

PART THREE

PROFESSIONAL ISSUES

CHAPTER 20

The Cultural in Cross-Cultural Neuropsychology

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Although brain-behavior relations in a cultural context have been of interest to psychologists for a long time, there is still a lack of research in this complex area (Ardila, 1995; Fletcher-Janzen, Strickland, & Reynolds, 2000; Puente & Perez-Garcia, 2000a, 2000b). The question of how mental processes are shaped by sociocultural forms investigated by Vygotsky and Luria in the 1930s still presents a challenge for neuropsychologists in the twenty-first century because it is still unknown how current models of brain-behavior interaction fit in different cultural contexts. We could say that Ebbinghaus' statement about psychology as a scientific discipline may as well be applied to cross-cultural neuropsychological research: It has a long past, and a short history.

Are humans all the same in terms of cerebral organization of memory, cognition, and perception, or does culture affect the patterns of higher cortical functions? Is the way in which people perceive and solve problems determined by interaction of their genetic endowment and the culture in which they mature, or is the mind universal? These are the questions to which there are still no clear answers. To borrow from Nell

(2000): "If mind, like brain, is one, and therefore unitary in all humans, then neuropsychological assessment founded on human universals will work equally well in London, New York, or the subsistence farming villages of South Africa and Brazil. If mind is many, however, . . . then identical tests may make geniuses of average people in one culture and imbeciles of equally average people in another" (p. 13).

Another important question is the subject of contemporary neuropsychology per se. Indeed, is what is measured by clinical neuropsychological instruments what neuropsychologists believe? Does brain dysfunction affect the performance on a given task, or could it be a lack of patient's familiarity with the cultural norms and attitudes that are being measured? If we, so to speak, set a brain apart to measure (neuropsychologically) its functioning without cultural context in which the mind has developed, what will we really assess? And what would be the ecological validity of the results? As noted by Massimini and Delle Fave (2000), biology, culture, and individuals are three interacting systems; hence, one of them should not be studied without considering the others.

CULTURE AS A VARIABLE IN NEUROPSYCHOLOGY

The role of culture in neuropsychology has traditionally been ignored, if not misunderstood. We believe that culture may play a much broader role than possibly age and education in shaping neuropsychological function.

Definitions

Culture is a broad concept that is not so easy to define. The study of culture as a unique phenomenon can be traced back to Greek historian and philosopher Herodotus (Cole, 1997), and by now several definitions of culture are in use (e.g., Herskovits, 1948; Triandis, Vassiliou, Vassiliou, Tanaka, & Shanmugam, 1972). Generally, culture refers to a body of customary beliefs and social norms that are shared by a particular group of people (Wong, Strickland, Fletcher-Janzen, Ardila, & Reynolds, 2000). It is important to discriminate between physical culture (tools, buildings, works of art, etc.) and subjective culture, that is, social norms, roles, beliefs, and values (Triandis et al., 1972), as the individual can be assimilated into the physical culture but carry on subjective culture, which is different from the individual's cultural environment.

Culture presents an independent variable of interest to neuropsychology (Wong et al., 2000). As emphasized in a number of publications discussed in this chapter, it is important to keep culture in mind while conducting neuropsychological investigations involving culturally dissimilar individuals to avoid potential problems and misleading conclusions.

The Origins of Cross-Cultural Neuropsychology

The application of culture to neuropsychology has both a long past and a short history, especially in North America. This section addresses such origins with a particular focus on Russian neuropsychology.

Cultural-Historical Psychology

Among the first attempts to bring cultural issues into scientific psychology and neuropsychology was the theory of cultural-historical psychology, which is associated with the Russian psychological school, and in this regard, with the prominent scholars Lev Vygotsky and Aleksandr Luria. Vygotsky's main argument was that mind is the product of the material conditions of culture (Vygotsky, 1987, 1996). Grounded on Marxian concept of a historically determined human psychology, his fundamental hypothesis was that the higher mental functions are socially formed and culturally transmitted.

Vygotsky's theory (1978) has three major postulates. First, evolution resulted in the capability of human beings to change their environment. Second, as a consequence, human beings have learned to operate with their own consciousness. This led to development of voluntary forms of actions, and in turn, to the emergence of higher mental functions. He emphasized that development of control over the environment and over one's own behavior are parallel processes deeply interrelated with each other. Additionally, these two processes are tool-mediated, that is, while mechanical tools are applied to operate with the nature, psychological tools—symbols—are used to operate with one's behavior. The third part of Vygotsky's concept is what he referred to as "interiorization," that is the reorganization of external psychological tools (e.g., symbols, words said out loud) into internal concepts and images. Thus, higher psychological functions are based on the usage of inner, usually verbal sources that were originally acquired in communication with others.

Vygotsky wrote that the origin of higher psychological functions is located "not in the hidden properties of nervous tissue, but outside the organism of the individual person in objectively existing social history which is independent of the individual" (Luria, 1965, p. 338). These higher cortical functions are seen by Vygotsky as complex functional systems rather than isolated functions, and "are formed in history and changing in the process of ontogenetic development" (p. 389). Vygotsky pointed out that functional systems "characterized by a new integration and co-relation of their parts. The whole and its parts develop parallel to each other and together." Vygotsky named the first structures "elementary." He described them as "psychological wholes, conditioned chiefly by biological determinants." The latter structures, "which emerge in the process of cultural development, are called higher structures . . . <which> are constructed on the basis of the use of signs and tools; these new formations unite the direct and indirect means of adaptation" (Vygotsky, *Tool and Symbol*—cited in John-Steiner & Soubberman, 1978, p. 124). Thus, higher psychological functions are voluntary, tool-mediated, and social in their origin. That is why it is necessary to study ontogenesis and especially the acquisition of psychological tools of the society in which we live to understand psychological functioning.

The belief of cultural-historical psychologists is that historical change in human thought arises in two interrelated ways. First is the shift from natural and unmediated to cultural and mediated thought. Second is development in the complexity and sophistication of mediational means that entails a corresponding development of thinking (Cole, 1997). This view was largely based on the ideas and data of late nineteenth and early twentieth century sociological and an-

thropological research associated with the works of Levy-Bruhl (1910) and Thurnwald (1922). Vygotsky and his collaborators argued for "heterogeneity of levels of cognitive functioning depending upon the kind of activity that people habitually engaged in" (Cole, 1997, p. 108).

