

THE LNNB AND CULTURALLY DISSIMILAR INDIVIDUALS

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This chapter takes the view that controlled experimentation examining the effects of culture or group membership on neuropsychological functioning is a basic requirement for the development of a universal theory of brain function and dysfunction. The LNNB is one of the most widely used and researched neuropsychological tests both inside and outside the United States. This presentation examines how work using the LNNB has investigated cultural and group membership issues, advancing the fundamental understanding of brain function. As an illustration, the development of a Spanish version of the LNNB is described.

There are at least two ways to pursue an understanding of the psychological functioning of individuals who do not belong to a majority group. A common approach is to consider the task a socio-political one; after all, ethnic minorities have been persecuted. Such an approach, ethically and politically astute as it may be, lacks the substance necessary when the pursuit in question is one of scientific understanding. If, indeed, psychology is the science of human behavior (Skinner, 1953), and if psychology is intended to account for the behavior of all humans, such a strictly socio-political approach has numerous shortcomings, not the least of which is that it diverts attention and resources from the task at hand. As Puente (1993) has argued, a more salient and valid approach is to have a psychology that is generalizable to the entire population. A psychology that is restricted to the supposed majority is to be avoided. This orientation is not so new. The third article written in the English language on psychological assessment and testing (Wiley & Heskowitz, 1927) was entitled "Psychology and Culture." The present chapter focuses on regaining a multicultural orientation in clinical neuropsychology in general, as well as in work that involves the Luria-Nebraska Neuropsychological Battery.

Of the 275 million people residing in the United States, a growing segment (approximately 30%) is culturally dissimilar to the majority group (U.S. Census Bureau, 1999). For example, Hispanics represent the fastest growing

segment of the population, growing at a rate 10 times faster than that of their Anglo counterparts. For many Hispanics, Spanish is their only form of verbal communication. Regardless of the argument that they should also know English, the reality is that if a scientific psychology is to understand all people, then expanding its horizons to study those outside the mainstream is a necessary requirement. This argument is further extended when the question becomes whether psychology is a science that is generalizable to the rest of the world. Despite the easily arguable claim that the United States is the most important country in the world as the new millennium begins, the U.S. population represents but 4% of the entire population of the world, which currently numbers about 6 billion. Thus, any psychological theory or test must address, or at the very least consider, how to regard those people who differ from the stereotypical American person or patient in terms of language and culture.

This appeal for a universal understanding is based on an appreciation of the role of group membership and cultural identity in psychological functioning. Ardila (1995) has argued that culture is indeed a powerful variable in the expression of brain dysfunction. Although most neuropsychologists have considered age and education as intervening or confounding variables to be seriously studied and reckoned with, culture has been relegated to the socio-political arena.

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Ardila and others have argued that this approach misunderstands how culture modulates brain function and dysfunction. Indeed, others (Puente & Pérez-García, in press) have argued for a neuropsychological "g" similar to a general intelligence factor. These authors propose that if group membership and cultural identity could be understood (and controlled), then the possibility increases that what is common to all human brain function would emerge. This assumes not that culture is synonymous with brain function, but that brain function is modulated or molded (possibly in an interactive fashion) by culture. Taking this view, controlled experimentation examining the effects of culture or group membership on neuropsychological functioning is a basic requirement for the development of truly universal theories of brain function and dysfunction.

The purpose of this chapter, then, will be to integrate these concepts with what is known about one of the most important tests of human brain function, the Luria-Nebraska Neuropsychological Battery (LNNB). As the twentieth anniversary of the test is celebrated, this chapter looks back and projects forward to how work using the LNNB has integrated cultural and group membership issues. In turn, the issue of how the LNNB has advanced the understanding of these fundamental issues will similarly be considered. The chapter is divided into three sections: (a) foundations of cultural and ethnic-minority neuropsychology, (b) application of the LNNB to special ethnic and cultural populations and settings, and (c) a description of the development of a Spanish version of the LNNB. A summary will conclude the chapter by addressing issues such as lessons learned, knowledge gained (both clinical and scientific), and directions for the future.

