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Neuropsychological, Cognitive, and Theoretical Considerations for Evaluation of Bilingual Individuals

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Abstract

As the number of bilinguals in the USA grows rapidly, it is increasingly important for neuropsychologists to be equipped and trained to address the unique challenges inherent in conducting ethical and competent neuropsychological evaluations with this population. Research on bilingualism has focused on two key cognitive mechanisms that introduce differences between bilinguals and monolinguals: (a) reduced frequency of language-specific use (weaker links), and (b) competition for selection within the language system in bilinguals (interference). Both mechanisms are needed to explain how bilingualism affects neuropsychological test performance, including the robust bilingual disadvantages found on verbal tasks, and more subtle bilingual advantages on some measures of cognitive control. These empirical results and theoretical claims can be used to derive a theoretically informed method for assessing cognitive status in bilinguals. We present specific considerations for measuring degree of bilingualism for both clients and examiners to aid in determinations of approaches to testing bilinguals, with practical guidelines for incorporating models of bilingualism and recent experimental data into neuropsychological evaluations. This integrated approach promises to provide improved clinical services for bilingual clients, and will also contribute to a program of research that will ultimately reveal the mechanisms underlying language processing and executive functioning in bilinguals and monolinguals alike.

Keywords

Bilingual; Assessment; Racial/ethnic minorities; Cognitive; Neuropsychological

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Introduction

Approximately one-third of the US population is part of a racial/ethnic minority group, and this ratio will climb to approximately one-half of the US population by 2050 (US Census Bureau 2002). With this evolving cultural diversity comes greater linguistic diversity (US Census Bureau 2003) which has profound implications for neuropsychology. Language is fundamental to virtually all aspects of the human experience, and represents a core focus of neuropsychological evaluation. However, many US neuropsychologists struggle with how to best evaluate and understand the neuropsychological function of 'linguistic minorities' (i.e., bilinguals and multilinguals; Echemendia et al. 1997; Paradis 2008). This discussion seeks to address this challenge by providing a critical review of key neuropsychological considerations for evaluating bilingual individuals.

US Demographics and Bilingualism

At the time of the 2000 US Census, approximately 18% of US residents (47 million total; age 5 and older) spoke a language other than English at home, and immigration patterns since then suggest that an even greater portion of US residents will speak a non-English language by the time the 2010 US Census occurs (US Census Bureau 2003, 2007). In seven US states, more than 25% of the respective populations already speak a language other than English at home: California (39%), New Mexico (37%), Texas (31%), New York (28%), Hawaii (27%), and Arizona and New Jersey (26% each; US Census Bureau 2003). Although the 2000 US Census does not specifically address the frequency of bilingualism, more than half of non-English speakers report also speaking English "very well," suggesting a high level of bilingualism in the US (based on self-report; US Census Bureau 2003).

Among the multitude of non-English languages spoken in the US, Spanish is by far the most prevalent, with over 28 million Spanish-speakers nationwide, followed by Chinese (2 million), French (1.6 million), and many others (US Census Bureau 2003). These figures have steadily increased, with the number of US residents who spoke a non-English language at home more than doubling between 1980 and 2000 (US Census Bureau 2003). By the 2030's, it is expected that 40% of the school-age population will include students whose home language is not English (Thomas and Collier 2002). This growth of bilinguals in the US is reflected in the scientific literature, with increasing numbers of studies focusing on bilingualism.

The US Hispanic/Latino population is a particularly important community within which to examine bilingualism because they are the largest and fastest growing racial/ethnic minority group in this country, currently making up approximately 15% of the US population (US Census Bureau 2007). As of 2005, the US has the third largest Latino population in the world (42.7 million), superseded only by Mexico (106.2 million) and Colombia (43 million), with more people of Spanish-speaking heritage in the US than even in Spain (40.3 million; US Census Bureau 2007). The majority (78%) of the US Latino population (age 5 and older) reports speaking Spanish at home, and more than half of this group reports also speaking English "very well," with many more reporting varying degrees of lower levels of English language fluency (US Census Bureau 2003, 2007). Consequently, there is a particular interest in studying Spanish–English bilingualism within the US; however, note that many studies reviewed below originate in other parts of the world where bilingualism is even more common than it is in the US.