Vygotsky proposed "the general law of cultural development." He wrote:

Any function in children's cultural development appears twice, or on two planes. First it appears on the social plane and then on psychological plane. . . . Social relations among people genetically underlie all higher functions and their relationship" (1996).

He suggested that specific relationships between particular centers of the brain emerge during the process of development. That is why, damage to a certain "center" in early ages leads to system damage of the nearest higher "center," while the same damage in adults causes deficit to a lower "center."

Luria (1979) further elaborated on Vygotsky's conception. He suggested that the development of a new "functional organs" occurs through the formation of new functional systems. "The human cerebral cortex, thanks to this principle, becomes an organ of civilization in which are hidden boundless possibilities and does not require new morphological apparatuses every time history creates the need for a new function" (1967, p. 54). Generally, in cultural-historical psychological school, higher cognitive processes are defined as social in their origin, culturally mediated in structure, and voluntary directed (Luria, 1980), each term in this formulation being tightly interconnected with the others (Cole, 1997). Cole (1997) suggested that if the Russian approach to psychological theory were to prevail, "all psychology would treat culture, along with biology and social interaction, as central" (p. 107).

Although written about 70 years ago, Vygotsky's theories are still of great influence to those scientists who are involved in cross-cultural studies. Quoting from Nell (1999), "Vygotsky's work has become the theoretical base for many psychologists and neuropsychologists, who see human development as a continuing process of change and growth rather than the achievement of a predetermined plateau" (p. 46).

The Lurian Expedition to Uzbekistan

Another "root" of cross-cultural neuropsychology can be traced back to 1930s, when Luria conducted a set of studies in the former Soviet republics of Uzbekistan and Kirgizia (Luria, 1976). The purpose of the expedition was to determine whether introduction of modern culture and public education, which accompanied collectivization occurring in the

former Soviet Union at that time, affected performance on simple cognitive tasks in native Uzbek people compared to those who had no formal education and were not exposed to "western" sociocultural norms. Luria implied that in line with Vygotsky's theory of cortical development through the mediation of social experiences, people on different levels of modernization would perform differently on given cognitive tasks. The results of the experiments showed that illiterate ("unsophisticated," in Luria's terminology) subjects were unable to form categories according to abstract characteristics. Instead, they used situational thinking that was resistant to change, consistently rejected the theoretical task in favor of the practical one, and classified objects on the basis of their practical experience and concrete operations. Following is a famous example of how one of Luria's "unsophisticated" subjects solved the syllogism:

In the Far North, where there is snow, all bears are white.
New Land is in the Far North and there is always snow there.
What color are the bears there?

The subject replied: "I don't know; I've seen a black bear. I've never seen any others. . . . I've never seen one and hence I can't say" (Luria, 1976, pp. 108–109).

When this work was terminated in 1932, Luria concluded that introduction of schooling and new models of socioeconomic life brought a qualitative shift to processes of perception, categorization, imagination, and self-analysis. In 1979, he wrote, "the processes of abstraction and generalization are not invariant at all stages of socioeconomic and cultural development. Rather, such processes are themselves products of the cultural environment" (p. 74). Unfortunately, the findings of this research remained mostly unpublished until the 1970s due to misinterpretation of the meaning of Luria's experiments by the Soviet officials. Still, Luria and his collaborators proved the main idea of the expedition regarding historical origin and tool-mediated nature of human psychological processes (Khomskaya, 1999).

Luria emphasized the importance of the environment in the development of functional systems and the importance of the roles different brain areas play in a given task. The more complex the behavior, the more variable its underlying functional system can be among different cultures; the more basic the behavior, the more likely the systems are universal (Luria, 1976). According to the Lurian scheme of neuropsychological assessment, functions are evaluated from a variety of perspectives to ensure that a deficit is consistently present regardless of the way it is evaluated. Lurian methods are not highly utilized in the United States, which most likely results from a strong psychometric tradition in North American psychology as well as from current standards of practice, which,

as noted by Tupper (1999a), "emphasize generation of numbers for payment." Still, there are a number of applications of Lurian conceptualizations in current neuropsychological practice (e.g., Das-Naglieri Cognitive Assessment System, Kaufman Assessment Battery for Children, Luria-Nebraska Neuropsychological Battery, Luria's Neuropsychological Investigation, and NEPSY). There are also new test measures being developed with an attempt to operationalize Lurian methods for use in different countries (e.g., Goldberg, Podell, Bilder, & Jaeger, 2000). Tupper (1999b) noted that development and standardization of the new tests consistent with Lurian theoretical approach "is expanding the traditional scope of cognitive assessment beyond a purely psychometric perspective" (p. 60).

Cross-Cultural Research in Other Areas of Psychology

In many ways, cultural issues have had a greater impact in other areas of psychology. Cross-cultural theories make three major assumptions: The general notion is that social evolution is a process that increases differentiation and complexity of social life. Basic mental operations of people are universal; and there is an ultimate relation between culture and mind (Cole, 1997). Within cross-cultural theories, comparisons have been conducted in various areas of psychology (e.g., sensation and perception, intelligence, and memory). These studies have also contributed to development of cross-cultural neuropsychology. For instance, a classic study of visual perception (Segall, Campbell, & Herskovits, 1966) demonstrated cultural differences in susceptibility to certain visual phenomena, including the Müller-Lyer Illusion. The researchers claimed that perceptual differences were due to differences in exposure to certain characteristics of visual information that are common to the western world and not common to other cultures. Studies of cross-cultural differences in memory focused on the serial position effect (Cole & Scribner, 1974) suggested that primacy and recency effects might be tied to specific memory strategies that develop through formal education. Therefore, these effects are not observed in individuals (or subcultures) with no formal education.

Cross-cultural research using IQ-tests technology has not advanced psychology's search for the nature of intelligence (Cole, 1997). If anything, it has reinforced doubts about the appropriateness of cross-cultural testing using such instruments. Nell (2000) adds with certain sarcasm that existing American research on IQ is "conducted as if the United States were the whole world" (p. 52) without actually considering different cultures.

Several investigations in social, personality, and clinical psychology in cross-cultural context (see S. Goldstein, 2000,

for a review) have had impact on research focused on brain-culture relations.

Toward Culture-Fair Neuropsychology

If indeed culture affects neuropsychological function, as proposed in this chapter, the question arises as to whether neuropsychology can be culturally fair. Historically, this concept has been ignored until very recently.