Foundations of Cultural and Ethnic Minority Neuropsychology

Understanding individuals from culturally dissimilar backgrounds has not typically been a major endeavor for clinical neuropsychology. One way to illustrate this situation is to examine more carefully how two important neuropsychological organizations have focused on these issues. The National Academy of Neuropsychology (NAN) represents the largest independent organization to focus on clinical neuropsychology. Within the American Psychological Association (APA), a division devoted to neuropsychological issues was founded in 1980: Division 40—Clinical Neuropsychology. Puente and Pérez-García (in press) and Puente and Marroto (in press) have explored the development of neuropsychology during the last several decades by examining trends, including ethnic-minority issues, in these two organizations. Here are some examples of how the field has dealt with this area.

1. Convention programs for The National Academy of Neuropsychology (Puente & Pérez-García, in press) and APA Division 40—Clinical Neuropsychology (Puente & Marroto, in press) reflect a paucity of cultural and ethnic-minority issues. On average, no more than a couple of posters or presentations per year address these topics.

2. The same pattern is reflected in the publication activities of the journals that are associated with both organizations (for NAN, the *Archives of Clinical Neuropsychology* and *Neuropsychology Review*; for APA, Division 40, *The Clinical Neuropsychologist* and *Neuropsychology*). In all cases, the number of articles directly addressing these issues is about the same as the number of posters and presentations at the annual conferences. In addition, the inclusion of ethnically different volunteers for studies is rarely reported (possibly either because of their low numbers or because of the lack of perceived importance in reporting this type of information).

3. This is similarly reflected in the numbers of fellows, members, and officers representing culturally dissimilar groups (e.g., African-American, Hispanic, Asian, and Native-American Indian) in both NAN and APA Division 40.

The assumption that will be adopted here to explain this paucity of representation and interest is that, traditionally, culture and ethnicity have not been deemed important variables in neuropsychological assessment. Indeed, neither of these variables could be found in the index for the first edition of Lezak's widely cited sourcebook, *Neuropsychological Assessment* (1980). The fact that the latest edition of Lezak's sourcebook (1995) does index these areas is evidence that the pattern does appear to be changing. In a recent survey, Echeburúa, Harris, Conger, Diaz, and Puente (1997) reported that clinical neuropsychologists are actually seeing greater numbers of ethnic minorities, including Hispanics, in their practice. Further, the survey participants expressed a strong sentiment that specific training and procedures might be required to assess people who speak Spanish as their native language. Nevertheless, most respondents in the survey admitted to a lack of training and tools for resolving this situation.

One way of gaining perspective on this situation was proposed by Puente & Pérez-García (in press). These authors use the concept of "education," an apparently simple variable used to calculate the extremely important Critical Level measure on the LNNB, to illustrate the situation. North Americans tend to consider "education" as a quantifiable measure that is correlated with intelligence. Thus, somebody with a doctorate degree has from 6 to as many as 12 years of schooling past high school. Further, the more education, the higher the intelligence. Thus, somebody with a doctorate degree is assumed to have substantially more intelligence, especially as measured by the Wechsler scales, than somebody with less education. A further assumption is usually made, of course, that the concept of education, the years of education, and intelligence are equivalent in terms of their implications for cognitive functioning across ethnic or culturally diverse groups. Unfortunately, these concepts, as rudimentary as they may appear, are not equivalent. Education in the United States is quantifiable and synonymous with educational and socioeconomic attainment. In fact, "years of education" is so highly correlated with "socioeconomic status" in the U.S.

that the two pieces of demographic data are considered virtually identical for research purposes. In other countries, the case is often very different.

In Hispanic countries, for instance, somebody who is "educated" is a person who possesses highly polished social skills—regardless of his or her years of education. (As Frank Zappa, the senior author's Geometry teacher in high school, used to say, "There are a lot of over-educated but under-cultured people out there.") In France, using the index finger is thought to reflect poor taste and limited "education." In the U.S., it is the common standard for showing direction, and is often a strategy used for giving item responses in the LNNB. Furthermore, although years of education are relatively easy to quantify in the United States, this is often not the case in other countries. For example, in Europe, a "bachelor's" degree is more equivalent to a master's degree in the United States, in terms of years of education. Finally, intelligence in other countries or even among cultural minorities in the U.S. goes beyond simple years of education or an IQ score. Pérez-Arce and Puentes (1997) and Puentes and Salazar (1997) have argued that although most Mexican migrant workers, for example, score very poorly on standardized intelligence tests, it takes unique intelligence and problem-solving abilities to travel a foreign country in old vehicles, without money, connections, social support, and special talents, all the while finding work across the U.S. mainland. Thus, what is intelligence? Possibly Thorndike's (1911) original view of intelligence as active problem solving comes closer to being valid than Terman's (1916) view of intelligence as a statistical deviation on artificial intellectual tasks.

