study will guarantee automatic entry into a raffle for the chance to win 1 of 4 Takealot vouchers worth R300**. Please note that if you withdraw from the study before its conclusion, you will not be permitted entry into the raffle. All identifying and personal data of yours will not be disclosed to anyone other than the principal researchers and their supervisors. Moreover, any data collected from you will be physically secured and stored on a password-protected laptop. If you wish to participate in this study, you may sign up by emailing any of the principal researchers.

Venue: **ACSENT Laboratory, Psychology Department, Upper Campus**
Signing up:
If you are a UCT student, please use the LINK: insert link for VULA sign up

If you are a student from another university, please email one of the principal researchers

Questions

Any questions or concerns regarding the study can be directed to the principal researchers (MFFGEO001@myuct.ac.za and PHLBRO005@myuct.ac.za). Any study-related questions or issues should be directed to the Research Ethics Committee of the Department of Psychology at the University of Cape Town (Mrs Rosalind Adams – 0216503417 or Rosalind.Adams@uct.ac.za).

Appendix C

Sociodemographic Questionnaire

Sociodemographic Questionnaire

ACSENT Laboratory University of Cape Town

Participant ID:

Demographics:

1.1. Age: _____

1.2. Sex: _____

1.3 Education (Years completed) _____

1.4 Handedness _____

Language of Education:

2.1. Are you currently an undergraduate student? O Yes O No

2.2. If so, please tick what applies to you (tick all that are applicable):

O I went to an Afrikaans-medium secondary school until my matric year

O I went to an English-medium secondary school until my matric year

O I took Afrikaans as a first-language subject until my matric year

O I took English as a first-language subject until my matric year

General Information

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

_____

3.2. Have you ever experienced a head injury that resulted in loss of consciousness and/or required hospitalization? O Yes O No

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

Appendix D

Adapted Language Experience and Profile Questionnaire (LEAP-Q)

Adapted Language Experience And Profile Questionnaire (LEAP-Q)

Part A

Participant ID:

1. Please list all the languages you know in order of dominance:

1._____ 2._____ 3._____ 4._____ 5._____

2. Please list all the languages you know in order of acquisition (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:					

Part B (to be filled in for each language)

Participant ID:
Language:

1. Age when you…. …this language

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

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 :

1 2 3 4 5 6 7 8 9 10

Understanding :

1 2 3 4 5 6 7 8 9 10

Reading :

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 :

1 2 3 4 5 6 7 8 9 10

Interacting with family :

1 2 3 4 5 6 7 8 9 10

Watching TV :

1 2 3 4 5 6 7 8 9 10

Listening to radio/music :

1 2 3 4 5 6 7 8 9 10

Reading :

1 2 3 4 5 6 7 8 9 10

Language-lab/self-instruction:

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.

Appendix E

Multicultural Neuropsychological Scale (MUNS): Subtest Descriptions

Personage (Karakter Geheue)

This task assesses verbal memory. The test taker is asked to choose, from an array of four images, the photo of an individual with whom they identify the most. The test administrator then reads out loud a short paragraph containing 15 (10 in the low-education version) personal facts (e.g., age, job, marital status) about this fictitious character in the photograph. Participants are asked to remember this information, with no indication of when or how this will be tested. After a filled 15–20-minute delay, there is a free recall trial wherein the test taker is asked to verbally recall the previously presented information. Immediately after this trial, a cued recall trial is administered wherein the administrator asks specific questions about the information regarding the fictitious character that the participant did not mention in the free recall trial. For example, if the participant did not mention what mode of transportation the character uses to travel to work in the first trial, the administrator would then ask, "How does he get to work?"

The outcome variable is information recalled on the free and cued recall trials. However, each item recalled may only be awarded a score once. Therefore, if an item is awarded a point during the free recall trial, it may not be awarded a point during the cued recall trial. Depending on the trial, certain items are awarded either 1 point or 5 points. Total free recall and total cued recall scores are added to form the overall total score for the subtest. The minimum achievable subtest score is 0 points, and the maximum is 55 points.