Theoretical Underpinnings

Recent years have brought a virtual explosion of experimental studies aimed at identifying the consequences of bilingualism for language functioning and for processing in other cognitive domains. The results of these studies have pragmatic implications for assessing cognitive status

in bilinguals, have theoretical implications for understanding bilingualism, and also have broader implications for understanding language processing in monolinguals and bilinguals alike. A challenge in reviewing the literature on bilingualism is that "bilingual" is defined in different ways across studies. On one end of the continuum are late-learners of a second language, and at the other end are highly balanced bilinguals who acquired both languages at an early age, use both languages frequently in daily life, and have similar competence levels in both languages in all domains. Most bilinguals fall somewhere in the middle of this continuum, including Spanish–English bilinguals who are born in the US (or immigrated early) and often have Spanish as their first-learned language, English as their dominant language and have been educated mostly—if not exclusively—in English. Ultimately, models of bilingualism will need to be able to explain all different types of bilingualism, and the multitude of studies embracing the full range of different types of bilinguals has been quite fruitful. Currently, a picture of bilingualism is emerging with some clear commonalities across bilingual types, and revealing the fundamental aspects of learning, maintaining, and using two languages within a single cognitive system.

The consequences of bilingualism for cognitive processing reveal two mechanisms as fundamental to the observed differences between bilinguals and monolinguals, and to managing the processing load inherent in becoming bilingual. These are: (a) competition or interference between languages, and (b) frequency of use. Early research on bilingualism was aimed at determining the extent to which bilinguals can "turn one language off" and function as monolinguals (for recent review see Kroll et al. 2008). To a large extent, this work has revealed that both languages are always active, which sometimes introduces a need to control activation of the nontarget language. The need for language control is most apparent when bilinguals speak in their nondominant language because the dominant language is generally more accessible and may need to be suppressed to allow the nondominant language to be produced (Green 1998). By contrast, when bilinguals speak the dominant language, the nondominant language is relatively less active, and bilinguals experience little (or no) interference from the nontarget language. Finally, dual-language activation often leads to facilitation effects (instead of interference) in comprehension tasks, and recent work identifies a relatively limited role for interference between languages in bilingual language comprehension (Lemhöfer et al. 2008).

Nevertheless, the presence of constant dual-language activation implies that bilingualism entails an exercise in cognitive control. This is particularly true for bilinguals who use both languages frequently, which involves switching between languages and speaking the relatively less dominant language a substantial portion of the time. Compellingly, language dominance sometimes reverses in mixed language tasks (such that bilinguals respond more slowly in the language that is otherwise usually dominant in language-selective conditions). Dominance reversal occurs both when language switches are cued and required (e.g., Costa and Santesteban 2004; Christoffels et al. 2007) and when bilinguals switch more voluntarily (Gollan and Ferreira 2007), suggesting that an effective strategy for language mixing is to roughly equalize the relative accessibility of both languages by inhibiting the dominant language (see also Green 1998; Kroll et al. 2008). As described below, the assumption of interference between languages has led to the discovery of a number of processing advantages associated with bilingualism throughout the life-span, and by implication associates general mechanisms of cognitive control—including neural underpinnings of such control—with language functioning (for all speakers).

Although research on bilingualism has been dominated in recent years by the assumption of interference between languages, as noted previously, dual-language activation does not always lead to interference (quite the opposite in some conditions; e.g., Costa et al. 1999; Gollan and Acenas 2004). It is difficult to explain all of the consequences of bilingualism as solely

reflecting competition for selection between languages (Gollan et al. 2008). If we set interference aside to consider other factors that could introduce differences between bilinguals and monolinguals, an equally important consideration is frequency of use. By virtue of speaking each language only some of the time, bilinguals use each language less frequently than monolinguals (who use the same language all of the time). There is a well-established connection between frequency of use and lexical accessibility such that frequently used words are accessed more quickly and accurately than low-frequency words (e.g., Oldfield and Wingfield 1965; Scarborough et al. 1977). As such, bilingual language users may effectively be "less proficient" relative to monolinguals who, in turn, might be characterized as "hyper-proficient" in the one language they speak. This view of how bilingualism affects performance assigns no role to interference between languages. Rather, it represents a more emergent way to explain how bilinguals differ from monolinguals, appealing to mechanisms that have a powerful influence upon all language users.