Another illustration regards the concept of time. Not surprisingly, time is factored into a large percentage of the items on the LNNB and on other tests of cognitive functioning. What if speed of processing is not universally associated with effective cognitive functioning, at least not in a point-to-point correspondence? In Hispanic culture, for instance, time is something to be enjoyed, savored. In North American and English culture, time is something to be conquered. "Productivity versus enjoyment" might describe the basic difference in how time is viewed across these two cultures. Speed of processing may thus reasonably be hypothesized as unrelated to or even negatively related to the manifestation of intelligence in Hispanic culture.

As to yet another area where culture equivalence can reasonably be questioned, neuropsychological tests, and especially those constructed following Lurian neuropsychological theory, rely heavily on the notion of left-hemisphere mediation of unimpaired cognitive functioning. Research to date indicates that many tasks commonly thought of as being mediated by the left hemisphere are highly susceptible to the effects of culture, language, and related variables. Thus, tests that currently rely on the use of such tasks in determining brain dysfunction, such as the LNNB, might not be applicable outside of, for example, westernized cultures.

At this stage of empirically based knowledge, it is clearly too early to determine whether these questions represent unfounded speculation or visionary revelation. The

ultimate goal of this discussion is to provoke empirical work that seeks equivalence across cultures for factors that are currently assumed to be universally important indicators of unimpaired cognitive functioning. This takes the issue of establishing multicultural equivalence for a neuropsychological test far beyond that of simply making sure that a translation of a test item preserves its original meaning. Avoidance of confounds such as the ones discussed here earlier decrease the error variance in making clinical judgments and in constructing universally applicable theories about how unimpaired neuropsychological functioning is expressed. Clinically, error should obviously be reduced as a means of limiting false positives and negatives. No clinician would dispute the statement that giving a test with items different than the published ones is scientifically and ethically incorrect. This consideration is no different. Secondly, theoretically, error should be reduced in the practical analysis of data collected for the purpose of developing a universal theory of neuropsychology. To put it bluntly, and from a purely scientific standpoint, neuropsychological tests for evaluating brain dysfunction should be demonstrated to be applicable not just with middle-class, college-educated, White suburbanite Americans, but with the broadest conceivable assembly of individuals.

The LNNB, for all its criticism, has turned out to be probably the most widely used neuropsychological instrument outside the United States. Therefore, the focus of the discussion turns to describing how the LNNB has been applied to understanding neuropsychological function and dysfunction in ethnically and culturally diverse groups.

The LNNB in Culturally Dissimilar Settings and Populations

One way to address the use of the LNNB with culturally dissimilar populations is to address the topic from the standpoint of general hypothetical constructs related to neuropsychological assessment—type of task, functional area, and so forth (e.g., Puentes, 1993). Considering that the research and practice of cultural neuropsychology are but a handful of years old, those constructs have not been fully delineated. Consequently, it was thought that a more prudent approach for this chapter would be to examine the published literature. Toward this aim, the roughly 500 abstracts on the LNNB listed in the APA's PsycINFO database were reviewed. An abstract was considered to be of value for this chapter if any of the following criteria were met: (a) it was published in a foreign journal, (b) the study was completed in a foreign country, (c) any ethnic-minority or foreign population was used in the study, or (d) ethnic-minority, culture, or foreign residence was a stated issue of concern or a variable that was measured or controlled. The purpose of this search was to cast a very wide net for studies that might, in any way possible, reflect and shed light upon the use of the LNNB with culturally or ethnically dissimilar individuals. The results of this effort are displayed in Table 1.