Word Learning (Woord Lys)

This task also assesses verbal memory. The test administrator reads the test taker a 14-word list (10 words in the low-education version). Each word belongs to one of two semantic categories (natural elements [e.g., *wind, cloud*] or body parts [e.g., *hand, knee*]). The list is read out loud by the instructor once for each of the three learning trials. Trial 1, 2 and 3 are immediate recall trials. Trial 4 is a delayed free recall trial administered after a filled 20-min delay; on this trial, the test taker is asked to recall as many words as they can. Trial 5, which follows immediately after Trial 4, is a recognition test: The test administrator reads a list that contains all the words from the original list as well as a set of similar words. The test taker is asked to indicate which words they can recall being in the original set of words.

The outcome variable is words recalled. For each of the three immediate recall trials and for the delayed recall trial, a score of 1 point is awarded if the test taker correctly recalls a word in positions 1–2 or 12–14 of the list. Three points are awarded for correct recall of words in the positions 3–11. Points for trials 1–4 are summed to give a total free recall score. For the recognition trial, one point is awarded per correct word recognised and the number of incorrect answers (words incorrectly recognised or not recalled) is subtracted from the total. This leaves a total possible score of 14 points for the recognition trial. In the currently proposed study, intrusions (i.e., words retrieved by the participant that did not appear in the list) will be noted for qualitative evaluation of the participant's performance.

Visual Memory (Visuele Geheue)

This task requires the test taker to remember the shaded-in parts of four pictured stimuli (flower, leaf, hand, and building) that should be universally recognisable. The administrator presents each stimulus for 10 seconds. The test taker is then given a sheet of paper with a blank version of the picture previously shown and is asked to fill in the areas that they can recall were shaded, without a time constraint. Following the presentation of each individual stimulus, there is an immediate recall trial. A delayed recall trial is administered after a filled delay.

The outcome variable is the number of shaded parts correctly identified ("hits"). For the first two stimuli (i.e., leaf and hand), each hit is awarded 1 point. For the last two stimuli (i.e., hand and building), 3 points are awarded for each hit, as these stimuli are more complex. The total score is the sum of all hits. The range of possible scores is 0–50. Any omissions and/or commissions made are recorded for qualitative evaluation of performance. If the test taker marks every part of a stimulus, then performance on that stimulus is annulled.

Arrows (Pyltjies)

This subtest, which consists of two parts, assesses attention. In part one, the test taker is shown a series of pictures of arrows pointing in different directions (left and right). Each picture is shown for 3 seconds and is immediately followed by the presentation of another picture. The test taker is required to keep track of the number of right-pointing arrows. Part two is similar in its presentation, but this time the test taker is required to keep track of the number of left-pointing arrows as well as up-pointing arrows and recall them in two separate categories. The participant responds to this task by verbally stating how many arrows they have counted following the presentation of the stimuli.

The outcome variable is the number of arrows remembered correctly. The score is obtained by giving one point per correct item. If a test taker provides an answer where the

total number of arrows they counted exceeds the maximum possible total correct number, then the extra number of arrows counted is subtracted from the total obtained score for this subtest. For example, if the maximum possible total correct was 14 arrows and the test taker recalled 15 arrows, one point will be deducted from that person's score (i.e., they would achieve a score of 14).

Party (Partytjie)

This task assesses executive functioning (specifically, planning, judgment, and decision making). The test taker is shown a two-dimensional map that features several different landmarks . Because the map is simply several rows of blocks, the landmarks are simply demarcations on some of the blocks. The test taker is tasked with choosing a route that will allow them to purchase several items (food, drink, silverware, table, chairs, and dessert) with a budget of 100 coins. Each item has a different price, and there are several places on the map where each item might be purchased. The test taker must mark their route using a pen on the map; the aim is to remain within budget while taking the shortest route possible to purchase one of each of the items. There is no time limit.

