View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Scholarship at UWindsor

University of Windsor
Scholarship at UWindsor

Electronic Theses and Dissertations

1996

Test re-test reliability of the Boston Naming Test and the Visual Naming Test on normal subjects with a comparison to subjects with complex partial seizure disorder.

Janet Lynn. Murray
University of Windsor

Follow this and additional works at: http://scholar.uwindsor.ca/etd

Recommended Citation

Murray, Janet Lynn., "Test re-test reliability of the Boston Naming Test and the Visual Naming Test on normal subjects with a comparison to subjects with complex partial seizure disorder." (1996). *Electronic Theses and Dissertations.* Paper 3733.

This online database contains the full-text of PhD dissertations and Masters' theses of University of Windsor students from 1954 forward. These documents are made available for personal study and research purposes only, in accordance with the Canadian Copyright Act and the Creative Commons license—CC BY-NC-ND (Attribution, Non-Commercial, No Derivative Works). Under this license, works must always be attributed to the copyright holder (original author), cannot be used for any commercial purposes, and may not be altered. Any other use would require the permission of the copyright holder. Students may inquire about withdrawing their dissertation and/or thesis from this database. For additional inquiries, please contact the repository administrator via email (scholarship@uwindsor.ca) or by telephone at 519-253-3000ext. 3208.

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

TEST RE-TEST RELIABILITY OF THE BOSTON NAMING TEST AND THE VISUAL NAMING TEST ON NORMAL SUBJECTS WITH A COMPARISON TO SUBJECTS WITH COMPLEX PARTIAL SEIZURE DISORDER

by

Janet L. Murray

B.A. University of Windsor, 1994

A Thesis Submitted to the
Faculty of Graduate Studies and Research
through the Department of Psychology
in Partial Fulfillment of the
Requirements for the Degree
of Master of Arts at the
University of Windsor
Windsor, Ontario, Canada
1996

Copyright 1996 Windsor, Ontario, Canada

National Library of Canada
Acquisitions and Bibliographic Services
395 Wellington Street
Ottawa ON K1A 0N4
Canada

Bibliothèque nationale du Canada
Acquisitions et services bibliographiques
395, rue Wellington
Ottawa ON K1A 0N4
Canada

Your file Votre référence

Our file Notre référence

The author has granted a non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of this thesis in microform, paper or electronic formats.

L'auteur a accordé une licence non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de cette thèse sous la forme de microfiche/film, de reproduction sur papier ou sur format électronique.

The author retains ownership of the copyright in this thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without the author's permission.

L'auteur conserve la propriété du droit d'auteur qui protège cette thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

0-612-30921-5

Canada

ABSTRACT

A number of neurological illnesses including temporal lobe epilepsy have been shown to result in deficits of confrontation naming or anomia. The Boston Naming Test (BNT) and the Visual Naming Test (VNT) are both standardized measures of naming ability. Serving as a neurologically intact group, thirty adult volunteers from the Windsor area were administered the BNT, VNT and the Controlled Oral Word Association Test (COWAT) on two occasions separated by a two month interval. Temporal stability of these measures was demonstrated by the high correlation between test re-test scores for the BNT, VNT and COWAT, respectively. Excellent intertest agreement of the BNT and VNT was shown by the high correlation of scores between the two tests. The BNT was administered as part of a Neuropsychological examination at the London Health Sciences Center-University Campus in London Ontario. Thirty-three and forty subjects with left temporal lobe epilepsy (L-TLE) and right temporal lobe epilepsy (R-TLE), respectively were administered the BNT. The L-TLE group performed significantly worse on the BNT compared to the normal and the R-TLE. The R-TLE group scored significantly lower on the BNT than the normal group. Implications for importance of the left inferior temporal lobe in relation to naming ability are discussed.

DEDICATION

I would like to dedicate this thesis to my father who has been an endless source of support and encouragement. Dad, you are a hero in my eyes.

ACKNOWLEDGMENTS

I would like to thank the members of my committee for their time, patients and assistance throughout the completion of this research. Dr. Doug Shore for his guidance and constructive criticism. Dr. David Reynolds for providing a unique view point, and Dr. Pinto for his humor and helpful comments. I would also like to thank Dr. Michael Harnedek who conceived this project and provided both data and useful commentary. In addition, I must thank Neil McTavish and the people at Outreach for their assistance in recruiting subjects as well as the people at the Aiki Centre of Canada. Finally, I owe a debt of gratitude to Michael Willetts for his support and faith in myself and my endeavors.

TABLE OF CONTENTS

page

ABSTRACT..iii

DEDICATION..iv

ACKNOWLEDGMENTS...v

LIST OF TABLES..viii

LIST OF FIGURES...ix

Chapter

I

INTRODUCTION...1

The BNT..................................1

Performance Correlates of the BNT.........3

Right-Left Differences in BNT Performance.4

Normative Data...........................6

The VNT..................................8

Normative Data for the VNT...............9

Validity of the BNT and VNT..............10

Naming Ability and Complex Partial Seizure Disorder.................................12

Statement of Purpose and Hypothesis......14

II

METHOD...16

Subjects.................................16

Procedure................................17

III

RESULTS..18

page

IV

DISCUSSION..26

Summary...............................33

Suggestions for future research...........35

REFERENCES..36

APPENDIX

Administration of the BNT.................41

Performance Correlates of the BNT.........43

Administration of the VNT.................44

VITA AUCTORIS.......................................46

LIST OF TABLES

Table Page

1 Summary of Standard Regression Analysis for Variables Predicting BNT_1 Scores..................20

2 Pearson Product Moment Correlation Coefficients Between BNT_1 Performance and Years of Eductions, VIQ, PIQ, FSIQ, and COWAT scores.................21

3 Summary of Standard Regression Analysis for Variables Predicting VNT_1 Scores.................22

4 Pearson Product Moment Correlation Coefficients Between VNT_1 Performance and Years of Eductions, VIQ, PIQ, FSIQ, and COWAT scores.................23

5 Pearson Product Moment Correlation Coefficients Between $COWAT_1$ Performance and Years of Eductions, VIQ, PIQ, FSIQ, and COWAT scores.................24

LIST OF FIGURES

Figures Page

1 Mean Test Re-test Scores for the BNT, VNT and COWAT..19

CHAPTER 1

INTRODUCTION

The everyday conversation of someone suffering anomia (word-finding difficulty) is circumlocutive and marked by an excessive use of phrases such as "that thing" for information bearing nouns and "do" in place of more descriptive action words. Another distinguishing feature is the overabundance of interjections such as "er...ah..." which buy time for word-finding, but interrupt the normal flow of speech (Kirk, 1992). Word-finding is considered the most vulnerable of language functions and hence often serves as a general indicator of left hemisphere dysfunction. One of the most common tests for anomic disturbances is the Boston Naming Test (BNT) of which there are several versions. Another similar, although less widely used test is the Visual Naming Test (VNT) from the Multilingual Aphasia Examination (MAE).

The BNT

The BNT is a measure of confrontation naming (verbally identifying a visually presented stimulus). Three versions of the BNT are currently in popular use. The original version was developed by Borod, Goodglass and Kaplan (1980), consists of 85 items and has subsequently come to be referred to as the 85 item experimental version of the BNT. The most widely used version of the BNT is the 60 item published version which was derived from the 85 item version. Kaplan, Goodglass and Weintraub (1983) utilized 60 of the original 85 drawings and arranged them in a different order to devise this 60 item test. Finally, Huff, Collins, Corkin and Rosen (1986) further modified the BNT by creating two equivalent forms known as the 42 item BNT. This third test was presented as a more time efficient version which accommodates test-re-test situaticns. The three versions correlate with one another with r values ranging between 0.92 and 0.96 which is significant at the .001 level (Thompson & Heaton, 1989). Hence, the three versions are essentially equivalent with regard to test results.