Disappointingly, only 36 articles were found using this search strategy. All of these articles pertained to the

Table 1
Summary of Articles Published About the LNNB
in International Neuropsychological Journals

Authors	Year	Country	Type of Study	Type of Subjects
Muñoz-Céspedes et al.	1995	Spain	Empirical	Alzheimer's Disease
Puente et al.	1995	Italy	Empirical	Head Injury
Pachalica et al.	1995	Poland	Empirical	Aphasia
Gálvez et al.	1993	Mexico	Empirical	Obsessive-Compulsive Disorder
Arnkelson	1993	Scandinavia	Empirical	Normal
Kang	1993	Korea	Empirical	Brain Damage
Marwix & Barnes	1991	India	Empirical	Head Injury
Meco et al.	1990	Italy	Empirical	Parkinson's Disease
Cimino et al.	1990	Italy	Empirical	Schizophrenia
Tonaglia et al.	1990	Italy	Other	Aphasia
Sabbadini et al.	1990	Italy	Other	Schizophrenia
Agaglia et al.	1990	Italy	Empirical	HIV
Brod et al.	1990	Australia	Empirical	Alzheimer's Disease
Faustman et al.	1990	Scandinavia	Empirical	Normal
Neumacker & Buzika	1989	Germany	Case History	Mental Impairment
Marcos & Gujarec	1989	Spain	Case History	Aphasia
Donus et al.	1989	Greece	Empirical	Brain Impairment
Boget, Hernández, & Marcos	1988	Spain	Empirical	CNS Disorder
Hernández et al.	1988	Spain	Empirical	CNS Disorder
Boget, Hernández, & Hombert	1988	Spain	Empirical	Schizophrenia
Panda	1988	India	Empirical	Schizophrenia
Bellini et al.	1988	Scandinavia	Empirical	Schizophrenia
Fruchauf	1987	Germany	Empirical	CNS Disorder
Dergan	1987	Chile	Other	N/A
Xu et al.	1987	China	Empirical	Brain Injury
Marcos	1986	Spain	Case History	Alexia
Bols	1986	Norway	Other	Psychiatric
Neumacker et al.	1984a	Germany	Empirical	Cortical
Neumacker et al.	1984b	Germany	Other	N/A
Berzanda et al.	1983	Italy	Empirical	Brain Damage
Goedter & Gruber	1983	Germany	Empirical	Schizophrenia
de Los Angeles Saavedra & Zagmat	1982	Chile	Empirical	Aphasia
Puentes	1982	Chile	Other	N/A
Golden & Urbina	1982	Chile	Other	N/A

development of the battery in foreign settings. None focused on the use of the LNNB with ethnic minorities in the United States. Four of the articles pertained to the children's version, and the others focused on the adult versions, exclusively Form I. Articles were found relating to the following countries or areas of the world: Australia, Chile, Germany, Greece, India, Italy, Korea, Mexico, Poland, Scandinavia, and Spain. Most articles involved the application of the LNNB to a single specific population (e.g., Koreans). However, there were a total of nine different studies that had attempted at least a formal translation and some aspect of standardization. Academic translations of the LNNB appear to be available in the literature in the following languages: Chinese, German, Greek, Icelandic, Italian, Korean, Polish, Scandinavian, and Spanish.

Of the 36 studies discovered in the course of this search, 23 reported the use of volunteers and actual collection of data; 7 discussed the theoretical and practical aspects of the battery, but no data were gathered; 4 presented case studies. Of the 23 studies that reported group data, groups ranged from 8 to 70 subjects. The average number of participants in these studies was 81.5, with 10 studies using two groups, 4 studies using three groups, and one study using four groups of volunteers. The most common group category was "brain damage," followed by schizophrenia. Other groups studied included Alzheimer's disease, HIV, mental impairment, multiple sclerosis/CNS disorder, obsessive-compulsive disorder, Parkinson's disease, and stroke/amnesia.

In summary, it appears that there are translations of the LNNB in at least nine languages. Most of these are associated with the collection of some data to support their use and some form of norms. Neurological patients for whom data is available are typically lumped together for the purpose of data analysis. Although these studies provide an initial glimpse into the potential application of the LNNB in culturally diverse situations, most of these studies were methodologically weak. For example, none reported the use of a formal translation or a check of that translation. The number of subjects was low, diagnoses were not well-described, test-reliability and other psychometric characteristics of the translated material were never reported, and so forth. In addition, no formally intended translation of the test has been published. Finally, considering the ever-expanding concerns in American psychology about ethnic minority issues, we were surprised to find no studies in which the primary topic was ethnic minorities or in which ethnic minority groups were formally identified in the study. As a consequence, this body of work is insufficient as a knowledge base for understanding the effect of culture and language on specific functional neuropsychological systems.

