Adapting Neuropsychological Assessments for Minority Groups: A Study Comparing White and Maori New Zealanders

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Culturally-appropriate neuropsychological assessment is important if we wish to gather valid information about the abilities of individuals from minority cultural groups. This study compares 20 Maori and 20 white New Zealanders (16–30 years) from a low socioeconomic group on a range of neuropsychological tests, some adapted in an attempt to increase their appropriateness for Maori. Results generally support the hypotheses that Maori score more poorly on tests that rely heavily on formal western education and concepts, and score as well as or better than the white New Zealanders on tests that rely on concepts valued by Maori (e.g., visuospatial abilities), or have some Maori content. The test adaptations in this study might provide ideas for test adaptation for other cultural groups.

It is no longer news that many of the tests used by neuropsychologists are both culturally biased and culturally "unfriendly" when used to assess people from cultures outside the mainstream white, English-speaking, European or American populations (Kaufman, McLean & Reynolds, 1988; Ogden & McFarlane-Nathan, 1997; Ogden, 2001). Culturally unfair tests add yet another "inequity" to the long list of inequities that make up the life-story of indigenous, colonised peoples in many countries, including Australia, Canada, New Zealand, North America and South Africa. Although a few culturally biased psychometric tests may seem trivial when compared with the more well-known sources of inequity in these countries, culturally biased neuropsychological assessments can result in incorrect diagnoses, too much or too little rehabilitation, and unfair estimates of any financial compensation awarded. For example, if a young Maori man is assessed on the Wechsler Adult Intelligence Scale-Revised (WAIS-R) following a moderate traumatic brain injury, and his Vocabulary score is 5 scaled score points below his Block Design score, his results may be interpreted as demonstrating an impairment of verbal abilities relative to his visuospatial abilities. In fact, if his scores were compared to those of a group of Maori men of the same age, socioeconomic group, educational history and ethnicity, his results would demonstrate no impairment at all (Ogden & McFarlane-Nathan, 1997). Conversely, if he demonstrated a pattern where his Vocabulary score was equal to his Block Design score, he may well have an impairment of visuospatial skills that would be missed if the WAIS-R normative data were used as the standard.

Of course, all neuropsychologists know that they should use appropriate norms for all their clients, but it seems an impossible task to develop norms for the many different cultural groups that live in our countries today. Even if it were feasible to develop norms for our common tests for at least the most significant or disadvantaged minority groups, this would not ensure equity. If we are interested in gaining valid information about an individual's abilities, test content must also be culturally appropriate (or at least not culturally unfair). Test developers have a tendency to

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develop tests that assess what *they* value. Commonly-used test batteries are unlikely to include tests of carving ability, which may favour Maori (Ogden, 1996), or footprint recognition, which may favour Australian Aborigines (Porteus, 1931), or the recognition of horses, which may favour Pueblo Indians (Dubois, 1939). Yet another factor that needs to be acknowledged when assessing people from the non-dominant culture, is the importance of motivation in test performance. As one participant in our study commented when asked his opinion of the Maori content in the tests, "It's good to have Maori stuff, its something familiar for us; like when you look at Maori words you think — hey, I know about that" (Ogden, 2001).

Maori, the indigenous people of New Zealand (NZ), comprise 15% of the total population, but almost 20% of the population in the 12–25 year age group. In common with the indigenous peoples of other colonised countries, Maori feature prominently in many of the negative statistics. Their life expectancy is 7 years less than that of the Pakeha (white New Zealander), and 39% of Maori leave school with no formal qualifications (compared with 13% of Pakeha; Statistics NZ, 2002). In the younger age groups (15 to 24 years), 26% of Maori are unemployed compared with 11.6% of Pakeha (Statistics NZ, 2002).

In NZ, a Government insurance body, the Accident Compensation Corporation (ACC), provides assessment, rehabilitation and compensation for lost wages to all people who are injured as the result of accidents. Traumatic brain injury (TBI) is the most common cause for an ACC referral to a neuropsychologist. Young men in the 16–24 year age group have proportionately more TBIs than any other group, and this holds for Maori. Indeed, young Maori men may be even more at risk for TBI than young Pakeha men given that a higher proportion of Maori (60 to 70%) belong to the two lowest socioeconomic groups, and the median age of the NZ population identifying as having some Maori ancestry is 21.4 years compared to 32.3 years for non-Maori (Statistics NZ; 1997). The ratio for Maori: non-Maori sustaining injuries in motor vehicle accidents is 1.5:1; Maori rates of alcohol abuse, alcohol-related deaths and drunk driving offences are two to four times higher than for non-Maori, and 50% of all Maori motor vehicle mortalities can be linked to alcohol. Violence is also a cause of hospitalisation and death for an increasing number of Maori of both sexes and all ages (Pomare, Keefe-Ormsby, & Ormsby, et al., 1995; Statistics, NZ., 1994; Te Puni Kokiri: Ministry of Maori Development, 1993a; Te Puni Kokiri: Ministry of Maori Development, 1993b). Maori comprise 55% of the prison population (but only 15% of the NZ population; Department of Corrections, 2000). One recent study reported lifetime prevalence rates for TBI (including mild to severe) in Maori prisoners as 91.4% compared with 79.4% for non-Maori prisoners (Barnfield & Leathem, 1998). Young Maori men are also prominent in contact sports such as rugby, a particularly rich source of mild to moderate TBI.

Most Maori are fluent English speakers, a small proportion speak Maori fluently as well, and a higher number speak and understand Maori to some extent, without claiming language fluency. The number of young Maori who are fluent Maori speakers is growing as increasing numbers of Maori children attend Maori schools where Maori language and cultural traditions are primary; or they learn Maori as a language at Western schools. Thus, it is increasingly common for neuropsychologists to be referred a Maori client who may be better served if assessed with instruments based on the Maori language and cultural understandings.