The History of Cultural Bias in Neuropsychological Assessment

In the past, neuropsychology was based on a world view that implied that all people would manifest the same behavior to the same stimulus in the brain (Sperry, 1961, 1965). Such historical foundations have led to partial or incorrect understanding of cultural effects on human behavior that is reflected in current western, male, and Caucasian-oriented methods of neuropsychological assessment (Puente & Agranovich, 2002). Despite unprecedented growth of neuropsychology over the last 20 years (Puente & Marcotte, 2000), to this date, culturally competent research studies relative to brain-behavior relationship are scarce.

In 1976, Lezak summed up the guidelines for the neuropsychological examination in his suggestion "to adapt the examination to the patient's needs, abilities, and limitations rather than other way around" (p. 105). However, a quarter-of-a-century later, the needs of the population that differ from the majority culture still have not come to the focus of neuropsychology. Although researchers have admitted that the United States could provide "the most fertile research database" (Puente et al., 2000b) for cross-cultural investigations, until recently only a few publications have related to cross-cultural issues in neuropsychology. Some of the recently published handbooks of neuropsychology addressed such factors as handedness, demographic variables, psychopathological, and medical issues in neuropsychological assessment (Goldstein & Hersen, 1990; Goldstein & Incagnoli, 1997; Puente & McCaffrey, 1992), but cultural variables were by and large neglected. Puente and Perez-Garcia (2000b) reviewed the tables of contents and reference lists of major neuropsychological publications from 1980s and 1990s and concluded that culture-related issues had not been addressed by that date. As a further illustration, the first workshop involving cultural issues in neuropsychology was presented by Puente at the annual meeting of the National Academy of Neuropsychology in 1993. Therefore, it is likely that our understanding of the brain organization of cognitive abilities,

and their disturbances in cases of brain pathology, is not only partial but, undoubtedly, culturally biased.

There have been attempts in the history of psychological testing to develop "culture-fair" measures (Anastasi, 1988). The initial assumption was that if verbal items were eliminated from the tests, the nonverbal measures would be equivalent in any culture. However, this assumption was proved wrong. The nonverbal tests may also be culturally biased (Ardila, 1995; Ardila & Moreno, 2001), as most of them require strategies and cognitive styles specific to certain (usually Western) cultures. Marked differences in the way individuals from different cultures perceive pictures have been reported in the literature (Miller, 1973). Furthermore, nonverbal tests often require specific strategies and cognitive styles based on characteristics of middle-class Western cultures (Cohen, 1969).

Reynolds and Brown (1984) put forward the following reasons for biased tests: inappropriate content, inappropriate standardization samples, examiner and language bias, inequitable social consequences, measurements of different constructs, and differential predictive validity.

Reynolds (2000) observed that different value systems among cultures might produce cognitively equivalent answers, which are scored as incorrect because of biased judgments, not differences in ability. Among other circumstances that cause cultural bias in neuropsychological tests is underrepresentation of ethnic minorities in standardization samples and in collection of norms. Psychologists who speak only standard English may intimidate people from other cultural groups. Such a language barrier may cause inequitable social consequences (e.g., being labeled as learning disabled) for minority group members. Qualitatively different minority and majority aptitude and personality are also listed among sources of bias (Puente et al., 2000b; Reynolds, 2000).

Current Trends

Within the last decade, interest in cross-cultural issues has substantially increased in North America (see Ardila, 1995, 2001; Ardila et al., 2001; Fletcher-Jansen et al., 2000; Greenfield, 1997; Puente et al., 2000a, 2000b). The diversity of the American population with increasing numbers of ethnic minority members, new waves of non-English-proficient immigrants, as well as multiple forensic cases that involve assessment of culturally diverse individuals have increased interest cross-cultural neuropsychology. Following are a few examples of cross-cultural differences, addressed in recently published research, that can be easily misinterpreted in neuropsychological assessment.

Time

In 1997, Perez-Arce and Puente addressed the importance of understanding the ecological validity of neuropsychological tests for Hispanics living in North America. They suggested that Hispanics use different problem-solving strategies than Anglo-Americans use. Slowed performance could mean prolonging the task of interest for a Hispanic; whereas an Anglo-American psychologist could interpret it as a sign of brain dysfunction. Although time is a critical variable in North American culture, this is not necessarily true for other cultures. Comparison of the research data on tapping tests collected in Russia (Kurgansky & Akhutina, 1998) with American norms suggest that average performance on timed North American standardized tests could be lower among Russians, because certain time-related skills are not relevant in their culture.

Attitude Toward Testing

Puente and Perez-Garcia (2000b) brought attention to the fact that, in some cultures, the client's fear of testing or lack of testing experience could prevent researchers from obtaining valid data. For example, Asian and Hispanic individuals not acculturated to North American standards may not permit a psychologist to examine their minds. Furthermore, in some cultures, personal communications with strangers are not acceptable (Ardila, 2001).

Values and Meanings

The same test items do not necessarily have the same meaning to members of different cultural groups even when these items are accurately and appropriately translated. For example, a question from WAIS-III "Why should people pay taxes?" may trigger different associations in a society where taxes are considered fairly expended compared to a society in which taxes are believed to be misused (Ardila, 2001). Western-world oriented items that discuss the protection of animals can also produce contradictory responses in hunting societies.

Modes of Knowing

It was observed in both classic and modern studies (Ardila et al., 2001; Luria, 1979) that the distinction between the process of knowing and the object of knowledge is not universal. Thus, for some cultures, a question that refers to a person's opinion about certain facts might be not comprehensible; and the respondent might say that the point is not what an individual thinks or considers, the point is how it is.

Patterns of Abilities

Cognitive abilities measured by neuropsychological tests represent culturally learned abilities and therefore, are affected by different environmental and cultural contexts (Ardila, 1995, 2001; Puente et al., 2000a). Thus, what is worth learning in Western culture does not necessarily make sense in the Far East, or in remote villages of Russia or South Africa. That is why there is a need for the theory and methods developed in a framework of cultural neuropsychology to recognize that "the best interests of minority and culturally different people can be served by recognizing culture-specific differences" (Nell, 2000, p. 12).