The next section describes a 10-year effort to translate and standardize the LNNB into Spanish, which illustrates some of the general aspects involved in such a task. It is of interest to note that, although a preliminary version of the study was first presented at the first paper session of the Hispanic Neuropsychological Society (at the 1997 NAN annual meeting), the abstracts were not published in the

Archives of Clinical Neuropsychology. Preliminary versions of this study have also been presented in Spanish psychological society meetings. In addition to being illustrative of the unusual effort and complications associated with a project of this kind, the study represents a potential window of opportunity for making progress in understanding how to conduct neuropsychological evaluations of the fastest growing segment of the American population, Hispanics.

A Spanish Version of the LNNB

In this section, an ongoing project involving a Spanish translation of the LNNB, which has lasted over a decade, is described. In the course of attending a related workshop preceding the first annual NAN convention in Orlando in 1979, it occurred to the senior author of this chapter that the LNNB could be "easily" translated and used with Spanish-speaking populations. An initial attempt was made to do so in Puerto Rico during the 1980s, but complications in regard to logistics and personnel prevented the successful completion of a translation. Approximately 2 years later, a student from the Universidad Complutense de Madrid who went to Wilmington, North Carolina, collaborated with the senior author to translate the battery. After several versions, the battery was sent to her professors, Juan Miguel-Tobal and Antonio Cano-Vindel, in Madrid. Due to the complications associated with the translations and substantial communication delays (this was before e-mail and the internet), this process took about 5 years. After significant revisions were finished around 1991 by Miguel-Tobal and Cano-Vindel and their colleagues, this translated LNNB was administered to a diverse group of individuals from Madrid, Granada, and Salamanca, Spain over the course of approximately another 5 years. Over the last several years, the focus has been primarily on the analyses of the data. In this section of the chapter, the study is presented at greater detail. The primary focus of the material presented here will be to describe the battery, as well as the difficulties associated with its development. In addition, the initial standardization of this version is presented along with a description of performance across a variety of clinical groups.

The translation and eventual standardization of the battery were completed by the authors of this chapter (Miguel-Tobal et al., 1992, 1993), in consultation with Charles Golden, the senior author of the LNNB. The initial study by these authors was later extended by another group of collaborators at the Universidad de Granada in the Andalucía section of southern Spain (García, 1996). The research arisen from this effort resulted in one of the first dissertations in Spain by a psychologist in which the dissertation was devoted exclusively to clinical neuropsychology. In a related but separate study, Muñoz-Céspedes et al. (1999) completed the comparison of the performance of different clinical groups with this battery. This study describes the work completed in Madrid, Granada, and Salamanca, Spain.

General difficulties with the translation and standardization effort. It is important to note several unusual

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problems with this work before the battery is described: most were due to the naivete of the senior author of this chapter and the general limited understanding of this kind of work in neuropsychology. Indeed, when this study was started informally around 1980, no study could be found in the psychological literature regarding the translation and standardization of an American neuropsychological test with a Spanish-speaking population. As one can see from the major effort attempted on this topic (Ardila, Rosselli, & Puente, 1994), numerous problems exist in the development of neuropsychological instruments for the Spanish speaker. Disappointingly, no other comparable large scale projects have been published in the literature. In fact, in a similar effort, the translation and standardization of the Wechsler scales for Spanish speakers was discontinued last year by The Psychological Corporation due to insurmountable logistical problems.

One of the less obvious difficulties is the question of generalizability of "the Spanish language" across all Spanish "subcultures." The first version of the Spanish LNNB was clearly a combination of Puerto Rican and Cuban Spanish—generally quite similar to each other, however, the translation was viewed in Madrid as inadequate. When a "Spanish" translation was completed in Madrid, several of the items were too geared for residents of Spain and not for Latin America. Hence, a final version with more generic Spanish finally evolved. A similar difficulty was encountered in the Wechsler studies (Puente & Salazar, 1997) when the multinational, Hispanic working group could not agree on a single proverb that was applicable to all the groups being represented: Cubans, Americans, Mexicans, Puerto Ricans, South Americans, and Hispanics residing in the United States.

A second problem was that certain items were translated literally. The items had to be translated again to be true not to the language, but to the concept in question. Here, the criterion was not fidelity to the language, but cognitive equivalence. A simple example involves the use of numbers. *Ocho* is a two-syllable word, whereas *eight* is only one syllable. (Sometimes, a number is not just a number.) Establishing cognitive equivalence was, by far, the hardest intellectual task of the study.