The outcome variables here are the number of items purchased, the number of blocks traveled, and the amount of money saved.

Points and Lines (Kolletjies en Lyne)

This is a visuo-constructional praxis test. The test taker is shown four different designs, each consisting of dots connected by lines, and is instructed to copy each one on a set of dots adjacent to the original design. There is no time limit.

The outcome variable here is the number of correctly connected lines.

Animal Fluency (Diere)

This task assesses language functioning. The test taker is instructed to name as many animals as possible within a 2-minute time limit.

The outcome variable here is the number of unique animals named. Because many South Africans are multilingual, we will accept, for instance, answers given in English by participants in the Afrikaans group and answers given in Afrikaans by participants in the English group.

Appendix F

Informed Consent Document: Replacement images for MUNS Personage subtest

CONSENT FORM FOR USE OF FACIAL IMAGE IN PSYCHOLOGICAL STUDY

Dear Sir

INVITATION TO PARTICIPATE IN STUDY

You are being asked for an image of your face to be used in a neuropsychological study at the University of Cape Town.

Nature of Study:

The purpose of this study is to investigate whether a neuropsychological assessment tool adapted into Afrikaans is culturally relevant for the Afrikaans-speaking population of the Western Cape.

Procedure

If you agree for your image to be used in this study, you will be requested to provide a high-quality facial image. This image will be printed and shown to participants during a memory test.

Confidentiality

All images used in this study will be used solely by the researchers for the purpose of a cognitive test. The images will not be distributed to third parties, nor will you be identifiable by name. Any reports or publications of the study material will never identify you.

Voluntary Participation

Your participation in this study is completely voluntary. If you no longer wish for your image to be used in this study, you may contact the researchers and ask for your image to be withdrawn.

Possible Risks

There are no known risks involved in this study and its procedures.

Possible Benefits

The use of your facial image will allow us to make neuropsychological assessment tools more widely accessible to South Africans.

Confidentiality

Your consent form and any other identifying information will not be disclosed to anybody except the principal researchers. Any reports about this study will not identify you. Physical copies of your facial image will be kept and used solely for research purposes. The equipment and devices used to hold your facial image will be password protected and physically secured by the research team.

Questions

Any questions or concerns regarding the study can be directed to the principal researchers (MFFGEO001@myuct.ac.za and PHLBRO005@myuct.ac.za). Any study-related questions or issues should be directed to the Research Ethics Committee of the Department of Psychology at the University of Cape Town (Mrs. Rosalind Adams – 0216503417 or Rosalind.Adams@uct.ac.za).

CONSENT TO TAKE PART IN STUDY

I have read the above and am satisfied with my understanding of the study and its possible risks and benefits. I hereby voluntarily consent to participation in the research study as described.

Name: _____Date: _____

Signed: _____

Appendix G

Informed Consent Document:

Participants recruited via SRPP

Thank you for choosing to participate in this study about performance on a new neuropsychological test battery.

Procedure

If you decide to participate in this study, you will be asked to complete a selection of questions regarding your personal details such as age, home language and level of study and a language fluency screening tool. If you are found to be fluent in either English or Afrikaans and choose to participate further, you will be administered a series of short cognitive tests (i.e., tests of memory, attention, language, and problem solving). The entire session should take 30-50 minutes to complete.

Possible Risks and Benefits

There are no known physical, psychological or psychosocial risks involved in this study and its procedures. Please note that participation in this study is completely voluntary, and you are free to stop participating with no penalty. If you are found to be neither English nor Afrikaans fluent, you will receive **1 SRPP point** for your participation. If you are found to be English and/or Afrikaans-fluent you will receive **3 SRPP points** for your participation in the full study.