The reduced-frequency-of-use hypothesis has been called the "weaker links" account (Gollan et al. 2008). It has been particularly useful for understanding bilingual disadvantages in dominant language production (which is relatively immune to interference), and in other cases in which interference between languages is not possible, or unlikely, such as when bilinguals are disadvantaged for retrieving words that they know in just one language (Gollan and Acenas 2004). Importantly, the weaker links and interference mechanisms are mutually compatible and likely operate simultaneously to influence bilingual performance in a variety of tasks. The two mechanisms do lead to opposing predictions in some cases so that the weaker links hypothesis, for example, predicts that bilinguals should be most disadvantaged for production of low-frequency words (Gollan et al. 2008; see also Ivanova and Costa 2008), but the interference account predicts that bilinguals should be most disadvantaged for production of high-frequency words. However, both assumptions are necessary to explain bilingual performance, and though this is seldom discussed in the literature, computational models of bilingual language processing implicitly adopt both assumptions; one language is more accessible than the other because of competition between languages, but also because of differences in frequency of use (e.g., Dijkstra and van Heuven 2002 pp. 178 & 182). Assuming an analogy between the bilingual versus monolingual contrast, and the dominant versus nondominant language contrast, both frequency of use and interference should play a role in explaining how bilinguals differ from monolinguals in language processing tasks. It is also likely that continuing research comparing bilinguals and monolinguals will reveal other mechanisms that play a role in performance differences between groups.

Cognitive Effects of Bilingualism Throughout the Lifespan

Historically, a great deal of the literature on bilingualism focused on its disadvantages without much attention to sociopolitical and methodological issues that might have significantly contributed to such negative valuations of bilingualism (Harris and Llorente 2005). More recent research has yielded a more balanced perspective of the cognitive disadvantages and advantages of bilingualism.

Disadvantages

Children who learn two languages simultaneously may initially acquire language more slowly than monolingual children and relative to bilingual children who learn one language first and add a second later (sequential bilinguals). However, such differences tend to diminish quickly after entering school (Collier 1995; Hamayan and Damico 1991). Research also suggests a disparity in the development of the kind of language proficiency necessary for higher order, cognitive and academic linguistic skills: for example, cognitive academic language proficiency (CALP) versus more conversational proficiency necessary for day-to-day social interactions (Cummins 1979; Corson 1995). Not surprisingly, children can typically acquire conversational

proficiency in a subsequent nondominant language within about 2 years; however, they take much longer to acquire higher-order language proficiency (Collier 1995; Cummins 1981; Klesmer 1994). This more rapid conversational fluency can put bilingual children at risk for being tested in their nondominant language prematurely. While such fluency may be adequate for day-to-day interactions, it falls short of the higher-order fluency required for cognitive processing in a 'context reduced' situation such as the neuropsychological evaluation (Cummings 1984a; French and Llorente 2008). This may at least in part help to explain why bilingual children in the US and abroad may perform worse on standardized academic achievement tests compared with their native English-speaking monolingual counterparts (Cummins 1984b; Skutnabb-Kangas and Toukomaa 1976).

Compelling evidence from a national study examining school effectiveness for linguistic minority students' long-term academic achievement revealed that the strongest predictor of academic achievement in the subsequent, nondominant language is years of formal schooling in the native, dominant language (Thomas and Collier 2002). While somewhat counter-intuitive, and inconsistent with the interference account, greater proficiency in the first-acquired language facilitates proficiency in the subsequent language. As such, current US educational trends toward placing non-English speaking children in *immersion* (i.e., English-only) classrooms as quickly as possible do not advance English language proficiency as much as dual-language programs (Thomas and Collier 2002). Rather, children in such immersion programs essentially lose ground in both languages, which requires them to make more gains than the average native-English speaker every year for several years to catch up to grade level (Thomas and Collier 2002).

Another disadvantage of bilingualism is vocabulary size. Given that bilinguals know two labels for many concepts, by logical extension bilinguals have a much larger vocabulary than monolinguals when words from both languages are counted. However, within each language bilinguals have a smaller vocabulary size relative to monolinguals' vocabulary in their one respective language. Bilingual children have smaller receptive (Bialystok and Feng 2008) and productive (Nicoladis and Giovanni 2000) vocabularies compared with their monolingual counterparts. There has been a suggestion that bilinguals catch up to monolinguals in vocabulary knowledge by adulthood (see review in Hamers and Blanc 2000), but the following work suggests otherwise.