A third obstacle related to publication copyright. The study was initiated without first being in contact with the publishers of the LNNB, Western Psychological Services. After realizing the potential legal problems with this approach (copyright control bolts across national boundaries), negotiations ensued to secure the continuation of the study while respecting the legal rights of the publisher. One issue that remains to be worked around is that many of the stimulus cards were photographed by Anne-Lise Christensen and remain copyrighted by a European company, from whom they are purchased for inclusion in LNNB Form I Kits. In fact, the senior author has visited Luria's laboratory in Moscow twice, and the senior researcher for the group, Janna Gluzina, spent a recent summer in Wilmington, North Carolina. In the course of these interactions, it has be-

come apparent that most of the cards are stimuli that Luria used, which he originated in Moscow, but which were never copyrighted for a number of social, political, and scientific reasons. Thus, although the cards are copyrighted in Europe, most of the stimuli (at least in concept) come from Moscow, where no copyright for the stimuli exists. Consequently, one reason that publication of the test in Spain has not been realized by the major psychological test publisher in Spain, TEA, is because of what they view as the prohibitive cost of having access to these cards. Thus, at present, the excellent translation of the test sits unpublished in large part because of unusual legal restrictions on stimuli that, ironically, were developed by Luria, who never obtained a copyright on his own work and who has been dead for almost 25 years. It is the express wish of the test authors, as well as the publisher of the LNNB, that a suitable resolution be discovered that will enable the publication of this work and related endeavors in the evolution of cultural neuropsychology to move forward.

Another problem relevant to empirical work in the area of cultural neuropsychology, at least in these formative years of the discipline, is that neurological patients in various countries are seen by personnel in sometimes competing professional groups. In Europe, for example, as well as in Latin America, the neuropsychological status of neurological patients is evaluated and treated almost exclusively by medically trained personnel rather than by psychologists familiar with the relevant underlying psychometric and theoretical issues. The opposite is now the case with regard to neuropsychological evaluation in the United States, although it has not always been so. Obtaining access to neurological patients for psychologists in these countries, therefore, can be difficult, as was the case in the U.S. approximately 20 years ago. This situation presented itself as an obstacle in the current study, and was overcome only through the maintenance of a healthy regard for existing professional boundaries, along with the mobilization of a patient persistence in work that will ultimately redefine these boundaries to some extent.

Translation of the LNNB into Spanish. The translation of the battery into Spanish was based on the proposed methodology of Brislin (1980). His focus was on the development of instruments that were intended to be used for eventual comparisons of concepts across cultures. The specific procedure used was as follows:

1. The original Form I of the LNNB in English was translated into Spanish by a bilingual person.
 2. Two other bilingual individuals, without access to the original materials, translated the Spanish version back into English.
 3. The new translation was examined for discrepancies relative to the original English version.
 4. A reconciliation between the two versions was resolved with a final translation.
- Like the original Form I in English (Golden, Purich, & Hermonck, 1979, 1995), the Spanish version contains 269 items in the same order. Despite this similarity, it is important to note that several changes were included relative to the

initial version. These changes in specific language were included to insure that the concept underlying each original item was preserved in the translated version. The major differences are described in the following paragraphs.

On the Receptive Speech scale (C5), Items 100-107 posed significant problems for a literal translation due to the phonological differences between the two languages. In similar fashion, the words used in item 112 do not represent an exact translation. In the Spanish version, the translation used the words *mor*, *bar*, and *por*, which are phonologically rather than semantically equivalent to *car*, *bar*, and *por* in the original Form I.

There were also several changes made on the Expressive Speech scale (C6), including those items that explored the ability to read and repeat specific sounds (Items 133-134 and 143-144) and words (Items 135-142, 146-152). In the case of words, the translation was accomplished not so much according to the criterion of literal meaning of the words, but with the goal of equivalences in phonological components and phonemes (e.g., number of syllables, similar phonemes, etc.). For example, the words in Item 145, *lee-see, tres-tris*, were changed to the words *si-sie and tres-tres*. In the same fashion, the composition of item 150, which requires the patient to read the words *act, hat, and fat*, has been changed in the Spanish version to use *cal, dal, and nar*. This maintains the greatest similarity relative to the number of syllables and sounds that correspond to the Spanish language, even though these syllables are not all actual words in Spanish.