In this study, therefore, our primary goal was to establish a core of neuropsychological tests culturally appropriate for Maori in the 16 to 24 age group. Statistically the "average" Maori in this age group falls within one of the two lowest socioeconomic groups (based on the parents' highest level of occupation), and left school at 15 years of age with no formal qualifications gained either at school or since. As we were interested in developing normative data and culturally-fair tests for the "average" unimpaired young Maori, we used these criteria to select our participants. In a previous study (Ogden & McFarlane-Nathan, 1997), the scores on common neuropsychological tests of 24 healthy adult Maori men in this age, socioeconomic and educational range were compared with published norms to see which tests were more or less culturally fair. Two groups of Maori men were compared; one from an urban environment (Auckland) and the other from a rural and more "traditional" Maori environment. It was hypothesised that the rural Maori would score more poorly on westernised tests given that these young men might be less acculturated into the dominant Pakeha western culture. No differences were found between the two groups either on test scores or on attitudes towards the assessment process and the results of the two groups were therefore amalgamated.

Young Maori men scored easily within the "average" range reported for the standardised population on WAIS-R Digit Span (DSp; scaled score = 9.29, *SD* = 2.03), the Selective Reminding Test (SRT; Buschke and Fuld, 1974), and the 20 minute delayed recall trial of the Rey Complex Figure Test (CFT; Maori raw score = 22.39, *SD* = 5.18; Meyers & Meyers, 1995; Rey, 1941). On the copy of the CFT their mean raw score was 31.60, *SD* = 2.50, more than 1 *SD* below the mean of 35.23, *SD* = 1.46, reported for the normative age-equivalent groups in Meyers and Meyers (1995) manual, and eight of the 24 men copied the figure in a piecemeal fashion (judged piecemeal if the main rectangle was not completed in sequential steps). They also scored more poorly on tests that relied on formal education or had a "westernised" content, including WAIS-R Vocabulary (Vocab; scaled score = 7.16, *SD* = 1.99), and WMS-R Logical Memory (LM; 17th to 19th percentile on immediate recall and 24th to 44th percentile on delayed recall).

Logical Memory-Maori (LM-M), a new alternative version of LM was also trialled, using stories about Maori events, written in English but with grammar and sentence structure typical of that used by Maori from this socioeconomic group. As predicted, the Maori men performed at a significantly higher level on LM-M (45th to 75th percentile on immediate recall, and 49th to 66th percentile for delayed recall) than on LM. Their scaled score on WAIS-R Block Design (BD) was 12.12, *SD* = 2.59, almost 1 *SD* above the standardised mean. The scaled score difference between Vocab and BD was significant at the 5% level for 67% of the men, with the Vocab score lower than BD for all 24 men.

In this present study healthy Maori men fitting within the same demographic criteria as for the Ogden and McFarlane-Nathan (1997) study were assessed on a wider group of tests, some as published and some adapted. This study, however, also included three additional groups of participants: Maori women, and Pakeha men and women, all matched on age, socioeconomic group and education with the Maori men. A specific aim of this study was to see which commonly-used or readily adaptable tests we could use for young men and women in both Maori and Pakeha cultural groups, and which of these tests would require separate norms or content for each group. Another important aim was to explore ways we could make the assessment process more enjoyable and Maori-friendly for the participants, thus increasing their motivation to do their best in the testing situation.

Method

Participants

A total of 40 participants, 20 Maori and 20 Pakeha, were assessed. All 40 participants were students from Training Opportunities Programmes (TOPS) in the Auckland region. TOPS are designed to assist people with low or no qualifications to acquire training and employment. Each group of 20 consisted of 10 women and 10 men. All participants gave informed verbal and written consent and fell within the following criteria:

(a) They had no history of neurological disorder or moderate to severe head injury, and no traumatic brain injury within the last 2 years.

(b) For the Maori participants, they were of Maori descent and identified as Maori. The majority of Maori participants identified with Taitokerau iwi (northern tribes). Ten iwi (tribes) were represented, with a number of participants identifying with more than one iwi. Two Maori participants could not identify their iwi.

(c) For the Pakeha sample, they were of Pakeha descent and identified as Pakeha (white New Zealanders).

(d) They were aged from 16 to 30 years (the age group experiencing the highest number of TBIs).

(e) They had no educational qualifications higher than fifth form School Certificate (a national examination usually taken around age 15 or 16 years).

(f) They lived in an urban environment (Auckland).

It was decided not to exclude participants who had a history of regular social alcohol and cannabis use, as to do so would have made it difficult to obtain participants, given that a previous study found that a majority of this demographic group are users of one or both of these drugs (Ogden & McFarlane, 1997). The level of drug use was, however, used as a variable in statistical calculations when test results suggested it may be affecting scores for some participants. Likewise, mild TBI more than 2 years previously was not used as an exclusion factor, given the possibility that many of the men in this age group (both Maori and Pakeha) may report that they have been concussed or "dazed", often more than once, during sporting activities, motorbike accidents and fights (Barnfield & Leathem, 1998; Ogden & McFarlane-Nathan, 1997). Independent confirmation of these reports is usually impossible. It therefore seemed appropriate to consider these

factors as "normal" for this population. Information on possible TBIs within the lifetime of the participant, was however collected. Every participant was asked the following questions: (a) Have you every suffered a concussion or have had to stop playing when playing sports such as rugby or netball? (b) Have you ever suffered a concussion or felt dazed after a vehicle accident, during a fight, or at any other time? Where answers were in the affirmative, the participant was queried further in order to gather as much information as possible about the possible TBI, including information on medical attention or hospitalisation.