The most widely used version of the BNT relies on normative data derived from small, poorly stratified groups of subjects. Although there is little doubt that the BNT does indeed measure word-finding ability, recent research has demonstrated that BNT scores are significantly influenced by an individual's breadth of vocabulary, reading ability, general intelligence, education, and race. On the other hand, the BNT has been shown to adequately distinguish left hemisphere damage from right hemisphere damage, and can be qualitatively examined to further localize a lesion site.

The present study deals primarily with the 60 item BNT since this is the most widely used version among clinicians, and indeed of all available confrontation naming tests (Butler, Retzlaff & Vanderploeg, 1991). For the sake of convenience, the 60 item test will be herein referred to as the BNT (See Appendix A for a discussion on administration of the BNT).

Performance Correlates of the BNT

Many different factors have been examined to determine their influence on BNT performance. One of the most comprehensive studies was conducted by Thompson and Heaton (1989) who correlated numerous variables with scores on the BNT (See Appendix B). According to this study, the measure which showed the greatest positive correlation with BNT performance was the WAIS-R Vocabulary score. Hence, an individual's vocabulary appears to significantly influence his/her score on the BNT. Following this, Verbal IQ (VIQ), is the next most highly correlated with BNT scores. Full Scale IQ (FSIQ) correlated with BNT performance to an almost identical degree to that of VIQ. This would suggest that an individual's overall level of intellectual functioning, and not solely his/her breadth of vocabulary, is a significant contributor to BNT performance (Thompson & Heaton, 1989). BNT performance is also correlated with an individual's Performance IQ (PIQ) at the .001 level of significance.

Other studies have demonstrated the relationship between vocabulary and the BNT. Hawkins et al. (1993) examined performance on the Gates-MacGinitie Reading Vocabulary test (G-MRVT) and found a positive correlation between the G-MRVT and the BNT ($\underline{r} = .81$, $\underline{p} < .001$). This finding is not surprising given the relationship between reading ability and vocabulary.

BNT scores are reported to negatively correlate with Average Impairment Rating (AIR) and performance on the Aphasia screening test (Thompson & Heaton, 1989). This is consistent with the use of the BNT as a general indicator of neuropsychological impairment.

Years of education was positively correlated with BNT scores ($p < .001$) among the Thompson and Heaton (1989) sample and the Hawkins et al. (1993) sample. Hawkins et al. attributes this relationship to the more unusual items such as a 'trellis' and 'abacus'. Since education is also related to vocabulary, it is likely that both of these variables contribute to the positive correlation between education and the BNT.

Several studies on normal populations have shown no relationship between age and BNT performance (Thompson & Heaton, 1989; Hawkins et al., 1994). Studies using elderly subjects have indicated that BNT performance declines after the age of 80 years, but is unaffected by age prior to the eighth decade (Lichenberg et al., 1994; VanGorp et al., 1986).

Finally, BNT scores do not appear to be affected by clinical depression even though this condition has been shown to negatively influence performance on the WAIS-R (Hawkins et al., 1993). Overall, the above studies demonstrate that BNT scores may not only reflect confrontation naming ability, but are also influenced by vocabulary, reading ability, intellectual functioning, and education. This raises the possibility that use of the BNT may result in misdiagnosis (false-positives) of confrontational naming deficits in individuals with poor vocabulary/reading abilities, less education and lower levels of intellectual functioning.

Right-Left Differences in BNT Performance

Word retrieval is considered the aspect of language functioning most vulnerable to neurological insult. By virtue of the BNT's ability to detect even mild word-retrieval problems, the BNT is considered a sensitive measure of language dysfunction. Following from this, since language occupies considerable functional space within the left hemisphere, the BNT is also often considered a general indicator of left hemisphere damage. This concept is considered valid for adults (Howell, Saling, Bradley, & Berkovic, 1994; Hermann, Seidenberg, Haltiner & Wyler, 1992). However, in the case of children, BNT scores have been shown to be affected by right hemisphere as well as left hemisphere damage (Kirk, 1992).

Several studies have shown BNT scores to be unaffected by chronic right hemisphere dysfunction or right hemisphere insult after the initial acute phase. The majority of these studies have examined BNT performance in individuals with temporal lobe epilepsy (TLE). Representative of these studies are Howell et al. (1994) and Hermann et al. (1992) who found significantly lower scores on the BNT among subjects with left temporal lobe epilepsy compared both to subjects with right temporal lobe epilepsy and normal subjects. The latter two groups displayed no differences in performance on the BNT.

Examination of the types of errors made on the BNT may be useful in determining the type of aphasia present and possibly the location of the lesion within the left hemisphere. Subjects with Broca's aphasia produce the most negative errors (responding with an unrelated word, e.g. tiger for a picture of a bed); anomic aphasics make the most phonemic and part-whole errors (naming part of the object instead of the whole object) and are the most circumlocutive. Wernicke's aphasics are not characterized by one particular type of error, but they rarely respond to phonemic cueing (Kohn & Goodglass, 1985). Hence, while significant impairment on the BNT is indicative of left hemisphere damage, some have suggested that a qualitative examination of the type of errors can help localize the lesion within that hemisphere (Lezak, 1995; Kohn & Goodglass, 1985).

Normative Data

"Provisional norms" accompanied the publication of the BNT in 1983 by Kaplan, Goodglass, and Weintraub. These norms were based on normal subjects at different ages, and aphasics at differing levels of severity. The "provisional norms" are based on a small number of subjects and are divided into two sets of adult norms. The first is based on 12 years or less of schooling verses more that 12 years of schooling. The second set is based on age and is broken down into five different age groups (Kaplan, Goodglass & Weintraub 1983). The means and standard deviations vary little across the groups. Specifically, the means for the two education groups are 55.73 and 55.77 for a non-significant difference of .02. With regard to age, the greatest difference was between the 20-29-year-olds with a mean of 55.86 and the 50-59-year-olds with a mean of 55.82 for a non-significant difference of .04 (Thompson & Heaton, 1989). These norms are generally considered inadequate because they do not include any information about variables which correlate with BNT performance, nor do they include any information about the reliability or validity of the BNT. In addition, all the normative subjects were gathered from the staff at a Boston Hospital (Thompson & Heaton, 1989). Although considered inadequate, these provisional norms are currently in widespread usage (Thompson & Heaton, 1989).

Since the publication of the BNT, several researchers have generated new sets of normative data which include children, the elderly, different ethnic populations, and neurologically impaired subjects. Indeed, a recent study by Yeates (1994) compared different published norms for children and found that the differences between the five available sets of norms reached significance ($p<.05$) at five of the eight age levels. Yeates suggests that the differences are due to variations in the ethnic and geographic composition of the different samples. Based on visual inspection, Yeates suggests that this may also be the case for the available adult norms, although no such study of the adult norms has been conducted to date.

The "provisional norms" also included limited norms for children based on a restricted age range including only children from ages 5- to 10-years-old. The most extensive children's norms to date were published by Kirk (1992) who tested 424 children (236 boys and 188 girls; ages 5-13 years). At the other end of the spectrum, normative data on the BNT for the elderly was extremely limited prior to the publication of a study by Lichtenberg, Ross, and Christensen (1994). These researchers normed the BNT on 57 physically ill or injured subjects who were consecutively referred to a rehabilitation institute.

Overall, review of the available norms for the BNT highlights the need for better stratified samples which include studies of the reliability and validity of the BNT. In the interim, as with most neuropsychological tests, collaborative evidence (from observation or other measures) should be present before concluding that a patient is suffering dysnomia.