The Writing (C7) and Reading (C8) scales also had to be altered. Two essential criteria were used for these two scales: (a) that the substitution words should have the same number of equivalent letters, and (b) that the new words should have the same frequency of use in the Spanish culture as the original English words have for Americans. For example, in Item 189, *stone and knight* were changed to *perro and carina*.

On the Arithmetic scale (C9), the main changes occurred with Items 204 and 205 and the stimuli for Items 208 and 209. In Spanish, the symbol (,) is used to represent decimals, and the symbol (.) is used for units of a million. Using the original items would have confused the patient.

Finally, the Intellectual Processes scale (C11) required the modification of idiomatic expressions used in Form I that would make no sense if translated literally. For example, in Item 245, there is no equivalent to "green thumb," so the expression "corazón de oro" was used. Likewise, the adage, "Don't count your chickens before they have hatched" was replaced with "Más vale pájaro en mano que ciento volando."

Standardization of the Spanish Translation. A sample of 232 normal individuals drawn from the population of residents of the city of Madrid was utilized for the standardization of the Spanish version of the LNNB. The standardization sample was composed of 126 men and 106 women. The mean age for the sample was 39.88 years, with a range of between 15 and 88. The mean educational attainment (roughly equivalent to the U.S.) was 9.93 years of education, with a range from 0 to 21.

The correlations of the translated LNNB clinical scale scores with age and education are shown in Table 2. The correlations with age ranged from as low as -.54 (for the Rhythm scale) to as high as .72 (for the Memory scale). Visual Function, Intellectual Processes, and Expressive Speech scores were also highly correlated with age, at .68, .68, and .70, respectively. These findings provide support for the importance of taking age into account with the Spanish version of the LNNB as with the English version.

Education was negatively correlated with all scale scores, with correlations ranging from -.48 for Tactile Function scores to -.72 for Writing and Intellectual Processes scores. These results indicate the strong influence of educational attainment on performance on the Spanish version of the LNNB. These findings are similar to those for the English version of Form I of the LNNB, and suggest that higher levels of educational attainment, as measured by years of education, are indeed associated with generally lower scores on the battery.

In addition, intercorrelations among the clinical scale scores were examined. As can be seen in Table 3, the different scales all appear to have high positive correlations with one another. All correlations were significant at the .001 level. The strongest correlations are between the Reading and Writing scales (.85) and the Intellectual Processes and Expressive Speech scales (.84). The Intellectual Processes score appears to have the highest level of relationship with all the other scale scores, with correlations ranging from .67 (Tactile Functions) to .84 (Expressive Speech). These findings echo similar relationships that have been found among scale scores for the English version of the test.

In separate studies (García, 1996; Muñoz-Céspedes et al., 1999), the standardized Spanish version of the LNNB

Table 2
Correlations Between Age and Education Across the Clinical Scales of the Spanish Version of the LNNB in a Normal Sample

Clinical Scales	Age	Years of Education
Motor Functions	.63	-.57
Rhythm	-.54	-.60
Tactile Functions	.58	-.48
Visual Functions	.65	-.64
Receptive Speech	.56	-.63
Expressive Speech	.70	-.67
Writing	.66	-.72
Reading	.57	-.66
Arithmetic	.62	-.63
Memory	.72	-.64
Intellectual Processes	.68	-.72

Note. *N* = 232.

was used with a variety of clinical groups. At present, a group of head-injured patients (*N* = 60) and a group of individuals with Alzheimer's dementia (*N* = 24) have been tested (Muñoz-Céspedes, Izquierdaga, Miguel-Tobal, & Cano-Vindel, 1995). Also, a group of chronic alcoholics and polydrug abusers are in the process of being tested. The results of initial studies with this population are found in Izquierdaga, Miguel-Tobal, Cano-Vindel, and Muñoz-Céspedes (1992a, 1992b); Izquierdaga, Miguel-Tobal, Cano-Vindel, Muñoz-Céspedes, and Puente (1994); Izquierdaga (1996, 1997); and Izquierdaga and Muñoz-Céspedes (1998). In Granada, Spain, 130 individuals were also tested, including a group of 60 controls, 60 neurological patients (including dementia and head injury), and 10 depressives (García, 1996). Finally, another group of 146 patients were independently tested in Salamanca, Spain (Boget & Hernández, 1994). In this study, 70 neurological patients, 49 schizophrenic patients, and 27 normal controls were evaluated. All of these studies have provided essentially the same results. The LNNB easily discriminates between neurological patients and controls, as well as psychiatric patients. However, the pattern of differentiation appears different for the different clinical samples in ways that are similar to patterns obtained for similar patient groups given the English language version of the test.