Procedure

The neuropsychological assessment, consisting of a test battery and qualitative questions, was given to all participants. Each session took approximately 2 to 2 $^1/_2$ hours to complete. Two Maori researchers (EC and MD) each assessed approximately half of the Maori and half of the Pakeha participants. Thirty-six participants were assessed on the TOPS course premises, and the remaining four at their homes. Efforts were made to ensure the testing environment was quiet with few or no distractions and considerable time was spent before testing began establishing rapport with the participants and thoroughly explaining the purposes of the research. This included reassuring participants that the tests were on trial, and not themselves.

Neuropsychological Test Battery

The tests administered were those considered useful to include in a neuropsychological battery to assess TBI and other common neurological disorders. The majority of tests were selected on the basis that they are frequently used by clinical psychologists conducting neuropsychological assessments. Well-known tests given included the WAIS-R (Wechsler, 1981) Digit Span (DSp) and Digit Symbol (DSy) subtests, the WMS-R (Wechsler, 1987) Logical Memory (LM) subtest, the Complex Figure Test (CFT; Meyers & Meyers, 1995; Rey, 1941); and the Trail Making Test (TMT; Spreen & Strauss, 1991).

Two tests less commonly used in neuropsychological assessment were piloted for the purpose of investigating how appropriate they may be for Maori. These were as follows:

The Design Fluency test (DFl; Jones-Gotman & Milner, 1977). This test measures nonverbal fluency and can be viewed as a counterpart to the Controlled Oral Word Association Test (COWA; Buschke & Fuld, 1974). Given the good scores achieved by young Maori on Block Design (Ogden & McFarlane-Nathan, 1997) in the previous study, and the cultural importance of visuospatial design (paintings and carvings) to Maori, we thought that Maori might enjoy this test. In our study participants were given the "free" condition requiring participants to draw as many original designs as possible in 5 minutes. The participant is informed that drawings of real or nameable objects, scribbling and drawings which are too similar are not acceptable. A warning can be given during the test if these rules are broken. The score is the number of total designs minus perseverative and rule-breaking responses.

The Speed and Capacity of Language Processing test (SCOLP; Thames Valley Test Company, 1992). This has two subtests as follows:

- **Spot-The-Word (STW)** involves the participant reading 60 pairs of items, one of which is a real word and the other a nonsense word, and ticking the real word. Words range from common to extremely rare, and the number of items identified correctly as words can be used to estimate the participant's IQ. We included this test as we thought it might be less embarrassing for participants from this poorly educated group, than having to read aloud difficult words, as required for the more commonly-used test of IQ estimate, the NART (Nelson & Willison, 1991).
- **Speed of Comprehension (SOC)** requires the participant to read 100 short statements, half of which are true (e.g., "Dogs have four legs"), and half of which are false (e.g., "Dogs have wings"). Participants put a tick by true statements and a cross by false statements, and the number correct in a 2-minute period is the final score. As all the statements are simple and easily interpreted, this test assesses speed of access to semantic memory, and speed of information processing, and thus may be a useful test for individuals with TBI. For both subtests, age-scaled scores and percentile scores can be obtained, and compared with normative data published in the manual.

Maori alternatives to three commonly used tests were also piloted. These were as follows:

Vocabulary — Maori Alternative (Vocab-M). Seven Maori words were added to the WAIS-R Vocabulary word list, one after every fifth English word. These words were selected on the premise that they were approximately of an equivalent difficulty level for Maori as the immediately preceding English word was for New

Zealanders (Maori and Pakeha). There are no data on the frequency with which Maori words are used, so the words were selected by a group of Maori who spoke Maori fluently. They selected Maori words as best they could, and produced a series of 1 and 2 point definitions for each word. It should be noted that in New Zealand, and especially in the Auckland area where this study was conducted, many Maori words are used commonly in everyday conversation by Pakeha as well as by Maori. Thus the "easiest" Maori word, "korero", placed after the fifth English word, would be known by many Pakeha as well as Maori, and the seventh word, "wenerau" placed after the 35th English word, would be known to very few Maori and even fewer Pakeha. Study participants were asked to give the definitions of all 42 words, and the test was not discontinued following five consecutive failures. This was to circumvent the finding in the previous study (Ogden & McFarlane-Nathan, 1997) that some words later in the WAIS-R Vocab list were more likely to be defined correctly than words earlier in the list. For example, the words "perimeter" and "obstruct" were defined correctly by most of the Maori men in the Ogden and McFarlane-Nathan (1997) study, usually by association with NZ's national sport, Rugby.

Controlled Oral Word Association — Maori Alternative (COWA-M). A number of people in NZ, and especially Maori, use English and Maori words interchangeably as part of their everyday language, although they may not be equally fluent in both languages. We thought that the validity of the COWA test would be increased if the instructions and examples were changed to signal that either English or Maori words would be acceptable responses. The Maori alphabet does not include F and S, two of the letters in the most common version of the COWA test, which uses F, A and S. To allow Maori as well as English words we selected three letters, T, P and W because all have a reasonably high frequency as the beginning letters of words in both languages (see Appendix 1 for the adapted instructions for COWA-M).

Logical Memory — Maori Alternative (LM-M). The LM-M test stories developed for a previous study (Ogden & McFarlane, 1997) were refined slightly for this study, based on the comments of participants in the previous study. Immediate and 30-minute delayed recall trials are given and scored in the same way as for the WMS-R LM test. Each story has 25 "bits" of information or ideas to be recalled. The score is the total recalled from both stories, with a maximum score of 50 (see Appendix 2).