The VNT

The VNT is one of eleven subtests of the MAE. The MAE was designed to detect the presence of an aphasic disorder and to assess the severity and qualitative aspects of the disorder. In accomplishing this task, the subtest of the

MAE address: (1) oral expression, (2) oral verbal understanding, (3) reading comprehension, and (4) three different forms of spelling. The VNT is considered part of the first category as it evaluates one aspect of oral expression - confrontation naming. The stated purpose of the test is to evaluate an individual's ability to verbally apply semantically correct labels to visually presented stimuli, separate from articulation deficits or lack of recognition (Benton & Hamsher, 1994). In this way the VNT measures only one specific linguistic capacity and not the subject's overall ability to communicate. To achieve this end, facilitation of visual recognition and allowances for speech disturbances are permissible under certain circumstances (See Appendix C).

Normative Data for the VNT

The MAE was standardized on 360 normal subjects who spoke English as their first language. Individuals with a history of brain injury, psychiatric disorder, or mental retardation were excluded from the standardization sample. The normative sample ranged in age from 16 to 65 years and was divided into cells based on age, education, and gender (Benton & Hamsher, 1994).

Like the BNT, normative performance on the VNT is correlated with years of education but does not correlate with age or sex. Hence, Benton and Hamsher (1994) provide raw score adjustments based on education. Individuals with less than 9 years of education have 8 points added to their raw score. Those with education levels between 9 to 11 years, 12 to 13 years, and 14 to 15 years receive and extra 6, 4, and 2 points, respectively. Subjects with 16 or more years of education do not receive an adjustment to their raw score.

The relationships between VIQ and FSIQ to VNT performance were not reported by Benton and Hamsher (1994). It is known that education positively correlates with FSIQ (Kaufman 1990). Given this fact and the report that education correlates positively with VNT performance (Benton & Hamsher, 1994), than it seems reasonable to assume that FSIQ also correlates with VNT performance.

Since the third edition of the MAE was published only recently (1994) few additional studies have been conducted on alternative sample populations. This may also be due in part to the large sample used by Benton and Hamsher (1994). This is in contrast to the BNT which was originally published with only provisional norms and hence, has stimulated the publication of several studies investigating different normative samples.

Validity of the BNT and VNT

As tests of confrontation naming, the BNT and VNT are certainly face valid. However, there is little information available as to other forms of validity with regard to these tests. One recent study by Axelrod, Ricker and Cherry (1994) utilized 100 consecutive male patients referred to the neuropsychology department at the Allen Park Veterans

Affairs Medical Center. This sample was diagnostically mixed with 42 subjects comprising a psychiatric diagnostic group and 56 subjects making up a neurological diagnostic group. Both the BNT and the VNT were administered as part of a standard battery. A Pearson Product Moment correlation coefficient ($\underline{r}$ = .86) revealed excellent intertest agreement suggesting high correspondence between the two measures for this clinical population. Presently, information about concurrent validity between the BNT and the VNT for a non-clinical population is not available.

There appear to be no studies of the content, predictive or ecological validity of the BNT or VNT. In addition, test-re-test reliability has not been examined (Spreen and Strauss, 1991). This latter shortcoming in the available data is particularly troublesome due to the use of these confrontation naming tests with temporal lobe resection candidates suffering intractable complex partial seizures. This particular patient group is typically given pre- and post-surgical neuropsychological evaluations. A post-surgical increase or decrease in naming performance is difficult to interpret without knowledge of the test re-test reliability or temporal stability of the measure.

There do not appear to be any studies of the construct validity of either the BNT or the VNT. According to Meehl (1973), a construct is the postulated attribute of the individual which a test is assumed to measure. In the case of the BNT and VNT, the postulated attribute is naming ability or more specifically the ability to retrieve the correct name of a stimulus when the individual recognizes and understands the stimulus (Mayeux, Brandt, Rosen & Benson, 1980). At face value it would appear that both the BNT and VNT would accomplish this task since the items to be named are common objects to which most individuals have had previous exposure. However, it has been suggested that the nature of the line drawings may pose difficult perceptual demands for some subjects and could impede performance (personal communication Shore, 1996). In addition, the BNT has been shown to correlate positively with vocabulary, Full Scale IQ and years of education (Thompson & Heaton, 1989). Hence, it would appear that the BNT and perhaps the VNT do not exclusively measure one's ability to retrieve the name of an object.

Naming Ability and Complex Partial Seizure Disorder

It has been demonstrated that deficits in naming ability (dysnomia) can occur as a result of circumscribed lesions to the left temporal lobe (Crosson, Cooper, Lincoln, Bauer, & Velozo, 1993; Gainotti, Silveri, Villa, & Miceli, 1980). This dysnomia often occurs in the context of grammatically correct, fluent conversational speech and normal comprehension (Crosson, Cooper, Lincoln, Bauer, & Velozo, 1993; Gainotti, Silveri, Villa, & Miceli, 1980). Likewise, individuals with seizure foci located in the left temporal lobe exhibit an analogous deficit. Mayeux, Brandt, Rosen, and Benson (1980) administered the 85-item BNT to adult subjects with idiopathic seizure disorder, left foci complex partial seizures (L-TLE), right foci complex partial seizures (R-TLE), and nonfocal generalized tonic-clonic seizures (GE). The L-TLE group performed significantly worse than either the R-TLE or the GE groups. No differences were found between the R-TLE and the GE group. Mayeux et al. concluded that patients with an epileptogenic lesion to the inferior left temporal lobe are at risk for significant nominal deficits resembling a word-selection anomia. Mayeux et al. suggest that the nominal deficit represents a breakdown in word selection. Hence, the deficit is one of retrieval as opposed to not understanding the stimulus, not having the stimulus word stored in one's semantic network, or deficits in word production.

Similar results were found by Howell et al. (1994) who compared the BNT performance of subjects with L-TLE and subjects with R-TLE. Again, the L-TLE group performed significantly worse than the R-TLE group. It should be noted that Howell et al. (1994) departed from the standard administration of the BNT by requiring the subjects to attempt all 60 objects instead of starting at card 30 and discontinuing after 6 consecutive failures.

Deficits in confrontation naming among L-TLE have also been demonstrated using the VNT. Hermann et al. (1992), compared the VNT scores of individuals with L-TLE to the scores of individuals with R-TLE. Comparable to the above studies using the BNT, the L-TLE group performed significantly worse ($p<0.01$) on the VNT than did the R-TLE group.

Statement of Purpose and Hypotheses

As previously mentioned, test re-test correlations for both the BNT and the VNT are not available in the literature. The primary purpose of the present study was to generate test re-test correlations for the BNT and the VNT on a group of normal (neurologically intact) subjects. Secondly, while intertest correlation between the BNT and the VNT are known for a clinical population (Axelrod, Ricker & Cherry, 1994), these correlation are not available for normal samples. Hence, the present study was intended to investigate the intertest correlations between the BNT and the VNT in a normal population. Finally, several studies have compared the BNT performances of L-TLE groups to that of R-TLE groups. In most cases, the scores of the L-TLEs were found to be significantly worse than that of the R-TLEs (Crosson, Cooper, Lincoln, Bauer & Velozo, 1993; Gainotti, Silveri, Villa & Miceli, 1980; Hermann, Seidenberg, Haltiner & Wyler, 1992). However, none of these studies included a normal group. Thus, the current study compared the BNT performances of L-TLE subjects, R-TLE subjects and a normal group. The following hypotheses are made:

1) It was hypothesized that both the BNT and the VNT would have high test re-test reliability over the two month re-test interval. In other words, the mean scores on the first administration of the BNT (BNT_1) and the mean scores on the

second administration of the BNT (BNT_2) would correlate significantly with one another. Likewise, the mean scores on the first administration of the VNT (VNT_1) would correlate significantly with the mean scores on the second administration of the VNT (VNT_2).

2) It was hypothesized that the BNT and the VNT would correlate significantly with one another in a normative sample of subjects. In other words, the normal subjects' performance on the BNT_1 would not differ significantly from their performance on the VNT_1.