Bilingual disadvantages have been observed in receptive vocabulary scores in both young and older adults on standardized tests such as the Peabody Picture Vocabulary Test (PPVT; e.g., Bialystok et al. 2008). Because comprehension generally precedes production in lexical accessibility, any differences that can be observed on comprehension-based measures, such as the PPVT, will likely be present in tasks that require language production. Consistent with this claim, young adult bilinguals recognize fewer difficult vocabulary words than monolinguals and have more tip-of-the-tongue or TOT retrieval failures than monolinguals (see review in Gollan and Brown 2006), name pictures more slowly than monolinguals (e.g., Gollan et al. 2008), and name fewer pictures correctly on standardized naming tests such as the Boston Naming Test (BNT; Roberts et al. 2002). Importantly, these bilingual disadvantages were found even when bilinguals were tested exclusively in their first-acquired, and dominant language (e.g., Gollan and Acenas 2004; Ivanova and Costa 2008). Moreover, balanced bilinguals named fewer BNT pictures correctly than unbalanced bilinguals in a study of elderly subjects, implying a direct relationship between the degree of bilingualism and the disadvantage (Gollan et al. 2007). Young and older bilinguals are also disadvantaged in verbal fluency tests, with a greater bilingual disadvantage on semantic than on letter fluency (e.g., Gollan et al. 2002; Rosselli et al. 2000).

Advantages

According to Green (1998), bilinguals receive an early opportunity to practice inhibitory control so that when they communicate in one language, the nontarget language is suppressed by the same executive functions used generally to control attention and inhibition. For instance, the ability to switch between two languages may require inhibitory control. Several studies reveal that the cost of language than switching is greater when switching from the weaker second language to the stronger dominant language than switching from the stronger dominant language to the weaker second language (see original report in Meuter and Allport 1999; review in Kroll et al. 2008). This asymmetry of switch costs implies that the dominant language must be inhibited to allow production in the nondominant language. Consistent with this claim, the experience of bilingualism appears to confer an advantage in executive function throughout the life span.

Bilingual children outperform monolingual children on tasks of inhibitory control of attention, one key aspect of executive function (Bialystok 1999, 2001; Bunge et al. 2002; Zelazo et al. 2003). Because of their presumably higher level of control of linguistic processing, bilingual children have more experience than monolingual children in attentional control (Bialystok 1988). Further, research suggests earlier development of executive function in bilingual children (as early as 3 years of age) compared to monolingual children at approximately 4–5 years of age (Bialystok 1999; Diamond et al. 2005; Kloo and Perner 2005; Zelazo et al. 1996). Better performance and earlier success on executive function tasks among bilingual children may be attributed to superior inhibitory control of attention that may have developed as a result of bilingual experience (Bialystok and Martin 2004). These studies provide important insights into the potential role of bilingualism in early cognitive development. However, it is important to note that many of these studies were conducted in Canada, wherein bilingualism may systematically covary with other sociodemographic variables (e.g., differences in culture, or socioeconomic status, SES) that could also impact cognitive development.

Studies examining differences between high and low SES children on measures of cognitive functioning have found a low-SES disadvantage (Brooks-Gunn et al. 1996), particularly on tasks measuring attentional control (Mezzacappa 2004). In the US, where the vast majority of bilinguals are Latino—an ethnic group often associated with lower SES—it is possible that any bilingual advantage in cognitive control processes may be attenuated by a SES disadvantage (Harrell and Carrasquillo 2003; The Pew Hispanic Center 2005). A recent study of native bilingual (Spanish–English), late bilingual (English–Spanish), and monolingual children living in the US, revealed a bilingual advantage only after statistically controlling for age, verbal ability (which was lower in Latinos than in monolinguals), parent education level (as a proxy for SES), and parents' ratings of the importance of self-control (Latino parents rated this as more important). With this statistical control, native bilingual children demonstrated better performance on a battery of executive function tasks compared with their late bilingual and monolingual counterparts (Carlson and Meltzoff 2008). Note also that one small Canadian study of bilingual (French–English) and monolingual children also failed to show an advantage on an executive function task after controlling for SES and ethnicity (Morton and Harper 2007); however, this study may have lacked the power necessary to replicate the effects reported by Bialystok and colleagues. Nevertheless, the executive function advantages of bilingualism, when SES is also considered, are still somewhat equivocal. It remains to be determined, for example, whether Latino bilinguals who are matched to English-speaking monolinguals in SES will have the same control advantages as the bilinguals in Canada.