Order of Test Administration

The test battery was administered to each participant in the following order: CFT, copy; 3-minute break; CFT 3-minute immediate recall trial; WMS-R LM immediate recall trial; DSp; COWA-M; CFT 20-minute delayed recall trial; DSy; LM 20-minute delayed recall trial; 10 minute break; LM-M immediate recall trial; Vocab (including the seven Maori words); DFl; SOC; STW; LM-M 20-minute delayed recall trial; TMT.

Prior to administering the test battery, participants were asked to complete a Maori identity (MID) questionnaire regarding their identity with, and involvement in Maori culture and customs. This included six questions about their fluency in the Maori language, their level of participation in the Maori community, and their knowledge of their tribal affiliations. Scores depended on the level of answers, and could be scored 0 to 3 depending on the question. A 0 score was given for a "don't know" answer or if the question was not valid (e.g., tribal affiliations for white New Zealanders). The maximum score possible was 10. The MID form was developed for the purpose of deriving a measure of Maori identity that could later be used to assess whether Maori with a higher Maori identity score performed better on Maori Alternative tests than those with a lower Maori identity score, or Pakeha. Questions pertaining to the participant's views of the content and procedure of the assessment immediately followed the test battery. Attitudes towards the tests and assessment procedure were also sought at this time.

General Hypothesis

We hypothesised that, overall, Maori would perform at a lower level than Pakeha of the same age, gender and educational status on tests which appear to rely on dominant (Western) verbal concepts and knowledge (identified by their cultural specificity), and perform at the same level as Pakeha on tests that appear less reliant on these concepts (e.g., for Maori, tests which rely more on visuospatial abilities).

Specific Predictions

(a) The MID form was designed to measure Maori identity, thus we hypothesised that Maori would have significantly higher scores than Pakeha on the MID form.

(b) Maori with higher MID scores would perform at a higher level on Maori Alternative tests (Vocab-M, COWA-M, LM-M) and report more positive attitudes and opinions regarding these tests than Maori with lower MID scores, and Pakeha.

(c) As all participants had low education levels we hypothesised that they would all perform within the low average to average range on the following verbal tests: SOC and STW from the SCOLP, WAIS-R Vocabulary; and LM, but because of culturally-inappropriate test content Maori would perform at a lower level than Pakeha and would report more negative attitudes and opinions regarding these tests.

(d) DFl, TMT, CFT, DSp and DSy appear to contain fewer culture-specific elements: thus we hypothesised that Maori and Pakeha would perform at similar levels and report similar attitudes and opinions towards these tests.

(e) Estimated IQ from STW and the WAIS-R Vocab scaled score would be significantly positively correlated for all participants as both estimate IQ based on knowledge of English vocabulary.

Results

Quantitative Results

The mean age for all participants was 20.05 (*SD* 3.87) years. The mean age for the Maori group was 19.60 (*SD* 3.63) years, and 20.50 (*SD* 4.14) years for the Pakeha group. None of the participants reported having sustained a TBI (mild to severe) in the past 2 years. Only one Maori man reported that he thought he had been concussed for a minute or two (during rugby) more than 2 years previously, but said that he did not seek medical attention for this and did not remember noticing any problems afterwards. All but three participants admitted to drinking alcohol, and 21 participants admitted to regular cannabis use. Maori men were more likely to admit to frequent cannabis use than the other participant groups. The possible influence of cannabis use (none, moderate or frequent) on test results was therefore analysed for tests where scores differed across groups.

Means, standard deviations and ranges were calculated for each test for the Maori and Pakeha groups, and for women and men in each of the two ethnic groups. Statistical analyses compared the performance of participant groups on all the

TABLE 1
Mean Scores of Participants and Published Age-appropriate Means

Test	Maori		Pakeha		Published Norms	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
Vocabulary	7.5	1.6	9.0	1.8**	10.0	3.0
Vocabulary — Maori	7.4	1.6	8.1	1.4	N/A	N/A
Spot-The-Word	7.6	2.1	8.6	2.8	10.0	3.0
Speed of Comprehension	7.1	2.7	9.2	3.6*	10.0	3.0
Digit Span	10.7	2.4	10.7	2.0	10.0	3.0
Digit Symbol	9.1	2.6	9.6	2.1	10.0	3.0
Trails A (seconds)	27.8	8.4	27.9	9.3	27.4	9.6
Trails B (seconds)	60.3	20.8	57.2	14.3*	58.7	15.9
Controlled Oral Word Association — Maori (T, P, W) Total words 3 mins	39.6	10.5	38.9	10.6	35.5	—
Design Fluency, free condn, Total designs 5 mins	17.0	7.5	16.8	7.7	16.2	—
Complex Figure Test Copy	31.6	2.5	33.1	2.3	35.2	1.5
Complex Figure Test Delayed Recall	19.8	5.2	22.8	6.8	25.9	3.9
Logical Memory, immediate recall	19.4	7.4	25.4	7.2*	25.7	7.3
Logical Memory, delayed recall	16.4	8.8	21.6	7.3*	22.1	7.6
Logical Memory-Maori, immediate recall	21.1	8.0	20.2	6.4	N/A	N/A
Logical Memory-Maori, delayed recall	17.4	9.2	17.5	6.6	N/A	N/A

Note: * $p = .05$; ** $p = .01$; N/A = Not applicable

tests. On WAIS-R subtests, age-scaled scores were used for all comparisons. A probability level of .01 was used for all statistical tests due to the large number of analyses performed. Table 1 gives the test means for the two ethnic groups along with published norms where available.