3) Furthermore, it was predicted that the L-TLE group would perform significantly worse on the BNT than would either the R-TLE group or the normal group. To elaborate on this statement, it was predicted that:

a) the subjects with left temporal lobe epilepsy would perform significantly worse on the BNT_1 than would subjects with right temporal lobe epilepsy;

b) the subjects with left temporal lobe epilepsy would perform significantly worse on the BNT_1 than would the normal normal subjects.

Finally, it was predicted that there would not be significant differences in BNT performance between the R-TLE group and the normal group. More concisely, it was predicted that:

c) scores on the BNT_1 for the subjects with right temporal lobe epilepsy would not differ significantly from the scores obtained by the normal subjects.

CHAPTER 2

METHOD

Subjects

The normal sample was composed of 35 adult volunteers recruited from the Windsor area. Four subjects could not be re-tested due to individual time constraints. One case was discarded because of a positive psychological diagnosis which was not initially divulged. Hence, the final normal subject pool consisted of 30 adult volunteers ranging in age from 21 to 65. The subjects averaged 34 (SD = 10.5) years of age and had 14 (SD = 3.36) years of education. Eleven of the normal subjects were female while 19 were male. Subjects with a history of seizures, head injury, or psychiatric disorder were excluded from the normal group. In addition, any subject who did not speak English as his/her first language was excluded. All subjects had normal or corrected-to-normal vision.

Thirty-three subjects with left foci complex partial seizures and 40 subjects with right foci complex partial seizures made up the L-TLE and R-TLE groups respectively. These subjects were drawn from files of patients with complex partial seizures who were referred to Psychological Services at the London Health Sciences Center-University Campus in London, Ontario. The mean age and education level of the L-TLE group was 29.82 (SD = 10.76) years old and 11.88 (SD = 2.40) years of schooling. Nineteen of the L-TLE subjects were male while 14 were female. The mean age for subjects in the R-TLE group was 31.45 (SD = 8.38) years and the mean education was 11.65 (SD = 2.42) years. The R-TLE group was composed of 13 male and 10 female subjects.

Procedure

All normal subjects were assessed twice with testing sessions separated by an interval of 2 months. During the first session, subjects were administered the BNT (Kaplan, Goodglass & Weintraub, 1983) and the VNT (Benton & Hamsher, 1994) in a counterbalanced order. In addition, Silverstein's (1982) Vocabulary-Block Design (V-BD) dyad was administered as a short form of the Wechsler Adult Intelligence Test-Revised (WAIS-R). Finally, due to the high correlation between verbal fluency and performance on the BNT (Thompson & Heaton, 1989), the Controlled Oral Word Association Test (COWAT) (Benton & Hamsher, 1994) was also administered as a measure of verbal fluency.

After an interval of 2 months, the normal subjects were again administered the BNT, VNT and COWAT. Administration of the V-BD dyad was not repeated.

With regard to the L-TLE and R-TLE groups, all subjects were given the BNT as part of a Neuropsychological evaluation. Most L-TLE and R-TLE subjects completed a full WAIS-R while a few subjects received an abbreviated version.

CHAPTER 3

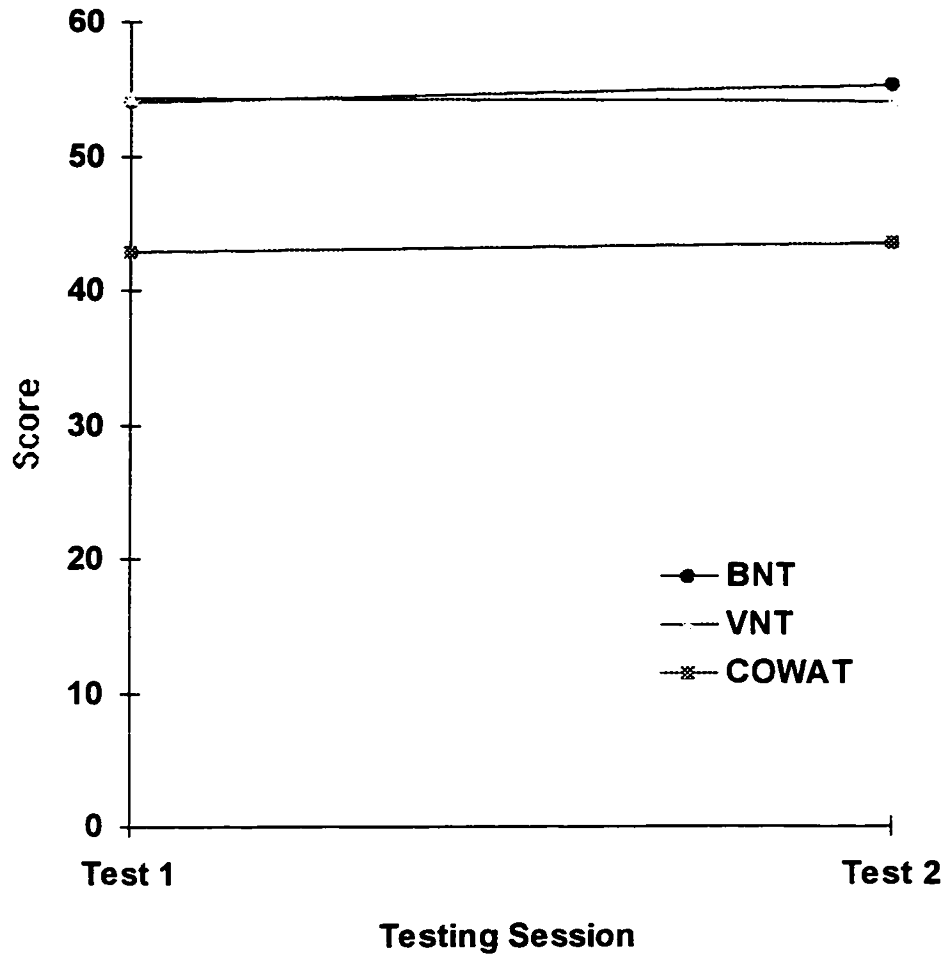
RESULTS

The normal group's raw scores on the BNT_1 ($\underline{M}$ = 54.00, $\underline{SD}$ = 4.96), BNT_2 ($\underline{M}$ = 55.20, $\underline{SD}$ = 4.93), VNT_1 ($\underline{M}$ = 54.30, $\underline{SD}$ = 6.46), and VNT_2 ($\underline{M}$ = 53.97, $\underline{SD}$ = 6.76), were converted to $\underline{t}$-scores. Using these t-scores, Pearson Product Moment Correlations were used to compare the test re-test scores for both the BNT (BNT_1 and BNT_2) and VNT (VNT_1 and VNT_2). The correlation coefficient between BNT_1 and BNT_2 revealed a test re-test reliability of $\underline{r}$ = .96 ($\underline{p}$ < .0001). Similarly, test re-test reliability between the VNT_1 and VNT_2 revealed a correlation coefficient of $\underline{r}$ = .91 ($\underline{p}$ < .0001). In addition, Pearson Product Moment correlations were used to compare the normal group's performance on the BNT to that of the VNT. The resulting coefficient ($\underline{r}$ = .79, p < .0001) revealed substantial intertest agreement for the two naming tests.

The correlation coefficient ($\underline{r}$ = .83, $\underline{p}$ < .0001) between $COWAT_1$ ($\underline{M}$ = 42.93, $\underline{SD}$ = 12.40) and $COWAT_2$ ($\underline{M}$ = 43.5, $\underline{SD}$ = 11.73), also demonstrated acceptable test re-test reliability with this verbal fluency test. Further, Pearson Product Moment correlation between $COWAT_1$ and BNT_1 (r = .70, p < .0001), and $COWAT_1$ and VNT_1 (r = .52 p < .003) were significant. See Figure 1 for a graphic representation of test re-test scores on the BNT, the VNT and the COWAT.