In addition to the literature on bilingual children, a more recently emerging body of literature supports the notion of advantages in executive functioning for adult bilinguals, including studies originating in Canada (Bialystok 2006; Bialystok et al. 2004), and in Europe (Costa et al. 2008). In one of these studies, young adult bilinguals were faster and more efficient than

matched monolinguals in responding to a central arrow in the presence of conflicting flankers in the Attentional Network Task (ANT; Fan et al. 2002), indicating a more efficient executive control network (Costa et al. 2008). Other preliminary research, including one study with more ethnically diverse populations (Kavé et al. 2008), suggests a protective effect of bilingualism against cognitive decline in healthy aging and in Alzheimer's disease (Bialystok et al. 2007). Other researchers originating in Europe, where bilingualism is not associated with lower SES, characterize some bilingual advantages as "…notoriously difficult to replicate." (e.g., Colzato et al. 2008, pp 302.), and fail to find bilingual advantages in active inhibitory control, but reveal differences between groups in other aspects of executive control.

The studies reviewed in this section seem to imply that continued need to control the activation of two languages in a single cognitive system leads to a more efficient executive control system in bilinguals relative to monolinguals. An important avenue to pursue in future work in this domain would be to obtain a more explicit connection between bilingualism and differences between groups. Studies exploring the cognitive effects of bilingualism across the lifespan seem to suggest bilingual advantages in executive control, but much of the work on bilingual processing advantages has failed to provide a clear association between degree of bilingualism and the advantages observed (for an exception see Bialystok et al. 2006), and further work in this area is needed.

Given that executive functioning can be affected by many variables (including SES), it may be more useful to investigate within-group variance among bilinguals to determine which aspects of bilingualism specifically lead to enhanced performance rather than variance between bilinguals and monolinguals. For example, if language switching confers bilingual advantages, then bilinguals who switch languages more frequently should show greater cognitive control than bilinguals who switch less frequently, and this relationship should hold both in high-SES and low-SES bilinguals. Importantly, language switching, and task switching in general, does not necessarily require inhibitory control, and can readily be explained with other cognitive mechanisms (e.g., Yeung and Monsell 2003). Additionally, it is not clear that inhibitory control, per se, is involved; bilingual advantages are often equally strong in trials that do (incongruent) and in trials that do not (congruent) entail response conflict (e.g., Costa et al. 2008). Further work in this area promises to reveal more about bilingualism and the role of executive control in language processing.

The Bilingual Brain

Despite some evidence to the contrary, there is a growing body of literature supporting the notion that L2 (the nondominant language) is primarily (though not entirely) stored in the same neural network as L1 (the dominant language; Abutalebi 2008; Abutalebi and Green 2007; Miozzo, Costa, Hernández, and Rapp, in press; for a different view, see Ullman 2001, 2004). Literature on neural development suggests that neural processes involved in language acquisition and speech disorders are similar in many ways across individuals, regardless of mono- or bilingualism (Holm et al. 1999). However, differences in processing may exist between languages, particularly in lower levels of language proficiency and later age of acquisition of an L2.

With regard to neural structure and function, prefrontal and frontal structures, along with neural plasticity in response to environmental demands, are clearly critical to the bilingual brain. Neuroimaging research also underscores the dynamic interplay of cortical and subcortical structures in resolving lexical competition through inhibitory control (for a comprehensive and systematic review, see Abutalebi and Green 2007). In one such study, six Spanish–English (Spanish-L1, English-dominant) early bilinguals were asked to identify a picture aloud in the target language, as indicated by the language of the cue (i.e., either the word "Say" or "Diga").

Language switching was associated with greater activation of the dorsolateral prefrontal cortex (DLPFC; Hernandez et al. 2000), a region of the brain that has been associated with conflict control, higher-order attentional processes (including selective attention), and inhibition among others (Chen et al. 2006; Posner and Presti 1987). But note that the observation of activation in DLPFC during language switching merely implies that executive control is important in the context of language switching. While it is reasonable to attribute the differential activation in these regions to differences in selective-attention allocation required by switch/non-switch conditions, whether such activation specifically indicates a role for inhibitory control in language selective production remains an open question, and stronger evidence for these claims (e.g., Abutalebi and Green 2007) is needed.