Maori Identity

A one-way *t* test demonstrated a significant difference in the expected direction between the mean scores of the two ethnic groups on the MID form, $t(38) = 8.53$, $p < .0001$. The mean score for the Maori group was 5.85, $SD = 1.69$, range = 2.00–8.00; and for the Pakeha group it was 1.80, $SD = 1.28$, range = 0.00–4.00 (note the maximum possible score was 10).

Vocabulary Tests

Spot-The-Word. Normative data are provided by the Thames Valley Test Company (1992) and are based on 224 normal British subjects. Norms were constructed following Wechsler's (1981) procedure by converting the distribution of raw scores of the sample group to a scale with a mean of 10 and a standard deviation of three. The data are presented in the form of age norms. While the mean age-scaled scores for Maori were lower than those for Pakeha, a two-way analysis of variance revealed no significant main effects for ethnicity or gender, and no significant interaction. Normative data indicate that the mean age scaled scores for all six groupings fall within the normal range.

Vocabulary. A two-way ANOVA revealed a significant main effect for ethnicity, $F(3, 36) = 7.88$, $p < .01$, with Pakeha scoring higher than Maori. No significant interactions were found. Bivariate Pearson Product-Moment correlations revealed a significant positive relationship between age-scaled scores on Vocab and STW ($r = 0.55$, $p < .001$), thus supporting the hypothesis that both are a measure of estimated Verbal IQ.

Vocab-M. A two-way ANOVA revealed no significant main effects for ethnicity or gender, and no significant interactions. Bivariate Pearson Product-Moment correlations revealed a significant positive relationship between scores on the MID and the seven Maori words ($r = 0.73$, $p < .001$), and a modest negative correlation which approached significance for scores on the MID and the seven English words immediately preceding the Maori words ($r = –0.35$, $p = .03$); that is the higher the Maori identity, the higher the score on the Maori words and the lower the score on English words.

Comparisons between Vocab and Vocab-M. When comparing the two versions of the Vocab test, only the seven Maori words and the seven English words preceding them were compared. The mean scores of both groups were at a lower level on Vocab-M than on the WAIS-R Vocab subtest. A two-way repeated measures ANOVA (using raw scores) revealed a significant main effect for word type (English vs. Maori), $F(1, 38) = 37.85$, $p < .001$, where all 40 participants gave more correct meanings for English words. Maori obtained a mean of 5.00, $SD = 2.77$, and Pakeha obtained a mean of 6.75, $SD = 2.63$ for the seven English words. For the seven Maori words, Maori obtained a mean of 3.90, $SD = 2.12$, and Pakeha a mean of 1.30, $SD = 1.13$. Note that the maximum score for the seven words in each language was 14. In addition, an interaction between word type and ethnicity was significant, $F(1, 38) = 16.69$, $p < .001$, with the difference between the scores for English and Maori words being greater for Pakeha than for Maori participants.

Logical Memory Tests

LM. Two-way ANOVAs revealed no significant main effects for ethnicity or gender, and no significant interactions for either the immediate or delayed recall trials of LM. However, ethnicity tended towards significance for LM, immediate recall, $F(3, 36) = 6.36$, $p = .016$, and for LM, delayed recall, $F(3, 36) = 3.98$, $p = .053$. On both tests, Pakeha achieved a higher score than Maori. Bivariate correlations revealed significant negative correlations between the MID score and the LM immediate scores ($r = –.48$, $p < .01$), and MID and the delayed recall scores ($r = –.42$, $p < .01$), with participants who had a stronger Maori identity scoring more poorly.

LM-M. Two-way ANOVAs revealed no significant main effects for ethnicity or gender, and no significant interactions for either the immediate or delayed recall trials of LM-M. Bivariate correlations revealed no significant correlations between the MID scores and the LM-M scores.

Comparison across the two forms of Logical Memory. Two-way repeated measures ANOVAs were computed for immediate and delayed recall scores, with "ethnicity" a between subject's factor, and test form (LM or LM-M) a within subject's factor. For immediate recall there were no significant main effects, but there was a significant interaction between ethnicity and test form, $F(1, 38) = 10.58$, $p = .002$, such that Maori performance improved between LM and LM-M, but Pakeha performance worsened. Similarly for

delayed recall, there were no significant main effects but the interaction between ethnicity and test form approached significance, F (1, 38) = 6.12, p = .018, such that Maori performance improved between LM and LM-M, but Pakeha performance worsened.

Tests with Non-significant Findings when Maori and Pakeha Scores Were Compared

A two-way ANOVA demonstrated no significant differences between Maori and Pakeha on their scores for COWA-M, although 85% (or 17/20) Maori gave one or more correct Maori words (range = 1–16) compared to 20% (or 4/20) Pakeha (range = 1–3). A bivariate Pearson Product-Moment correlation revealed a significant positive relationship between scores on the MID and the number of Maori words given in the COWA-M test (r = 0.54; p < .001), with participants who had a strong Maori identity responding with more Maori words.

A two-way ANOVA demonstrated no significant differences between Maori and Pakeha on their scores for DSp, DSy, DFl, SOC, TMT, or on the CFT-copy or delayed recall trials. On the CFT-copy, 45% (9/20) Maori and 40% (8/20) of Pakeha used a piecemeal approach when copying the Rey figure. To assess whether a piecemeal approach to the copy of the CFT lowered copy and delayed recall scores, t tests comparing copy and delayed recall scores of participants who used a piecemeal approach with those who used a "logical" approach were computed, with no significant differences found.