Within the focus of cross-cultural neuropsychology in the United States is the understanding of how an ethnic minority group compares and contrasts to the larger, majority group. It is assumed that the same principles apply to understanding any subculture within a larger group in any national or international setting (e.g., Amazon Indians in Brazil, small Asian subcultures within Russian Federation, or a Maori population in Australia). By and large, American research on the effect of culture on neuropsychological functioning has been focused on Hispanics (Ardila, 1995; Ardila, Roselli, & Puente, 1994; Puente et al., 2000a, 2000b; Puente & Salazar, 1998). In the context of changing demographics of American society this is easy to understand, because Hispanics are expected to reflect about 33 to 40 percent of the national population by the year of 2020 (see Puente et al., 2000a for review). Statistics have also shown that a large percentage of specific types of brain-injured individuals are from an ethnic minority (Puente, 1992). Among the very few tests that have been applied to diverse population are the Halstead-Reitan and Luria-Nebraska Neuropsychological batteries. However, even for such widely used tests, there have been few investigations of their cross-cultural application (Evans, Miller, Byrd, & Heaton, 2000; Puente et al., 2000b). Of all standardized tests, the Weschler Adult Intelligence Scale (WAIS) has received the most attention with regard to cultural adaptation (Puente et al., 2000b). Some norms have been collected for Canadian, Puerto-Rican, Spanish, and Russian versions. Among the other tests that are reported to be culture-reduced are Raven's Progressive Matrices, Peabody Picture Vocabulary Test, the Quick Test, the Army Beta (Nell, 2000; Puente et al., 2000b), and Color Trails Test (Maj, et al., 1993). Still, little evidence exists that these tests are culture free.

Research showed that cultural differences influence such variables as lateralization of language and spatial disturbances (see Ardila, 1995 for review) and have a profound effect on nonverbal behavior, language, and assumptions regarding

causality (Marlowe, 2000). Problem-solving styles also differ from culture to culture, and the more they differ, the more variable the results of tests that demand the use of such processes are. Furthermore, culturally different individuals may approach problems with different functional systems (Golden & Thomas, 2000). Greenfield (1997) noted that values and meanings, models of knowing, and conventions of communication could be culture specific and as such are not easy to translate across cultures. She concluded that because tests are not universal instruments, the criterion of a particular meaning must be understood before it is "translated." Evans and collaborators (Evans et al., 2000) added that there is a need for normative data to be collected on neuropsychological measures across cultures. Similar problems were addressed in a study of cultural bias in the Boston Naming Test (Barker-Collo, 2001), which compared performance on the test in New Zealand and the United States. Because New Zealand subjects made significantly more mistakes in naming some of the items, the author concluded that an adaptation of the test to a particular culture would be necessary to receive valid results.

Ardila (2001) suggested that cultural values involved in the assessment procedure, which are common for western cultures could at the same time be absurd for members of different cultural groups. Examples of such values include but are not limited to the following: one-to-one relationship between two strangers: the examiner and examinee; assumed background authority of the examiner; expectation of performance occurs at the examinee's highest possible level; isolated testing environment; stereotyped mode of communication; the requirement to perform as fast as possible on timed tasks; differences in subjective issues, such as concept of private information; and the use of specific testing elements and strategies, often referred to as "games" or "exercises."

Language is another cultural variable that can significantly affect test performance. Although certain characteristics of language can be found across cultures (deep meaning of sentences, distinction between nouns and verbs), only a few words occur universally across languages. Furthermore, there are words in different languages that cannot be literally translated from one language to another. Frequently used words in one language can have very low frequency if translated to another language. Grammatical differences exist across languages (e.g., verb tenses). Language usage differs according to cultural background and is highly correlated with a person's educational level. As a result, formal language used in testing can present a challenge for a person with limited education, because not all people are exposed to this kind of language in their everyday lives.

Most of the currently applied neuropsychological instruments have been validated for different age groups and educational levels. Several studies underlined the critical importance of educational level in performance on neuropsychological tests (Ardila, 1995, 2001; Ardila et al., 2001; Ardila et al., 1994; Ardila, Roselli, & Ostrosky-Solis, 1992; Harris, Echemendia, Ardila, & Roselli, 2001; Roselli, Ardila, & Rosas, 1990). Thus, Roselli and Ardila (1993) showed that some tests are more sensitive to educational variables (e.g., verbal tests) than others (e.g., the Wisconsin Card Sorting Test; WCST). Educational attainments significantly correlate with intelligence scales (Matarazzo, 1972), verbal meaning tests (Cornelious & Caspi, 1987), performance on memory task in elderly individuals (Ardila & Roselli, 1989), and a variety of neuropsychological measures including tests of language, problem solving, motor skills, and calculation abilities (Roselli et al., 1990). Ardila, Roselli, and Rosas (1989) suggested that educational variables might affect not only handedness, but also a degree of hemispheric dominance and cognitive abilities in general. Illiterates show greater involvement of the right hemisphere in language functions than do well-educated subjects (Lecours et al., 1988).

Ardila (1995) suggested that cross-cultural neuropsychology needs to address the following key points: standardization of current neuropsychological tests in different cultural contexts; development of new neuropsychological instruments, appropriate for different cultural groups; analysis of educational factors and cultural variations in relation to test performance; analysis of cognitive disturbances in different cultural and educational contexts; a search for common basis in neuropsychological performance among human groups; and analysis of origins of cognitive activity. Puente and Perez-Garcia (2000b) added to this that study of culture and psychopathology from a neurocognitive perspective provides a much larger pool of data about the human condition than the previously used paradigms offers. They suggested, that such an approach "could potentially yield unique insights into individual differences and general theories of psychological function and dysfunction" (p. 528).

CULTURALLY SENSITIVE NEUROPSYCHOLOGY ACROSS THE CONTINENTS

Gilbert (1986; see Nell, 2000 for review) replicated the Lurian Uzbek study, discussed earlier, in rural Kwa Zulu in South Africa. The results of Gilbert's study paralleled those of Luria. Less educated subjects showed patterns of concrete, situational responses on categorization tasks when asked to group geometric forms. Also, similar to the findings of Luria in

Uzbekistan and Gilbert in South Africa, the relationship between exposure to western cultural norms and cognitive performance was reported by Mirski (1995) in his San Pablo studies, and by Cole and his colleagues (Cole, 1988; Cole, Gay, & Glick, 1968; Cole & Means, 1981).