Figure 1

Mean Test Re-test Scores for the BNT, VNT and COWAT



Standard regression was performed with BNT_1 scores as the dependent variable and estimated VIQ (M = 101.33, SD = 18.14), estimated PIQ (M = 107.50, SD = 22.07), estimated FSIQ (M = 104.87, SD = 20.25), years of education, and $COWAT_1$ scores as independent variables. Analysis was performed using SPSS REGRESSION. Table 1 displays the unstandardized regression coefficients (*B*) and the standardized regression coefficients (Beta). $\underline{R}$ for the regression was significantly different from zero ($\underline{F}$ (5, 24) = 6.15, $\underline{p} < .001$). Only $COWAT_1$ scores contributed significantly to prediction of BNT_1 scores. The five independent variables in combination contribute 33.36 in shared variability. Altogether, 56% (47% adjusted) of the variability in BNT_1 scores was predicted by knowing the scores on the five independent variables.

Table 1

<u>Summary of Standard Regression Analysis for Variables Predicting BNT_1 Scores.</u>

Variable	<u>B</u>	Beta
Education	0.06	0.07
VIQ	0.22	0.82
PIQ	0.10	0.43
FSIQ	-0.21	-0.85
$COWAT_1$	0.19	0.46^{***}

*** $\underline{p} < .002$

Using the derived $\underline{t}$-scores, Pearson Product Moment Correlations were used to compare scores on the BNT_1 to years of education, VIQ, PIQ, FSIQ and COWAT. Table 2 displays the Pearson Product Moment Correlations of performance on the BNT_1 to the above variables. Years of education was significantly correlated with BNT_1 scores (r = .49, $p < .001$). BNT_1 scores also correlated significantly with VIQ (r = .67, $p < .0001$), PIQ (r = .50, $p < .001$), and FSIQ (r = .65, $p < .0001$). Finally, performance on the COWAT was significantly correlated with performance on the BNT_1 (r = .70, $p < .0001$).

Table 2

Pearson Product Moment Correlation Coefficients Between BNT_1 Performance and Years of Education, VIQ, PIQ, FSIQ, and COWAT Scores.

Variable	r
Education	$.49^{**}$
VIQ	$.67^{***}$
PIQ	$.50^{**}$
FSIQ	$.65^{***}$
COWAT	$.70^{***}$

** $p < .001$

*** $p < .0001$

Standard regression was also performed using VNT_1 scores as the dependent variable and estimated VIQ, estimated PIQ, estimated FSIQ, years of education, and

$COWAT_1$ scores as independent variables. Analysis was performed using SPSS REGRESSION. Table 3 displays the unstandardized regression coefficients (*B*) and the standardized regression coefficients (Beta). $\underline{R}$ for the regression was significantly different from zero ($\underline{F}$ (5, 24) = 3.71, $\underline{p} < .05$). The five independent variables in combination contribute 22.26 in shared variability. Altogether, 44% (32% adjusted) of the variability in VNT_1 scores was predicted by knowing the scores on the five independent variables.

Table 3

Summary of Standard Regression Analysis for Variables Predicting VNT_1 Scores.

Variable	$\underline{B}$	Beta
Education	-0.03	-0.32
VIQ	0.56	1.52
PIQ	0.41	1.38
FSIQ	-0.68	-2.11
$COWAT_1$	0.07	0.13

Using the derived $\underline{t}$-scores, Pearson Product Moment Correlations were used to compare scores on the VNT_1 to years of education, VIQ, PIQ, FSIQ and COWAT. Table 4 displays the Pearson Product Moment Correlations of performance on the VNT_1 to the above variables. Years of education was significantly correlated with VNT_1 scores (r = .43, $p < .001$). VNT_1 scores also correlated significantly with VIQ (r = .60, $p < .0001$), PIQ (r = .57, $p < .0059$), and FSIQ (r = .65, $p < .0001$). Finally, performance on the COWAT was significantly correlated with performance on the VNT_1 (r = .52, $p < .001$).

Table 4

Pearson Product Moment Correlation Coefficients Between VNT_1 Performance and Years of Education, VIQ, PIQ, FSIQ, and COWAT Scores.

Variable	r
Education	$.43^{**}$
VIQ	$.60^{***}$
PIQ	$.57^{***}$
FSIQ	$.59^{***}$
COWAT	$.52^{**}$

** $p < .001$

*** $p < .0001$

Individual Pearson Product Moment Correlations were calculated for $COWAT_1$ scores compared to years of education, VIQ, PIQ, and FSIQ scores. The $COWAT_1$ scores were found to be significantly correlated with years of education (r = .45, $p < .001$). In addition, COWAT1 scores were significantly correlated with scores on the VIQ (r = .69, $p < .0001$), PIQ (r = .55, $p < .001$), and FSIQ (r = .68, $p < .0001$). Table 5 shows the correlates of $COWAT_1$ scores with the above variables.

Table 5

Pearson Product Moment Correlation Coefficients Between $COWAT_1$ Performance and Years of Education, VIQ, PIQ, FSIQ, and COWAT Scores.

Variable	r
Education	$.43^{**}$
VIQ	$.60^{***}$
PIQ	$.57^{***}$
FSIQ	$.59^{***}$
COWAT	$.52^{**}$

** $p < .001$

*** $p < .0001$

A one-way analysis of variance (ANOVA) was performed on the BNT_1 scores for the normal group, the pre-operative BNT scores for the L-TLE group (M = 46.13, SD = 13.64) and the R-TLE group (M = 49.64, SD = 14.84). The ANOVA showed a significant difference between the groups on this measure [F (2,101) = 44.72, $p < .001$]. Tukey-HSD post-hoc comparisons revealed that the normal subjects performed significantly better on the BNT than either the L-TLE subjects or the R-TLE subjects. Additionally, the Tukey-HSD revealed that the R-TLE groups performance on the BNT was superior to that of the L-TLE group.

CHAPTER 4

DISCUSSION

The results of the present study are consistent with the first hypothesis that the BNT and VNT have a high test re-test reliability. In other words, both the BNT and the VNT demonstrate temporal stability over a two month period. This stability implies that either the BNT or VNT can be re-administered in order to monitor changes in naming ability over time without undue concern for practice effects.

This finding has important implications for several different populations. For instance, in monitoring the progress of individuals who have suffered a cerebral vascular accident or traumatic brain injury resulting in aphasic disturbances, any improvement on re-administration of the BNT or VNT (with at least 2 months separating administrations) would indicate improvement in the aphasic disturbance and not simply represent a practice effect.

The demonstrated temporal stability of the BNT and VNT is particularly important with regards to individuals suffering L-TLE in which anomia is a common disturbance. Repeated administration of the BNT or VNT can be used to monitor the severity of the anomia over two month intervals in these individuals. This is particularly relevant for those individuals who have increasing seizure frequency. Increased seizure frequency is related to further brain pathology (Adams & Victor, 1993). Both the BNT and VNT could be used to infer changes in degree of pathology by monitoring the severity of anomia.

Moreover, administration of the BNT or VNT at pre- and post-temporal resection surgery intervals can serve to gauge the outcome of the surgery. Specifically, the good test re-test reliability of these measures allows the clinician to infer that equivalent performance on the BNT or VNT at pre- and post-surgery intervals is interpretable as no change in degree of anomia following the acute post-surgical phase. Previously, it could not be stated that equivalent performance indicated no change in anomia due to the possibility that re-administration of these measures may produce a practice effect. If this were indeed the case, then equivalent performance would have potentially indicated an increase in anomic disturbance due to the failure of the individual to demonstrate a significant practice effect.

The temporal stability of the BNT and VNT also has implications when monitoring the effects of temporal lobe resection on language functioning as a whole. Specifically, given that naming ability is considered the most vulnerable aspect of language functioning, a minimal change (less than the standard error of measure for the test) in performance on the BNT or VNT would suggest that language functioning as a whole was not further disturbed as a result of surgery.

Scores on $COWAT_1$ were found to be significantly correlated with scores on $COWAT_2$. Hence, the present study demonstrates. Excellent test re-test reliability for the COWAT. This implies that, like the BNT and VNT, the COWAT can be used to monitor changes in verbal fluency over time without undue concern about practice effects.