On the DSy test there was a significant main effect for gender, with women performing better than men, F (3, 36) = 13.76, p = .001. The mean age scaled score for women was 10.55 (SD = 2.33) and 8.1 (SD = 1.74) for men. On the DFl, DSy, and TMT, the scores of the Maori men were lower (although this did not reach significance) than the scores of all other groups. Given that aspects of these tests are to some extent reliant on processes that are sensitive to diffuse brain damage that can be caused by drug use or central nervous system depressants, and given the high number of Maori men who admitted to high levels of cannabis use, in contrast to Maori women and Pakeha, we hypothesised that these lowered scores may be the result of drug taking. To test this we carried out one-way analyses of variance for each of these tests for all participants. The independent variable was drug use with three levels: 1 = non user (n = 19); 2 = moderate user (n = 15); 3 = frequent user (n = 6). No significant findings were revealed, although a main effect for drugs on Part B of the TMT did approach significance, F (1, 37) = 3.54, p = .04; that is those participants using drugs tended to take longer to complete Part B. Given the very small number of participants who did not use alcohol (n = 3), the effect of alcohol on performance was not investigated.

Qualitative Results

Eighteen of the 20 participants in each ethnic group completed the questions on their attitudes to test content and assessment procedures. In contrast to the negative attitudes of 83% of Maori and 66% of Pakeha participants to tests in general (the remainder were "indifferent"), 50% of Maori and 78% of Pakeha participants expressed a positive attitude to the study assessment. Only four Maori and one Pakeha were negative, and the remainder were indifferent. Most Maori participants (83%) were positive about the Maori content in the tests or embedded within the instructions. The Pakeha participants were generally positive (33%) or indifferent (28%) to the Maori content. Only two Maori and five Pakeha did not like the Maori content. A comment typical of those expressing support for the Maori content in tests was "It was good to see that its in there instead of totally ignoring it like other tests do" (from a Maori participant), and "It would be good for Maori to see, and then if they got it right they'll feel good about themselves and keep going" (from a Pakeha participant).

The tests enjoyed most by the Maori participants, with numbers of participants out of 18 respondents who enjoyed them in brackets, were LM-M (17), Vocab-M (15), TMT (14), DSy (14), DSp Forwards (13), CFT (12) and COWA-M (10). The tests liked by the fewest Maori participants were Design Fluency (5), Vocab (3), and STW (1). The Pakeha participants showed a very similar preference pattern, with only two reversals; 9/18 Pakeha liked Vocab, and only 4/18 Pakeha liked Vocab-M.

With respect to contextual factors, 56% of Maori and 61% of Pakeha would prefer to be assessed in a familiar environment (e.g., at home). Both groups (72% in each) preferred *not* to have family members present at the assessment. Typical comments indicated that the participant would feel too shy to perform in the presence of others. Most Maori (61%) and Pakeha (72%) believed that it was important for the assessor to spend time building rapport with the client. As one Maori client commented, "It's real important — if you're not comfortable you won't end up doing it

properly". Surprisingly, only one participant (a Maori) had a preference for an assessor of the same ethnic group as the client, and all other participants said they did not mind whether the assessor was Maori or Pakeha. Maori clients did, however, comment that it was important for the assessor to be culturally sensitive.

Discussion

The hypotheses were generally supported, in that two of the tests most dependent on formal western education and culture (Vocabulary and Logical Memory) were those on which the Pakeha group scored better than the Maori group at, or close to the $p = .01$ significance level. In contrast, the Maori participants performed within the published means and the means of the Pakeha control group on the Rey Complex Figure and Design Fluency, both tests with content strongly aligned to the visuospatial abilities valued in Maori culture. On tests of attention and concentration, which are less likely to depend on formal education or culturally-specific knowledge (Digit Span, Digit Symbol, Trail-Making Test) the Maori and Pakeha mean scores did not differ from each other, nor from published norms.

On two tests where Maori content either replaced the western content (Logical Memory-Maori) or was inserted in the instructions and permitted in the responses to make them more "Maori-friendly" (Controlled Oral Word Association-Maori), Maori either improved their scores relative to the western version (i.e., on Logical Memory-Maori), or performed as well as Pakeha (i.e., on Controlled Oral Word Association-Maori). Maori participants particularly enjoyed these Maori-friendly tests. Design Fluency, a test which was included because it was believed that Maori might enjoy it, was experienced as difficult by both Maori and Pakeha participants. It was also very difficult to score, and therefore we suggest excluding it from future neuropsychological test batteries. Although Pakeha did not do quite so well on the Logical Memory-Maori test as on the Logical Memory test, their scores did not differ significantly from those of their Maori compatriots. If normative data were gathered across a larger cross-section of New Zealanders on this test it might prove to be a useful cross-cultural verbal memory test for New Zealanders generally.

Spot-The-Word, which was included to see whether it might be more acceptable than the NART, was not liked by 78% of Maori ("Didn't like that one because I didn't know the words"), nor by 56% of Pakeha ("I hated it — made me feel stupid"). Never-the-less, the difference between Maori and Pakeha scores on Spot-the-Word was not significant, although they were on Vocabulary. Given that Vocabulary and Spot-the-Word scores were significantly correlated, suggesting that both are measuring the same factor and are equivalent measures of Verbal IQ estimate, it may be better to use Spot-the-Word with Maori participants. Both Vocabulary and Spot-The-Word estimated the participants' Verbal IQs to be at the low end of the Average range, which is probably reasonable for this particular cohort. However, the "western" content of both these tests remains a validity issue, and estimating "true" IQ based on either of these tests is not ideal for Maori who are not acculturated into the dominant white culture. For example it is feasible that an acclaimed Maori novelist who writes in Maori (but is also fluent in English) could score at a level much lower than his or her "true" IQ on these tests. The Vocabulary-Maori test proved to be more difficult than the Vocabulary test for both Maori and Pakeha (although more so for Pakeha). It seems likely that the failure of this test was a result of an inappropriate choice of Maori words. Even the easiest words as selected by the fluent Maori speakers were not known to most of the young Maori in this particular socioeconomic and educational cohort. Nevertheless, the high number of Maori who liked Vocab-M even though their scores on this were marginally lower than their scores on Vocab, demonstrates the importance of Maori-friendly content in neuropsychological tests in order to improve motivation to perform. Clearly further research on better adaptations of the Vocabulary subtest is required if it is to be considered for use for this population.