An interesting investigation of neuropsychological differences among AIDS patients was completed under auspices of the World Health Organization (WHO) in five countries of Europe, North America, South America, Asia, and Africa (Maj, et al., 1993). The researchers developed two new tests, the Color Trails Test (CTT) and World Health Association/University of California at Los Angeles Auditory Learning Test (WHO/UCLA AVLTL), and they compared performance on these tests as well as on widely used Trail Making Test and Rey Auditory Verbal Learning Test (RAVLT) in different cultural groups. Among other objectives, they investigated whether these new tests were less influenced by cultural factors than the standard tests were. The reported results suggested that the Trail Making Test and RAVLT present problems to non-Western test takers because of the words specific to American culture in the latter, and English alphabet in the former. The new tests showed lower variability of the scores between cultures as compared to traditionally used tests. Therefore, CTT and WHO/UCLA AVLTL were suggested to be appropriate for cross-cultural application.

Nell (2000) illustrated the failure of universalism to account for test score differences across cultures and countries on examples of data received in 24 studies in 13 countries on 4 continents—the largest available international comparative database, which was accumulated for the WHO Neurobehavioral Core Test Battery (WHO-NCTB). This core test battery—a "standard marker tests within larger batteries to allow cross-cultural comparison between studies and countries" (p. 172)—included several subtests from the Wechsler Adult Intelligence Test (WAIS-III) and the Wechsler Memory Scale (WMS-III), as well as the Grooved Pegboard Test, the Santa Ana Pegboard, the Pursuit Aiming, the Simple Reaction Time, and the Benton Visual Retention tests. From the examples of these well-known tests, Nell described cross-cultural differences between Western and non-Western cultural groups. In line with North American data (Ardila, 1995; Ardila et al., 2001; Puente et al., 2000a, 2000b), South African studies proved that researchers could hardly expect that cultural differences in testing to be eliminated by so-called test adaptation (Nell, 2000). It is apparent that such a variable as culture-dependent skills (or lack of such) could lead to significant differences in test performance.

Similarly, Sheperd, and Leathem (1999) conducted a study with Maori groups in Australia and suggested that ethnic minority clients might be adversely affected by the assessment

experience because of cultural differences in their expectations, perceptions of the testing environment, and performance on neuropsychological tests.

Among a few examples of cross-cultural research in South America is an evaluation of Auca Indians of the Ecuadorian basin conducted by Pontius (1989). He administered a four-colored Kohs Block Design test and found that deficits in block design particularly related to representations and construction of certain spatial relations and graphic representational skills. Also, in 1993, Pontius conducted another neuropsychological evaluation of members of a hunter-gatherers society of Indonesia. He showed that because a hunter-gatherer's survival depends on prompt assessment of the salient shape of prey and attackers, their basic cognitive processes (i.e., visual-spatial pattern matching, representation, and construction) differ from those of Western urban societies.

Ardila and Moreno (2001) administered a brief neuropsychological test battery (visual-constructive and visual-perceptual abilities, memory, ideomotor praxis, verbal fluency, spatial abilities, and concept formation) to Aruaco Indians from Colombia. They proposed that age and cultural relevance significantly affected performance on these tasks, and therefore, evaluation of a culturally different group using existing neuropsychological instruments, procedures, and norms, would result in conceptual errors in assessment. For example, because time restrictions do not make any sense in the Aruaco culture, performance on the tests was extremely slow according to Western standards. These findings once again suggested that culture-mediated differences in attitudes toward time could significantly affect performance on neuropsychological tests.

Additional cross-cultural research includes a recent publication of Campbell and Xue (2001), who studied differences in arithmetic performance between Canadian and Chinese students. They found that Chinese students outperformed their Canadian peers in given tasks. The authors showed that the differences in performance are not related to formal education but are dependent on extracurricular, culture-specific factors. They suggested that the wide-spread, extensive use of calculators in early education in the Western world might restrict the level of expertise achieved in working memory skills for arithmetic.

REQUIREMENTS FOR THE DEVELOPMENT, VALIDATION, AND INTERPRETATION OF CULTURE-FAIR NEUROPSYCHOLOGICAL INSTRUMENTS

Development of the instruments appropriate for different cultural contexts represents a challenge for neuropsychologists.

Whether it is necessary to develop entirely new tests to use across cultures or careful translation and culture-specific validation of existing tools could be sufficient remains an open question. It is important to keep in mind that cultural variables should be taken into account during each stage of neuropsychological evaluation, beginning with a review of records and concluding with interpretation of the results.

Reviewing Records

Puente and Perez-Garcia (2000a) suggested that when reviewing records, researchers should be aware of the fact that some variables that seem equivalent at first sight hold different meaning across the cultures. For example, 10 years of formal education in Russia results in a high school diploma; whereas in the United States it takes 12 years to complete the program, and in Germany high school programs are based on 13 years of attendance. And still the diplomas may be comparable. College degrees from some of European countries are equivalent to a Master's degree in the United States.

Interview

During the interview, the researcher should consider the native culture of the client, the value and significance of specific cultural concepts, model of knowledge, and model of communication (Greenfield, 1997). Prior testing history, level of education, and acculturation also need to be taken into account (Puente et al., 2000a). Performing the interview as a drama with as close a connection to roles played in the real world as possible is an important suggestion for assessing culturally dissimilar individuals (Nell, 2000).

Selecting Methods

Puente and Perez-Garcia (2000a) suggested that when selecting assessment methods, researchers should address the variable that needs to be measured, and then select the test that measures those variables; select measures that have been accurately translated according to cognitive rather than linguistic equivalence; when possible, use tests that have appropriate norms accompanied with specific instructions and protocols; select tests that reflect the language ability and culture of the patient; and if available, use ecologically valid tests of function. The content of the tests needs to be varied to accommodate different cultures (Ardila, 1995; Luria, 1980). For instance, a picture of a telephone should not be used for visual identification in a culture that has never seen the telephone; on the other hand, the picture of a telephone used in the original Lurian battery might be not recognized by young individuals in modern society, as that model is obsolete.

Golden and Thomas (2000) recommended that, when translating the tests to apply to different cultures, researchers should choose the items that are relatively simple, and include words with about the same frequency as in the original. Each item of the test must be reviewed for appropriate cultural content with regard to the intentions of the item. They emphasized that while arithmetic and memory scales translate reasonably well, intelligence scales present the major challenge in cross-cultural adaptation. Ardila and Moreno (2001) offered the following criteria for test selection: short and easy to administer; adapted to the living conditions of the cultural group that is being tested; and sampling a large range of cognitive abilities (i.e., language, memory, spatial, constructive, perceptual, praxis, and conceptual abilities).