As discussed in the Introduction, the study by Axelrod, Ricker & Cherry (1994) demonstrated a high correlation between the BNT and the VNT in a population of mixed clinical patients. The results of the present study confirm the second hypothesis that performance on the BNT and VNT will be highly correlated in a sample of neurologically intact subjects. This finding implies that administration of both the BNT and VNT as part of a neuropsychological battery would be redundant since, the BNT and the VNT appear to measure the same function. Additionally, this finding suggests that the BNT and the VNT can be used alternately when monitoring temporal changes in naming ability for reasons discussed above. However, using the BNT and VNT in this manner must be done with some caution since the interpretation of scores (whether the performance is impaired, borderline, etc.) for the two tests differs somewhat. For example, the same numerical score interpreted as low average on the BNT may be interpreted as borderline on the VNT. If the two tests are being used alternatively the clinician or researcher should take this into account.

An estimate of VIQ, PIQ, and FSIQ were considered important due to the high correlation of these scores with performance on the BNT (Thompson & Heaton, 1989). The V-BD dyad has been shown to correlate highly with the WAIS-R FSIQ (.91) and has an excellent split-half reliability coefficient of .94 (Silverstein, 1982). According to Kaufman (1990), the V-BD dyad is ideal for use in research where group performance is more important than an individual's precise score. As mentioned above, several studies have demonstrated that BNT performance is significantly predicted by FSIQ, VIQ, PIQ, and education (Thompson & Heaton, 1989; Hawkins et al., 1993). The nature of the relationship between these variables and the BNT was not hypothesized in the present paper. Individual Pearson Product Moment Correlations indicated that all four variables are significantly correlated with BNT performance. This confirms the relationship reported by Thompson and Heaton (1989) and Hawkins et al. (1993) that years of education and VIQ, PIQ and FSIQ scores predict performance on the BNT. It is interesting to note that standard regression analysis was non-significant with regard to the predictability of BNT scores on the basis of FSIQ, VIQ, PIQ or years of education. COWAT scores were found to significantly predict BNT performance. However, individual correlations demonstrated that the COWAT was more highly correlated with years of education, VIQ, PIQ, and FSIQ than was BNT performance. Therefore, years of education, VIQ, PIQ, and FSIQ did not add any predictability to the regression beyond that contributed by COWAT scores. Hence, these variables failed to be significant in the regression analysis even though they correlate significantly with BNT performance.

Similarly, individual Pearson Product Moment Correlations between the VNT and years of education, VIQ, PIQ, FSIQ, and COWAT scores demonstrated significant correlation coefficients. Benton and Hamsher (1994) have previously demonstrated that years of education significantly predicts VNT performance. Likewise, the current study demonstrates that VIQ, PIQ, and FSIQ all predict VNT performance. A standard regression analysis using education, VIQ, PIQ, FSIQ, and COWAT scores to predict VNT performance was significant. However, the analysis revealed that none of the independent variables significantly contributed to predicting scores on the VNT. Individual Pearson Product Moment Correlation's revealed that Scores on the COWAT were more highly correlated with education, VIQ, PIQ, and FSIQ than was VNT performance. Therefore, years of education, VIQ, PIQ, and FSIQ did not significantly contribute to the regression beyond the predictability of COWAT scores. Hence, these variables failed to be significant in the regression analysis while they significantly correlate with VNT performance.

Thompson and Heaton (1988) reported the Thurstone Fluency test to be significantly correlated to BNT performance. The current study utilized the COWAT as a measure of verbal fluency. Consistent with the findings of Thompson and Heaton, the COWAT was found to be significantly correlated with BNT performance. This finding is consistent with the expectation the one's verbal fluency has an impact upon BNT performance (Thompson and Heaton, 1988). In the current study, COWAT scores and VNT scores were also significantly correlated. Hence, verbal fluency also impacts upon one's performance on the VNT.

As hypothesized in the current study, the R-TLE group demonstrated significantly superior performance on the BNT as compared to the L-TLE group. Contrary to what was predicted, the R-TLE group performed worse on the BNT compared to the normal subjects. The former finding confirms the finding of Myeux et al. (1980) who reported superior performance of R-TLE subjects to that of L-TLE subjects on the 85-item BNT. Similarly, Howell et al. (1994) demonstrated significantly higher scores on a non-standardized administration of the BNT for R-TLE subjects compare to L-TLE subjects. Secondly, as predicted, the normal subjects performed significantly better on the BNT compared to the L-TLE group. This finding further supports the contention made by Blaxton and Bookheimer (1993) that left temporal foci are associated with naming deficits.

Naming a specific object in response to a visual stimulus requires a complex system of cerebral associations. Butters and Brody (1969) have suggested that integration of sensory information occurs in the parietal lobe and specifically the left angular gyrus. It has been further suggested by Gross (1973) that connections between this association area in the parietal lobe and the left inferior temporal lobe are required for the retrieval of memories or in this case words from one's lexical repository. EEG studies have shown that individuals with left temporal lobe epilepsy predominantly have lesions in the left inferior lobe (Lothman & Collins, 1989). The findings of the current study and those by Mayeux et al. (1980) and Howell et al. (1994) confirm the notion that the left inferior temporal lobe is, in part, responsible for retrieval of words to visually presented stimulus.

Contrary to the stated hypothesis, there were significant differences between the BNT performance of the normal group compared to the R-TLE group. Specifically, the normal group performed significantly better than the R-TLE group on the BNT. There are two possible reasons for this finding. First, it suggests that individuals suffering right temporal lobe epilepsy experience some language deficits and/or other cognitive inefficiencies that result in reduced naming ability as compared to normal individuals but superior naming ability compared to individuals with left temporal lobe epilepsy. This is supported by the supposition the naming ability is considered the most vulnerable of language functions and thus could potentially be affected by any neurological pathology or cognitive inefficiency. In addition, research by Falconer (1971) suggests that uncontrolled (or irritractable) seizures in one temporal pole may result in the development of a contralateral lesion. Therefore, the subjects in the R-TLE group may also suffer from less severe lesions in the left temporal lobe. The presents of these lesions would undoubtedly result in poorer performance on the BNT compared to normal subjects.

Secondly, the difference in mean education levels between the R-TLE group and the normal group may partially account for the inferior performance of the former group compared to the normal subjects. This is supported by the high correlation between education and BNT performance reported by Thompson and Heaton (1989). Further research matching normal subjects and R-TLE subjects for education, VIQ and PIQ would help determine which of the two above possibilities is correct. Differences in level of education would account for the above finding, if the BNT performance on a neurologically intact group of subjects was found not to be significantly different from that of a R-TLE group matched for years of education.

Lack of an adequate pool of TLE subjects who received the VNT prevented an examination of VNT performance over the three groups. Given the high correlation between the BNT and VNT it is likely that the results of such an analysis would be comparable to that found on the BNT. This could be confirmed by future studies using VNT scores.

Summary

In summary, the present study has demonstrated that an normal individual's performance on the BNT, VNT and COWAT should be stable over time (2 month interval). This supports the use of these tests to monitor changes in naming ability (BNT and VNT) and verbal fluency (COWAT) over time, without undue concern about practice effects. This finding is particularly important in regard to the current use of the BNT and VNT at both pre- and post- temporal lobe resection surgery intervals.

Corresponding to the hypothesis, the BNT and VNT were shown to have excellent intertest agreement in a neurologically intact population. This indicates that the two tests a measuring the same function. In addition, the BNT and the VNT could be used on separate occasions to monitor changes in naming ability.

The superior BNT performance of the normal subjects and the R-TLE group compared to the L-TLE group confirms those findings of Mayeux et al. (1973) and Hermann et al. (1992). Furthermore, this substantiates suggestions that the left inferior temporal lobe is in part responsible for naming in response to a visual stimulus.