The piecemeal copy of the Rey Complex Figure, seen in a high proportion of both Maori and Pakeha participants, was a surprise finding. This was also found in the Ogden amd McFarlane-Nathan (1997) study, but it was suggested that this might be a Maori-specific finding, as only Maori men were assessed. However, this has not been supported, as in this study many Pakeha participants in the same low socioeconomic and educational group also copied the drawing piecemeal. One possibility is that copying a figure like this in a "logical" way may be a function of formal western education; for example experience with geometry. Rosselli and Ardila (1991) found that the Rey Complex Figure was highly sensitive to education levels despite being a nonverbal test. Whatever the reason for the piecemeal approach, this finding suggests that as long as the copy score is at least average, neuropsychologists should be

cautious about interpreting a piecemeal approach as abnormal if observed in clients with a poor education or low average or poorer scores on verbal tests.

This study is small, and was carried out on groups of young adults in the low socioeconomic groups. Thus the findings are only suggestive, but generally support the importance of developing neuropsychological assessment instruments and normative data for minority groups. It is also important to ensure that the assessment is culturally-friendly in every way possible, as this can only improve the validity of the assessment, and encourage the client to participate in any future assessments and rehabilitation programs. Large-scale validation studies are needed for the tests that appear promising for Maori (Logical Memory-Maori, Controlled Oral Word Association with Maori-friendly instructions). A tentative conclusion is that some commonly-used tests including Digit Span, Digit Symbol, Trail-Making test and the Rey Complex Figure appear to be as suitable for the "average" young Maori adult as for Pakeha, and that the published normative data may be appropriate for Maori. A previous study (Ogden & McFarlane-Nathan, 1997) also demonstrated that the Block Design and Selective Reminding tests and their published normative data might be appropriate for young Maori. Larger validation studies would give clinicians more confidence that this is indeed the case.

Until these larger studies are conducted we suggest that some verbal tests that rely heavily on formal western education or include culturally-alien concepts (such as Vocabulary and Logical Memory) are avoided when assessing Maori in this socioeconomic group. Other tests, such as Spot-The-Word and Design Fluency are disliked by Maori (and Pakeha), and thus should be avoided when possible, although if some measure of estimated Verbal IQ is required, Spot-The-Word may be the least distressing (when compared with the NART), and could be used as one aspect of such an estimate. It is always important to obtain other qualitative information to improve any estimate of premorbid abilities.

Although the simple Maori Identity questionnaire used did demonstrate that, in this cohort at least, participants who knew more about their Maori heritage tended to score more poorly on tests like Vocabulary, this may not hold for all Maori. It is clear that some Maori can be highly acculturated into the western culture and thus perform well on tests like Vocabulary, but still have a strong Maori Identity and score well on the Maori Identity questionnaire. There is also a danger in giving Maori such a questionnaire, as some Maori may feel embarrassed that they cannot answer some of the questions (e.g., "Can you speak Maori fluently, in conversation, a little, not at all?"). Not only is such a question open to different interpretations regarding level of linguistic competence, many Maori may not be able to speak Maori but strongly identify as Maori. A sensitive interview is more likely to provide the neuropsychologist with information not only about Maori identity, but also about level of acculturation. Both types of information will guide the neuropsychologist regarding the importance of following a Maori-friendly assessment process and including tests with Maori content.

Whilst Maori participants did not appear to be concerned by the ethnicity of the neuropsychologist assessing them as long as he or she was culturally sensitive, their responses may have been influenced by the likelihood that, apart from this research study, they are unlikely to have had much experience of what it *could* be like to interact with a professional from their own culture. Even "culturally sensitive" neuropsychologists from the dominant cultural group would be wise to seek consultation from a psychologist from the minority ethnic group whenever they assess or are involved in the rehabilitation of a client from the minority group. Even if the "consultant" is not a neuropsychologist they may well be able to assist in interpretation of qualitative data.

In all countries where there are significant minority cultural groups, neuropsychologists need to be alert to the problems inherent in the use of many of our commonly-used tests. There is an urgent need for large-scale validation studies for each minority to find out which of our common tests can be used validly with those groups. In some cases, simply adapting the instructions to incorporate appropriate cultural examples, or replacing some of the content with new content that is more culturally meaningful, may increase the motivation of the individual to do his or her best on the test. The assessment situation and assessment procedures are also important, and these too may require adaptation for specific cultures. It must not be forgotten that, although oppressed minorities may have many things in common, *what* they have in common cannot be assumed. For example, Kaufman et al.'s (1988) re-analysis of the original WAIS-R data found that African-Americans scored well below white Americans on both Vocabulary and Block Design. In the Ogden and McFarlane-Nathan (1997) study, poorly educated Maori men

from a low socioeconomic background scored almost 1 *SD above* the mean on Block Design and almost 1 *SD below* the mean on Vocabulary. Clearly it is not appropriate to make generalisations about "normal" patterns of abilities across minority groups any more than it is valid to do so across Pakeha and Maori, or across American Whites and African Americans. Our task, preferably in collaboration with the minority groups of focus, is to develop a range of tests that will assess those abilities shared by all humans (e.g., verbal and visuospatial functions, memory, executive functions), but using material, content and processes valued by the specific minority group. Perhaps we will then be on the road to righting some of the inequities in our society.