Testing

Preferably, native and well-trained members of other cultures should be consulted when carrying out cross-cultural analysis (Ardila, 1995). Furthermore, for the language scales, including writing and reading, it is not always enough to translate accurately when applying the scales to another cultural group. It is more important to maintain the original intent (i.e., cognitive equivalence) of the item, than to word it exactly. Where the repetition of basic phonemes is necessary, items must be modified to include frequent sounds in a given language. In the case of using abstract items, there may be a need to alter the ideas to fit a certain culture (Golden et al., 2000). One of the most important considerations in an assessment is to place the client in his or her own biopsychological context and not the psychologist's context (Puente et al., 2000b). However, the literature suggests that this advice has seldom been followed thus far (Ardila, 1995; Nell, 2000).

Interpreting the Results

Interpretation of the results must be based on an awareness of how individuals from a particular cultural group approach and analyze specific tasks. Thus, such cultural variables as patterns of abilities (Puente et al., 2000b), cultural values, familiarity with testing procedure (Ardila, 2001), exposure to schooling, and language proficiency (Ardila, 1995; Greenfield, 1997) should be taken into consideration.

Norms

An issue of significant complexity is that of norms. Taking the case of Hispanics, one of the major concerns is that most tests, including those that have been adequately translated into Spanish, for example the Minnesota Multiphasic Person-

ality Inventory (MMPI), do not have appropriate norms. Then comes the issue of what would be considered appropriate norms. In the case of Hispanics, there are significant between-group differences among Mexicans, Cubans, and Puerto Ricans. Next, there is the issue of acculturation. Is a Cuban residing in the United States since 1960 equivalent to one who just arrived in this country? And, finally, and most perplexing is the issue of who the reference sample is. If an individual has been living in the United States for 40 years but does not speak Spanish, as is sometimes the case in Miami, Los Angeles, and so on, who do we compare that person to?

Developing New Measures

When developing tests to be used across cultures, the researcher has to know what is relevant, and what is being measured in a particular neuropsychological domain. For example, while spelling is a significant task in English, it is not as relevant in Spanish, and nonexistent in Chinese. The results of a tapping test in undeveloped countries could be much lower when compared to North American norms due to the lack of relevant experience in those countries (e.g., as computers are not widespread in the countries of the Third World, very little "tapping" occurs on a day-to-day basis). American people are used to timed tests from the beginning of elementary school and assume that faster is better. In Russia, however, there is different concept of time. The tests require quality and depth of processing. Therefore, people are not generally as concerned with the speed of performance. This pattern is also reflected in neuropsychological testing. Thus, Vasserman and colleagues (1997) suggested that the speed of testing should be individualized and one should not require a patient to accomplish a task fast—a far cry from North American approaches.

Overall, the following types of equivalence ought to be considered in test development to control for cultural bias (Helms, 1997):

1. Functional equivalence—the extent to which the test scores have the same meaning in different cultural groups and measure the same psychological constructs with equal accuracy within these groups.
2. Conceptual equivalence—whether the groups have the same level of familiarity with the test items and therefore assign the same meaning to them.
3. Linguistic equivalence—the extent to which the language used in the tests has equivalent meaning across cultural groups.
4. Psychometric equivalence—the extent to which tests measure the same thing at the same level across cultural groups.

5. Testing condition equivalence—the idea of testing and the procedures are equally familiar and accessible across groups.
6. Contextual equivalence—the evidence that the cognitive ability being assessed is comparable across environments.
7. Sampling equivalence—the samples of subjects representing cultural groups are comparable.

CONCLUSION

Existing neuropsychological assessment tools are far from universal. Cultural bias and the inappropriateness of the majority of standardized, Western-culture-oriented tests and norms for evaluation of cognitive functions in individuals from different cultural background, as well as lack of attention to a variety of cultural variables, can significantly affect the outcome of neuropsychological evaluation. That is why it is important to “keep culture in mind” (Cole, 1997) while conducting the research or providing clinical evaluations using a neuropsychological approach.

In contrast, when studying the relationship between culture and brain, it is important to remember that, “the job of science is to find the orderly relationships among phenomena, not differences” (Sidman, 1960, p. 15). Furthermore, the foundation of cross-cultural neuropsychology should be the investigation of the existence of neuropsychological *g* (Puente et al., 2000b). That is, if neuropsychologists are ever able to define the common factors or cognitive mechanisms that are shared by all members of human race, it would be possible to develop culture-free measures of cognitive performance that could provide clinically and scientifically reliable data about the functioning of the human brain, and as such would allow neuropsychologists to diagnose and treat disturbances of the nervous system regardless of an individual’s cultural identity.

From the clinical perspective, studying neuropsychological phenomena in the cross-cultural context could not only provide better possibilities for assessment to clinicians in different cultures and subcultures, but it could also enhance the understanding of the relationship between the brain and cognition (Ardila, 1995; Nell, 2000).

Meanwhile, it is critical to focus research on the revision and expansion of existing neuropsychological methods and on the development of the norms for non-Western cultural groups to make the methods applicable to assessment of culturally diverse individuals. To do otherwise would relegate clinical neuropsychology to a Western phenomenon perpetuating the concept that psychology and its specialties are ve-

hicles of “intellectual imperialism” and not of value to all cultures of this world.