In summary, it appears that despite initial problems with the translation of the LNNB into Spanish, the test appears viable. The battery has strong internal consistency and appears to be positively correlated with age and negatively correlated with education. All these findings are similar to

the results obtained in studies of Form I of the LNNB. Further, a large standardization sample, especially when compared to the original LNNB studies, is provided. Finally, the test appears to have good quantitative discriminability between controls and both neurological and psychiatric patients—again, similar to findings for the original English version of the battery.

A few cautionary words are in order. First, this version of the LNNB was translated and adapted primarily for use with Spanish speakers residing in Spain. Although the battery has been successfully applied in three distinct geographic/cultural locations across Spain, the generalizability of the current battery to other Spanish speakers in the United States and in Latin America has yet to be formally explored. Second, preliminary research indicates similarity between the Spanish and English versions of the LNNB in terms of the relationships observed among scale scores and the relationship of these scores with external criteria in the form of demographic variables and neuropsychological status. However, this should in no way be taken as encouragement to disregard the importance of the fact that this equivalence is being established empirically rather than simply assumed.

Summary

Neuropsychology has matured to the point of realizing that variables beyond age and education can play a significant role in neuropsychological function and dysfunction. Over the last decade, there has been a growing awareness of

Table 3
Correlations Between Clinical Scales in the Spanish Version of the LNNB in a Normal Sample

Clinical Scales	Motor Functions	Rhythm	Tactile Functions	Visual Functions	Receptive Speech	Expressive Speech	Writing	Reading	Arithmetic	Memory	Intellectual Processes
Motor Functions	—										
Rhythm	.70	—									
Tactile Functions	.59	.52	—								
Visual Functions	.70	.68	.64	—							
Receptive Speech	.73	.73	.56	.70	—						
Expressive Speech	.70	.69	.66	.78	.78	—					
Writing	.64	.65	.64	.75	.75	.83	—				
Reading	.53	.59	.65	.71	.70	.83	.85	—			
Arithmetic	.58	.64	.59	.70	.66	.78	.79	.76	—		
Memory	.75	.72	.63	.75	.73	.80	.75	.65	.72	—	
Intellectual Processes	.69	.69	.67	.82	.75	.84	.82	.78	.81	.82	—

Note. *N* = 232.

the importance of understanding how culturally dissimilar individuals perform cognitive tasks and how neuropsychological impairment is expressed in their performance. For some reason that is not as yet understood, most of the work in this area has been done with Spanish speakers and with other foreign populations. Nine viable research translations of the LNNB have been reported in the literature. Although the studies are weak by U.S. standards, they do provide a preliminary indication of the validity of the LNNB for systematic neuropsychological research and clinical assessment across an unusual variety of cultures—from Chile to China. In addition, a fully elaborated Spanish version of the test has been described for the first time in the scientific literature. This work reflects a decade-long research program attempting to adapt the LNNB to Spanish speakers, and illustrates the complexities associated with this kind of task. The initial findings provide support, as with all the other studies with foreign samples, of the LNNB as a uniquely robust battery when specific language and cultural differences are controlled.

Although the findings reported in the literature reviewed in this chapter are promising, as are those reported elsewhere for other Spanish studies, the authors feel that the paucity of empirical studies and the lack of any public expression of curiosity concerning the use of the LNNB and other neuropsychological tests with ethnic minorities in the U.S. is alarming. This is not a political statement, but a scientific one. For cultural clinical neuropsychology to adequately prosper and contribute to the long term legacy of scientific neuropsychology in this country, more attention will need to be directed to remedy this situation. The apparent robustness of the LNNB across eight different cultures and languages, along with the results of empirical work using the Spanish LNNB, would lead one to conclude that the instrument is available as a valuable tool that should be easily adaptable for use in assessing the neuropsychology of ethnic minorities residing in the U.S.

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