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References

Barnfield, T.V., & Leathem, J.M. (1998). Incidence and outcomes of traumatic brain injury and substance abuse in a New Zealand prison population. *Brain Injury, 12,* 455–466.

Buschke, H., & Fuld, P.A. (1974). Evaluating storage, retention, and retrieval in disordered memory and learning. *Neurology, 11,* 1019–1025.

Department of Corrections. (2000). *Census of Prison Inmates 1999*. Wellington, Dept of Corrections.

Dubois, P.H. (1939). A test standardised on Pueblo Indian children. *Psychological Bulletin, 36,* 523–545.

Jones-Gotman, M., & Milner, B. (1977). Design Fluency: The invention of nonsense drawings after focal cortical lesions. *Neuropsychologia, 15,* 653–674.

Kaufman, A., McLean, J., & Reynolds, C. (1988). Sex, race, residence, region. and education differences on the 11 WAIS-R subtests. *Journal of Clinical Psychology, 44,* 231–248.

Meyers, J.E., & Meyers, K.R. (1995*). Rey Complex Figure Test and Recognition Trial: Professional Manual.* Florida: Psychological Assessment Resources.

Nelson, H.E., & Willison, J. (1991). *National Adult Reading Test (NART)* (2nd ed). Windsor: NFER-Nelson.

Ogden, J. A. (1996) *Fractured minds: A case-study approach to clinical neuropsychology.* New York: Oxford University Press.

Ogden, J.A. & McFarlane-Nathan, G. (1997). Cultural bias in the neuropsychological assessment of young Maori men. *NZ Journal of Psychology, 26,* 2–12.

Ogden, J.A. (2001). First do no harm. Culturally-appropriate neuropsychological assessment for indigenous people: A position paper. *Brain Impairment, 2,* 1–10.

Pomare, E., Keefe-Ormsby, V., Ormsby, C., Pearce, N., Reid, P., Robson, B., et al. (1995). *Hauora: Maori Standards of Health III — A Study of the Years 1970–1991*. Wellington: Te Ropu Rangahau Hauora a Eru Pomare.

Porteus, S.D. (1931). *The Psychology of a Primitive People*. New York: Longmans, Green.

Rey, A. (1941). L'examen psychologique dans les cas d'encephalopathie traumatique. *Archives de Psychologie, 28,* 286–340.

Rosselli, M., & Ardila, A. (1991). Effects of age, education and gender on the Rey Osterrieth Complex Figure. *The Clinical Neuropsychologist, 5,* 370–376.

Spreen, O., & Strauss, E. (1991*). A Compendium of Neuropsychological Tests.* New York: Oxford University Press.

Statistics New Zealand. (1994). *1991 Census of Population and Dwellings: Population Overview*. Wellington: Statistics New Zealand.

Statistics New Zealand (1997). *Census 96: Maori*. Wellington: Statistics New Zealand.

Statistics New Zealand (2002). *2001 Census of Population and Dwellings: Population Overview*. Wellington: Statistics New Zealand.

Te Puni Kokiri: Ministry of Maori Development. (1993a). *He Kakano: A Handbook of Maori Health Data.* Wellington: Ministry of Maori Development.

Te Puni Kokiri: Ministry of Maori Development. (1993b). *Nga ia o te Oranga Hinengaro Maori — Trends in Maori Mental Health: A Discussion Document*. Wellington: Ministry of Maori Development.

Thames Valley Test Company. (1992). *The Speed and Capacity of Language-Processing Test Manual*. Suffolk, England: The Medical Research Council.

Wechsler, D. (1981). *WAIS-R Manual.* New York: Psychological Corporation.

Wechsler, D. (1987). *Wechsler Memory Scale-Revised. Manual.* San Antonio: The Psychological Corporation.

Appendix A

Controlled Oral Word Association – Maori Instructions

We have another task to do. Shortly, I will ask you to tell me some words which begin with one of the letters of the alphabet. I will tell you the letter and then I will give you one minute to tell me as many words as you can which begin with that letter. Try to tell me as quickly as you can. For example, if I say "K", you might say to me "kitchen, korero, kick, kai".

In this exercise we don't want you to use words which begin with a capital letter like names of brands, people or places, such as Kaitaia and Kelly. Also, don't say numbers; or different forms of the same word such as "eat" and "eating", or "karanga, karangatia or kaikaranga".

Do you have any questions? You can begin telling me the words as soon as I say the letter. When you are ready we will begin. Shall we start now?

The first letter is … T

The second letter is … P

The third letter is … W

Stop the participant after 60 seconds for each letter.

Appendix B

Logical Memory – Maori Stories

Administer both stories. Score 1 point for each correct item.

Logical Memory I – Maori	*Score*
Story A Bill / Ramaki / of Tai Tokerau / had a job / putting down hangi / for his local marae. / One evening / two whole pigs / and three bags / of kumara / were dropped off / at his place / for a big hui / the following day. / Bill was down the road / at his mother's place / playing cards. / When he came home / expecting to see / the kai / he couldn't / find anything. / He immediately contacted / his kuia / and kaumatua. / Max. = 25 Total Story A	
Story B Mere / Pomare / heard that / one of her uncles / had been killed / in an accident / in the bush. / She went to his tangi / at Ngaruawahia / with some of her cousins. / She cried a lot / when she heard / the women / doing the karanga / and wailing. / Everyone / was talking about / what a hard case / and a good man / her uncle had been. / She really enjoyed / meeting up with / all of her / relations / who were there. / Max. = 25 Total Story B	
Max. = 50 Record Clock Time: Total Sum of Stories A + B	