REFERENCES

- Anastasi, A. (1988). *Psychological testing*. New York: Macmillan.
- Ardila, A. (1995). Directions of research in cross-cultural neuropsychology. *Journal of Clinical and Experimental Neuropsychology*, 17, 143–150.
- Ardila, A. (2001). The impact of culture on neuropsychological test performance. Course 13. Presented at 21st Annual Conference of National Academy of Neuropsychology. San Francisco, CA.
- Ardila, A., & Moreno, S. (2001). Neuropsychological test performance in Aruaco Indians: An exploratory study. *Journal of International Neuropsychological Society*, 7, 4, 510–515.
- Ardila, A., & Roselli, M. (1989). Neuropsychological characteristics of normal aging. *Developmental Neuropsychology*, 5, 307–320.
- Ardila, A., Roselli, M., & Ostrosky-Solis, F. (1992). Socioeducational. In A.E. Puente & R.J. McCaffrey (Eds.), *Handbook of neuropsychological assessment* (pp. 181–192). NY: Plenum.
- Ardila, A., Roselli, M., & Puente, A.E. (1994). *Neuropsychological assessment of Spanish-speaker*. New York: Plenum Press.
- Ardila, A., Roselli, M., & Rosas, P. (1989). Neuropsychological assessment in illiterates: Visuo-spatial and memory abilities. *Brain and Cognition*, 11, 147–166.
- Barker-Collo, S.L. (2001). The 60-item Boston naming test: Cultural bias and possible adaptations for New Zealand. *Aphasiology*, 15, 1, 85–92.
- Campbell, J.I.D., & Xue, Q. (2001). Cognitive arithmetic across cultures. *Journal of Experimental Psychology: General*, 130, 2, 299–315.
- Cohen, R.A. (1969). Conceptual styles, culture conflict, and non-verbal tests. *American Anthropologist*, 71, 828–856.
- Cole, M. (1988). Cross-cultural research in the sociohistorical tradition. *Human Development*, 31, 137–151.
- Cole, M. (1997). *Cultural psychology: a once and future discipline*. Cambridge, MA: Belknap Press of Harvard University Press.
- Cole, M., Gay, J., & Glick, J.A. (1968). A cross-cultural study of information processing. *International Journal of Psychology*, 3, 93–102.
- Cole, M., & Means, B. (1981). *Comparative studies of how people think*. Cambridge, MA: Harvard University Press.
- Cole, M., & Scribner, S. (1974). *Culture and thought: A psychological introduction*. New York: Wiley.
- Cornelious, S.W., & Caspi, A. (1987). Everyday problem solving in adulthood and old age. *Psychology and Aging*, 2, 144–153.
- Evans, J.D., Miller, S.W., Byrd, D.A., & Heaton, R.K. (2000). Cross-cultural applications of the Halstead-Reitan batteries. In E. Fletcher-Janzen, T.L. Strickland, & C.R. Reynolds (Eds.),

- Handbook of cross-cultural neuropsychology* (pp. 287–303). New York: Kluwer/Plenum.
- Fletcher-Janzen, E., Strickland, T.L., & Reynolds, C.R. (2000). (Eds.) *Handbook of cross-cultural neuropsychology*. New York: Kluwer/Plenum.
- Gilbert, A.J. (1986). *Psychology and social change in the third world: A cognitive perspective*. Unpublished doctoral dissertation. University of South Africa, Pretoria.
- Goldberg, E., Podell, K., Bilder, R., & Jaeger, J. (2000). *The Executive Control Battery*. Australia: Psych Press.
- Golden, C.J., & Thomas, R.B. (2000). Cross-cultural application of the Luria-Nebraska neuropsychological test battery and Lurian principles of syndrome analysis. In E. Fletcher-Janzen, T.L. Strickland, & C.R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 305–315). New York: Kluwer/Plenum.
- Goldstein, G. & Hersen, M. (Eds.) (1990). *Handbook of psychological assessment*. 2nd ed. New York: Pergamon Press.
- Goldstein, G., & Incagnoli, T.M. (Eds.) (1997). *Contemporary approaches to neuropsychological assessment*. New York: Plenum Press.
- Goldstein, S. (2000). *Cross-cultural explorations*. Activities in culture and psychology. Boston: Allyn & Bacon.
- Greenfield, P.M. (1997). You can't take it with you. Why ability assessment don't cross cultures. *American Psychologist*, 52, 1115–1124.
- Harris, J.G., Echemendia, R., Ardila, A., & Roselli, M. (2001). Cross-cultural cognitive and neuropsychological assessment. In J.J.W. Andrews & D.H. Saklofske (Eds.), *Handbook of psycho-educational assessment. Ability, achievement, and behavior in children* (pp. 391–414). San Diego, CA: Academic Press.
- Helms, J.E. (1997). The triple quandary of race, culture, and social class in standardized cognitive ability testing. In D.P. Flanagan, J.L. Genshaft, & P.L. Harrison (Eds.), *Contemporary intellectual assessment* (pp. 517–532). New York: Guilford.
- Herskovits, M.J. (1948). *Man and his works: The science of cultural anthropology*. New York: Knopf.
- John-Steiner, V., & Souberman, E. (1978). Afterword. In L.S. Vygotsky. *Mind in society. The development of higher psychological processes* (pp. 121–133). Cambridge, MA: Harvard University Press.
- Khomskaya, E.D. (1999). L.S. Vygotsky's role in Luria's work. In E.D. Khomskaya & T.V. Akhutina (Eds.), *Handbook of neuropsychology* (pp. 32–37). Moscow: Russian Psychological Society (In Russian).
- Kurgansky, A.V., & Akhutina, T.V. (1998). Temporal parameters of rhythmic tapping in adult and children: Dependence on structural complexity. In E.D. Khomskaya & T.V. Akhutina (Eds.), *Proceedings of the First Luria Memorial International Conference* (pp. 166–177). Moscow: Russian Psychological Society (in Russian).
- Lecours, A.R., Mehler, J., Parente, M.A., Caldeira, A., Cary, L., Castro, M.J., Carrond, V., Chagastelles, L., Dehaut, F., (1988). Illiteracy and brain damage. *Neuropsychologia*, 26, 575–589.
- Levy-Bruhl, L. (1910/1966). *How natives think*. New York: Washington Square Press.
- Lezak, M.D. (1976). *Neuropsychological assessment*. New York: Oxford University Press.
- Luria, A.R. (1965). L.S. Vygotsky and the problem of localization of functions. *Neuropsychologia*, 3, 387–392.
- Luria, A.R. (1976). *Cognitive development: Its cultural and social foundations*. Cambridge, MA: Harvard University Press.
- Luria, A.R. (1979). *The making of mind: A personal account of Soviet psychology*. Cambridge, MA: Harvard University Press.
- Luria, A.R. (1980). *Higher cortical functions in man*. 2nd Ed. New York: Basic Books.
- Maj, M., DiElia, L., Satz, P., Jansen, R., Zauding, M., Uchiyama, C., Starace, F., Galderisi, S. & Chervinsky, D. (1993). Evaluation of two new neuropsychological tests designed to minimize cultural bias in the assessment of HIV-1 seropositive persons: A WHO study. *Archives of Clinical Neuropsychology*, 8, 123–135.
- Marlowe, W.B. (2000). Multicultural perspectives on neuropsychological assessment of children and adolescents. In E. Fletcher-Janzen, T.L. Strickland, & C.R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 145–165). New York: Kluwer/Plenum.
- Massimini, F., & Delle Fave, A. (2000). Individual development in a bio-cultural perspective. *American Psychologist*, 55, 2, 24–33.
- Matarazzo, J.D. (1972). *Wechsler's measurement and appraisal of adult intelligence*. Baltimore: Williams & Wilkins.
- Miller, R.J. (1973). Cross-cultural research in the perception of pictorial materials. *Psychological Bulletin*, 80, 135–150.
- Nell, V. (1999). Luria in Uzbekistan: The vicissitudes of cross-cultural neuropsychology. *Neuropsychology Review*, 9, 1, 45–52.
- Nell, V. (2000). *Cross-cultural neuropsychological assessment: Theory and practice*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Perez-Arce, P., & Puente, A.E. (1997). Neuropsychological assessment of ethnic minorities. The case of assessing Hispanics living in North America. In R.J. Shordone & C.J. Long (Eds.), *Ecological validity of neuropsychological tests* (pp. 283–300). Delray Beach, FL: St. Lucie Press.
- Pontius, A.A. (1989). Color and spatial error in block design in stone age Auca Indians: Ecological underuse of occipital-parietal system in men and frontal lobes in women. *Brain & Cognition*, 10, 54–75.
- Pontius, A.A. (1993). Spatial representation, modified by ecology: From hunter-gatherers to city dwellers in Indonesia. *Journal of Cross-Cultural Psychology*, 24, 4, 399–413.
- Puente, A.E. (1992). The status of clinical neuropsychology. *Archives of Clinical Neuropsychology*, 7, 297–312.
- Puente, A.E., & Agranovich, A.V. (2002). Are neuropsychological tests measuring cultural knowledge? A review of V. Nell, Cross-