The inferior BNT performance of the R-TLE subjects compared to the normal groups suggests that right temporal lobe epilepsy may impact upon naming ability. However, this impact is not as severe as seen in individuals with left temporal lobe epilepsy. This finding may also be a function of differences in mean education between the normal subjects and the R-TLE subjects.

Suggestions for Future Research

The current study has dealt with the test re-test reliability and concurrent validity of the BNT and VNT. There are a lack of studies addressing the content, predictive or ecological validity of the BNT or VNT and hence these are areas where future research should be concentrated.

With the current finding that re-administration of the BNT or VNT does not result in a significant practice effect in normal subjects, pre- and post-surgery scores on these tests should be examined. Such a study would highlight the effects of temporal lobe resection surgery on an individual naming ability.

REFERENCES

Adams, R. D. & Victor, M. (1993). Principles of Neurology (3rd ed.). New York: McGraw-Hill, Inc.

Axelrod, B. N., Ricker, J. H. & Cherry, S. A. (1994). Concurrent validity of the MAE visual naming test. Archives of Clinical Neuropsychology, 9, 317-321.

Benton, A. L. & Hamsher, K. (1994). Multilingual aphasia examination: Manual of instructions. Iowa City IO: AJA Associates, Inc.

Borod, J. C., Goodglass, H., & Kaplan, E. (1980). Normative data on the Boston diagnostic aphasia examination, parietal lobe battery, and the Boston naming test. Journal of Clinical Neuropsychology, 2, 209-215.

Butler, M., Terzlaff, P., & Vanderploeg, R. (1991). Neuropsychological test usage. Professional Psychology: Research and Practice, 22, 510-512.

Blaxton, T. A., & Bookheimer, S. W. (1993). Retrieval inhibition in anomia. Brain and Language, 44, 221-237.

Butters, N. & Brody, N. (1968). The role of the left parietal lobe in the mediation of inter- and cross-modal associations. Cortex, 4, 328-343.

Crosson, B., Cooper, P. V., Lincoln, R. K., Bauer, R. M. & Velozo, C. A. (1993). Relationship between verbal memory and language performance after blunt head injury. The Clinical Neuropsychologist, 7, 250-267.

Falconer, M. A. (1971). Genetic and related aetiological factors in temporal lobe epilepsy: A review. Epilepsia, 12, 96-113.

Gross, C. R. (1973). Visual functions of infero-temporal cortex. In R. Jung (Ed.), Handbook of sensory physiology. New York, Springer-Varlag.

Hawkins, K. A., Sledge, W. H., Orlean, J. F., Quinlan, D. M., Rakfeldt, J. & Hoffman, R. E. (1993). Normative implications of the relationship between reading vocabulary and Boston naming test performance. Archives of Clinical Neuropsychology, 8, 525-537.

Hermann, B. P., Seidenberg, M., Haltiner, A. & Wyler, A. R. (1992). Adequacy of language function and verbal memory performance in unilateral temporal lobe epilepsy. Cortex, 28, 423-433.

Howell, R. A., Saling, M. M., Bradley, D. C. & Berkovic, S. F. (1994). Interictal language fluency in temporal lobe epilepsy. Cortex, 30, 469-478.

Huff, F. J., Collins, C., Corkin, S., & Rosen, T. J. (1986). Equivalent forms of the Boston naming test. Journal of Clinical and Experimental Neuropsychology, 8, 556-562.

Gainotti, G., Silveri, M. C., Villa, G. & Miceli, G. (1980). Anomia with and without comprehension disorders. Brain and Language, 29, 18-30.

Kaplan, E., Goodglass, H., & Weintraub, S. (1983). The Boston Naming Test. Philadelphia: Lea and Febiger.

Kaufman, A. S. (1990). Assessing adolescent and adult intelligence. Toronto ON: Allyn and Bacon.

Kindlon, D., & Garrison, W. (1984). The Boston naming test: Norm data and cue utilization in a sample of normal 6- and 7-year old children. Brain and Language, 21, 255-259.

Kirk, U. (1992). Confrontation naming in normally developing children: Word-retrieval or word knowledge. The Clinical Neuropsychologist, 6, 156-170.

LaBarge, E., Edwards, D. & Knesevich, J. W. (1986). Performance of normal elderly on the Boston naming test. Brain and Language, 27, 380-384.

Lichtenberg, P. A., Ross, T. & Christensen, B, (1994). Preliminary normative data on the Boston naming test for an older urban population. The Clinical Neuropsychologist, 8, 109-111.

Mayeux, R., Brandt, J., Rosen, J. & Benson, D. F. (1980). Interictal memory and language impairment in temporal lobe epilepsy. Neurology, 30, 120-125.

Meehl, P. E. (1973). Psychodiagnosis: Selected papers. Minneapolis: University of Minnesota Press.

Nicholas, M., Obler, L., Albert, M. & Goodglass, H. (1985). Lexical retrieval in healthy aging . Cortex, 21, 595- 606.

Silverstein A. B. (1982). Two- and four-subtest short forms of the Wechsler Adult Intelligence Scale-Revised. Journal of Consulting and Clinical Psychology, 50, 414-418.

Spreen, O. & Strauss, E. (1991). A compendium of neuropsychological tests: Administration, norms, and commentary. New York NY: Oxford University Press, Inc.

Thompson, L. L. & Heaton, R. K. (1989). Comparison of different versions of the Boston naming test. The Clinical Neuropsychologist, 3, 184-192.

VanGorp, W. G., Satz, P., Evans-Kiersch, M., & Henry, R., (1986). Normative data on the Boston naming test for a group of normal older adults. Journal of Clinical and Experimental Neuropsychology, 8, 702-705.

Wechsler, D. (1981). Manual for the Wecshler Adult Intelligence Scale-Revised (WAIS-R). San Antonio, TX: The Psychological Corporation.

Yeates, K. O. (1994). Comparison of developmental norms for the Boston naming test. The Clinical Neuropsychologist, 8, 91-98.

APPENDIX "A"

ADMINISTRATION OF THE BNT

Physically, the BNT consists of a top spiral bound booklet containing 60 line drawings of items arranged in order of difficulty from 'bed' to 'abacus'. The administration begins halfway through the booklet at card 30 which is a harmonica. The patient is shown the harmonica and simply asked "*What is this?*" This question can be repeated for each picture, but this occurs rarely since most subjects quickly catch onto the task requirements. Each card presentation has three conditions. The first is the non-cued condition in which the patient's task is to identify the item without the use of a cue. A stimulus cue is provided only if the patient's response reflects a misperception (e.g., answers *lion* for *sphinx*) or a lack of recognition (e.g., responds: "I don't know" or does not respond). The stimulus cues are supplied for the examiner on the scoring sheet and briefly describe the item. For example, the stimulus cue for Hammock is "this is something you sleep in." The patient has twenty seconds to respond during the stimulus cued condition (Kaplan, Goodglass & Weintraub 1983).

If the response during the non-cued condition indicates recognition but there is difficulty retrieving the item name (e.g., responds by saying "I know what that is, I just can't think of the name" or "It starts with a T" etc.) then the examiner should proceed directly to the phonemic cue condition. The phonemic cue is also provided on the scoring sheet and usually involves supplying the patient with the first phoneme of the item. For example, the phonemic cue for hammock is "it starts with the sound *Ha*." Again the patient has twenty seconds to provide the correct answer during the phonemic cued condition. The item is considered a failure if the patient cannot produce the correct name. After six consecutive failures the test is discontinued (Kaplan, Goodglass & Weintraub 1983).