Confidentiality

All information collected for this study will be kept confidential. Neither your consent form or any form of self-identifying information will be disclosed to anybody other than the principal researchers and their supervisors. Any reports or publications of the study material will never identify you. The equipment and devices used to hold and analyze the data collected from this study will be password protected and physically secured by the researchers.

Questions

Any questions or concerns regarding the study can be directed to the principal researchers (MFFGEO001@myuct.ac.za and PHLBRO005@myuct.ac.za). Any study-related questions or issues should be directed to the Research Ethics Committee of the Department of

Psychology at the University of Cape Town (Mrs Rosalind Adams – 0216503417 or Rosalind.Adams@uct.ac.za).

CONSENT TO TAKE PART IN STUDY

I have read the above and am satisfied with my understanding of the study and its possible risks and benefits. I hereby voluntarily consent to participation in the research study as described.

Name: _____Date: _____

Student Number:

Course code for which the points should be allocated (e.g., PSY1400F):

Email: _____Signed: _____

If you would like a copy of the study results sent to you via email, please tick the box below:

☐

Appendix H

Informed Consent Document:

Participants not recruited via SRPP

Thank you for choosing to participate in this study about performance on a new neuropsychological test battery.

Procedure:

If you decide to participate in this study, you will be asked to complete a selection of questions regarding your personal details such as age, home language and level of study and a language fluency screening tool. If you are found to be fluent in either English or Afrikaans and choose to participate further, you will be administered a series of short cognitive tests (i.e., tests of memory, attention, language, and problem solving). The entire session should take 30-50 minutes to complete.

Possible Risks and Benefits

There are no known physical, psychological or psychosocial risks involved in this study and its procedures. Please note that participation in this study is completely voluntary, and you are free to stop participating with no penalty. If you are found to be English and/or Afrikaans-fluent you will be permitted to participate in the full study .**Full participation in the study will guarantee you automatic entry into a raffle for the chance to win 1 of 4 Takealot vouchers worth R300.** At the end of the study, participants that have been randomly selected as the winners of the vouchers will be contacted via email. Please note that if you withdraw from the study before its conclusion, you will not be permitted entry into the raffle.

Confidentiality

All information collected for this study will be kept confidential. Neither your consent form or any form of self-identifying information will be disclosed to anybody other than the principal researchers and their supervisors. Any reports or publications of the study material will never identify you. The equipment and devices used to hold and analyze the data collected from this study will be password protected and physically secured by the researchers.

Questions

Any questions or concerns regarding the study can be directed to the principal researchers (MFFGEO001@myuct.ac.za and PHLBRO005@myuct.ac.za). Any study-related questions or issues should be directed to the Research Ethics Committee of the Department of Psychology at the University of Cape Town (Mrs Rosalind Adams – 0216503417 or Rosalind.Adams@uct.ac.za).

CONSENT TO TAKE PART IN STUDY

I have read the above and am satisfied with my understanding of the study and its possible risks and benefits. I hereby voluntarily consent to participation in the research study as described.

Name: _____ Date: _____

Email: _____ Signed: _____

If you would like a copy of the study results sent to you via email, please tick the box below:

☐

Appendix I

Debriefing Form

Cross-Cultural Adaptation of the Multicultural Neuropsychological Scales (MUNS) into Afrikaans for use in South Africa

Thank you for participating in this study. The aim of this form is to provide you with information and explanations pertaining to the aims and measures used in this research study.

The aim of this study was to assess participant performance on the subtests of the Multicultural Neuropsychological Scale (MUNS). Neuropsychological test batteries are often designed by and for Western English-speaking individuals. The MUNS is different. It was designed by a team of South American researchers and is specifically intended for global and cross-cultural use. Our research team adapted the MUNS for the South African population; this is the first application of this battery in Africa. So, our study aimed to investigate whether or not this subtest is culturally fair in a South African context.

If for any reason you experience any distress or discomfort consequent to your participation in this research, please direct your concerns to the following individuals:

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