- cultural neuropsychological assessment: Theory and practice. *Applied Neuropsychology*, 9, 2, 121–124.
- Puente, A.E., & Marcotte, A.C. (2000). A history of division 40 (clinical neuropsychology). In D.A. Dewsbury (Ed.), *Unification through division: Histories of the divisions of the American Psychological Association*, Vol. 5 (pp. 137–160). American Psychological Association, Washington, DC.
- Puente, A.E., & McCaffrey, R.J. (Eds.) *Handbook of neuropsychological assessment*. New York: Plenum.
- Puente, A.E., & Perez-Garcia, M. (2000a). Neuropsychological assessment of ethnic minorities: Clinical issues. In Cuellar, S. & Paniagua, F. (Eds.), *Handbook of Multicultural Mental Health* (pp. 419–435). New York: Academic Press.
- Puente, A.E., & Perez-Garcia, M. (2000b). Psychological assessment of ethnic minorities. In G. Goldstein & M. Hersen (Eds.), *Handbook of psychological assessment*, 3rd ed. (pp. 527–552). New York: Pergamon.
- Puente, A.E., & Salazar, G.D. (1998). Assessment of minority and culturally diverse children. In A. Prifitera & D. Saklofske (Eds.), *WISC-III: Clinical use and interpretation* (pp. 227–248). San Diego: Academic Press.
- Reynolds, C.R., & Brown, R. (1984). *Bias in mental testing*. New York: Plenum.
- Reynolds, C.R. (2000). Methods for detecting and evaluating cultural bias in neuropsychological tests. In E. Fletcher-Janzen, T.L. Strickland & C.R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 249–285). Dordrecht, Netherlands: Kluwer.
- Roselli, M., & Ardila, A. (1993). Effects of age, gender and socioeconomic level on the Wisconsin Card Sorting Test. *The Clinical Neuropsychologist*, 7, 145–154.
- Roselli, M., Ardila, A. & Rosas, M. (1990). Neuropsychological assessment in illiterates II: Language and praxis abilities. *Brain and Cognition*, 12, 281–296.
- Segall, M.H., Campbell, D.T., & Herskovitz, M.J. (1966). *The influence of culture on visual perception*. Indianapolis: Bobbs-Merrill.
- Shepherd, I., & Leatham, J. (1999). Factors affecting performance in cross-cultural neuropsychology: From a New Zealand bicultural perspective. *Journal of the International Neuropsychological Society*, 5, 1, 83–84.
- Sidman, M. (1960). *Tactics of scientific research: Evaluating experimental data in psychology*. New York: Basic Books.
- Sperry, R.W. (1961). Cerebral organization and behavior. *Science*, 133, 1749–1757.
- Sperry, R.W. (1965). Mind, brain, and humanist values. In J.R. Platt (Ed.), *New views of the nature of man* (pp. 71–92). Chicago: University of Chicago Press.
- Thrunwald, R. (1922). Psychology of primitive men. In I.G. Kafka (Ed.), *Handbook of cultural psychology. Vol.1*. Munich: Verlag von Ernst Reinhardt (in German).
- Triandis, H.C., Vassiliou, V., Vassiliou, G., Tanaka, Y., & Shanmugam, A.V. (1972). *The analysis of subjective culture*. New York: Wiley.
- Tupper, D.E. (1999a). Introduction: Aleksandr Luria's continuing influence on worldwide neuropsychology. *Neuropsychology Review*, 9, 1, 1–7.
- Tupper, D.E. (1999b). Introduction: Neuropsychological assessment apres Luria. *Neuropsychology Review*, 9, 2, 57–61.
- Vasserman, L.I., Dorofeeva, S.A., & Meyerson, Y.A. (1997). *Methods of neuropsychological diagnostics: Practical manual*. St. Petersburg, Russia: Stoipechat (in Russian).
- Vygotsky, L.S. (1978). *Mind in society. The development of higher psychological processes*. M. Cole, V. John-Stainer, S. Scribner, & E. Souberman (Eds.). Cambridge, MA: Harvard University Press.
- Vygotsky, L.S. (1996). The Problem of development of higher psychical functions. In M.G. Yaroshevsky (Ed.), *L.S. Vygotsky. Developmental psychology as a cultural phenomenon. Selected chapters*. Moscow: Institut Prakticheskoi Psychologii (In Russian).
- Wong, T.M., Strickland, T.L., Fletcher-Janzen, E., Ardila, A., & Reynolds, C.R. (2000). Theoretical and practical issues in the neuropsychological assessment and treatment of culturally dissimilar patients. In E. Fletcher-Janzen, T.L. Strickland & C.R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 3–18). New York: Kluwer/Plenum.