The subject is required to correctly name the first eight items. If an item is missed in the first eight cards presented (numbers 30-38), the examiner reverts to card 29 and begins working backwards until there are 8 consecutive correct responses (e.g., responses 28 through 36 are correct) at which point the examiner returns to the card following the failed item. When scoring the BNT, all items which were correctly named during either the non-cued condition or the stimulus cued condition receive a score of one point. The items below card thirty which are not administered are given one point each. All the points are summed to produce the final score. The highest possible score is 60. Items correctly named during the phonemic cue condition, while not considered failures, do not receive points and hence are not reflected in the overall score (Kaplan, Goodglass & Weintraub 1983).

APPENDIX "B"

PERFORMANCE CORRELATES OF THE BNT

Pearson correlation between BNT scores and other measures (Thompson & Heaton, 1989 pg. 186).

Measure	Mean	(SD)	85 item	60 item	Form I	Form II
85 item	72.3	(8.2)	--	.96***	.92***	.95***
60 item	52.7	(5.5)	.96***	--	.92***	.95***
Form I	35.4	(4.4)	.92***	.92***	--	.84***
Form II	35.2	(4.5)	.95***	.95***	.84***	--
Age	42.3	(14.7)	.30*	.24	.10	.25***
Education	13.3	(3.1)	.47***	.50***	.41**	.53***
AIR	1.5	(0.7)	-.49***	-.56***	-.59***	-.50***
WAIS-R Voc.	9.6	(2.8)	.81***	.79***	.74***	.80***
Aphasia errors	6.0	(4.8)	-.42**	-.43**	-.48***	-.39***
Thurstone Fluency	44.8	(18.8)	.46***	.45***	.45***	.44***
VIQ	99.1	(14.0)	.74***	.74***	.68***	.73***
PIQ	96.3	(15.4)	.55***	.59***	.55***	.56***
FSIQ	97.6	(14.6)	.72***	.73***	.67***	.71***

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

APPENDIX "C"

ADMINISTRATION OF THE VNT

The stimulus material consists of a booklet of ten pictures, a pen or stylus, and the scoring sheet. Typically, the subject is required to name the whole picture (e.g. elephant) then to name some specific details of the picture (e.g. ears). In this way 30 naming responses are elicited using only 10 different pictures (the BNT used 30 pictures). The test begins with Picture A-Stimulus 1 (elephant). Using a pen or stylus, the examiner points to the stimulus and says "Tell me the name of this" or asks "What do you call this?" Once the response is given, the examiner then points to a detail of the picture and asks "What is the name of this part of the *item* (elephant)?" (Benton & Hamsher, 1994 pg. 3).

If at any time the subject fails to respond, the examiner repeats the question. If the subject has failed to respond and there is uncertainty about his/her visual perception of the picture or detail the examiner may say "You can't give the name, but can you tell something about it?" If appropriate to the item, this command can be replaced by "What do you do with this?" "What is it used for?" or "Do you know what it is?" (Benton & Hamsher, 1994 pg. 3).

Approximately 10 seconds are allowed for each response. However, if the patient is still attempting to produce an answer, is giving successive answers, or is distracted/confused then an additional 5 seconds may be given. If the subject produces the correct answer during this additional 5 seconds it is noted on the record sheet (Benton & Hamsher, 1994).

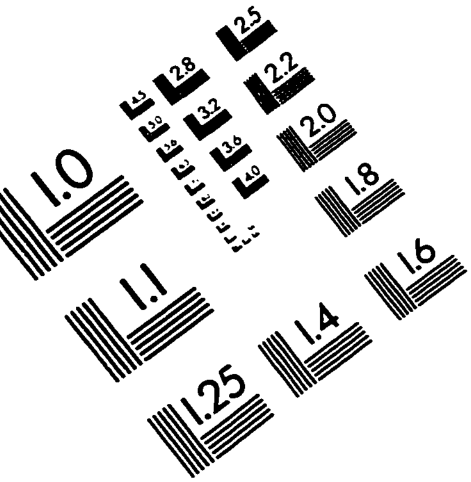
All responses are recorded verbatim including any misarticulations. Lack of response and unrecognizable responses are considered errors and do not receive points. Likewise, any semantic substitutions or descriptions of the characteristics or functions of the item without the name are also considered to be errors. However, if the subject has an articulation disturbance (e.g. dysarthria) or has deviant pronunciation for cultural reasons (e.g. foreign accent, dialectic speech) any misarticulation which resembles the proper articulation of the item is considered correct. In contrast, if there are no apparent pronunciation or articulation deficits, any misarticulation is scored as an error. Obviously these exceptions introduce a subjective aspect to the scoring of the VNT.

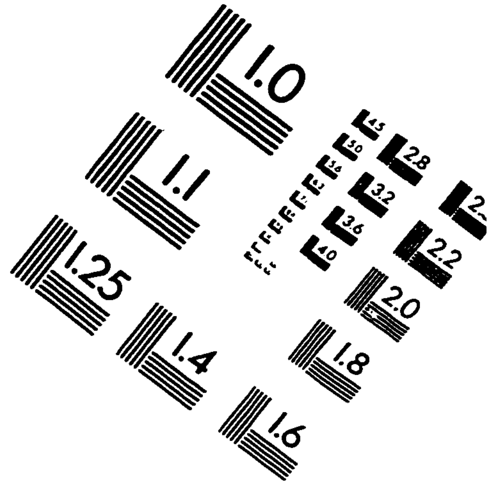
Two points are awarded for each correct response. Unlike the BNT, more than one response may be correct. Acceptable alternatives are listed in the manual along with the standard correct answers.

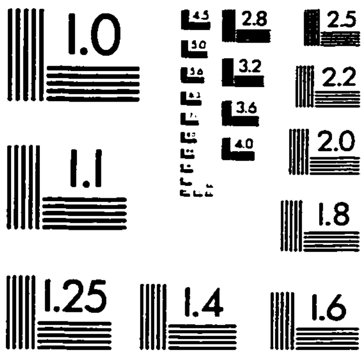
VITA AUCTORIS

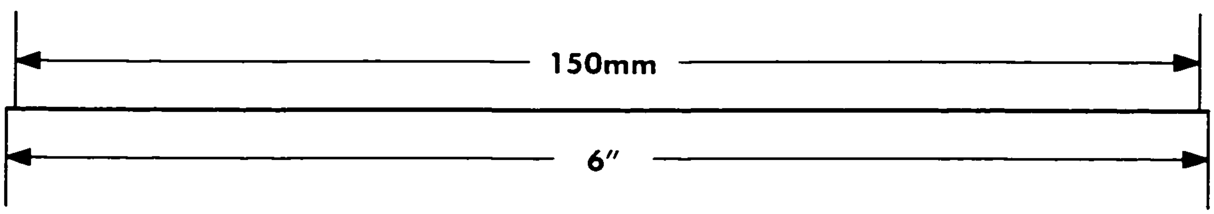
Janet Murray was born to David Murray (M. Sc., University of Windsor) and Linda (Murray) Marner on November 13, 1971 in Medicine Hat, Alberta. She graduated from the University of Windsor in 1994 with an Honours Bachelor of Arts. Since 1994, she has been a graduate student in the Clinical Neuropsychology programme at the University of Windsor.

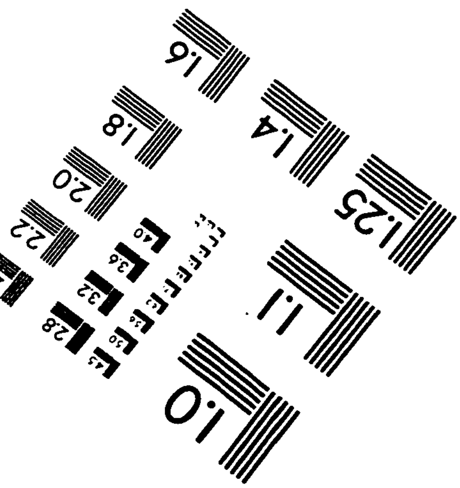
IMAGE EVALUATION TEST TARGET (QA-3)











APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989

© 1993, Applied Image, Inc., All Rights Reserved