Only one recent imaging study compared bilinguals to monolinguals when bilinguals were tested in just one language (without language mixing or switching) and revealed a greater role for the DLPFC in language-selective processing for bilinguals. However, bilinguals in this study may have completed a language-switching block immediately prior to the language selective testing block (block order was random and this factor was not considered in the analyses; Kovelman et al. 2008). Notably, several studies suggest that lack of proficiency in the nondominant language (L2) is associated with recruitment of additional regions, specifically prefrontal areas (Briellmann et al. 2004; Meschyan and Hernandez 2006; Pillai et al. 2003. The parallel results across studies, such that bilingualism and language proficiency are both associated with increased activation in frontal regions of the brain, support the analogy between language proficiency and the effects of bilingualism on language processing, and may or may not be specifically related to inhibitory control.

A handful of studies comparing bilinguals to monolinguals reveal some differences in patterns of brain activation between groups. A study comparing Italian–English bilinguals (native Italian speakers) to monolinguals, found an increase in the density of gray matter in the left-inferior parietal cortex of bilinguals relative to monolinguals (Mechelli et al. 2004). This effect was found to be more pronounced in early rather than late bilinguals, particularly in the left hemisphere. Additionally, gray-matter density in this region increased with greater second language proficiency and decreased as the age of acquisition increased. These results are consistent with growing scientific evidence that bilingualism can lead to cognitive processing advantages, and further suggest that the human brain changes structurally in response to environmental demands (Mechelli et al. 2004). However, there is a need to replicate this work with bilinguals of different language combinations, while also accounting for important sociodemographic variables (including SES).

The appearance of significant differences between bilinguals and monolinguals in imaging studies provides converging evidence for the differences reviewed in the previous section. Although suggestive, the mere involvement of areas associated with cognitive control (e.g., DLPFC) in bilingual tasks (such as language switching) does not necessarily imply that inhibitory control is the mechanism of language switching. An equally plausible alternative is that language control involves increasing attention or activation (Posner and Presti 1987) to the target language, and more studies are needed to identify the precise mechanism of bilingual control. Additional work in this area may reveal other differences between bilinguals and monolinguals, such as frequency of use, as being equally important for understanding the neural underpinnings of bilingualism (e.g., see Graves et al. 2007 for the neural signature of frequency effects).

Neuropsychological Evaluation of Bilinguals: Critical Issues

It is clear that US demographics have evolved to the point that neuropsychologists across the country are increasingly likely to encounter bilingual clients. It is also clear that bilingualism

has a profound impact on cognitive development, as well as brain structure and function. However, for many, there is less clarity about how to best approach neuropsychological evaluation of linguistic minorities, particularly bilingual clients. Neuropsychologists have an ethical mandate to provide culturally-competent neuropsychological services to linguistic minorities (cf. Rivera Mindt et al. 2008a), but the American Psychological Association's (APA) *Ethical Principles of Psychologists and Code of Conduct* (APA 2002) offers little in the way of specifics for actually working with such populations. In this section, we discuss critical considerations for competently evaluating bilinguals, with the caveat that there is no standard method for this purpose.

Who is Bilingual?

Clients—The first task in evaluating a bilingual client is systematically determining the client's linguistic proficiency in both languages (Pontón 2001, p. 45) and whether the client is bilingual enough that s/he warrants having the neuropsychological evaluation administered by a bilingual examiner. Since self-reported ability alone may not always be the most accurate assessment of actual proficiency (Harris and Llorente 2005), researchers and clinicians will need to provide more accurate assessments by using both subjective and objective measures. Proficiency in each language may differ depending on the skill assessed (e.g., reading, writing, listening, or speaking), and thus evaluation in both languages in multiple modalities is preferred when possible. Subjective measurement includes clinical interview in which the examiner can judge basic interpersonal fluency, questionnaires regarding linguistic preferences in which the client rates her or his own fluency, and measures of acculturation (i.e., Marín and Gamba 1996; Zea et al. 2003).

Objective measurements include comparison of proficiency on verbal fluency tests in both languages [e.g., F-A-S in English and P-M-R in Spanish (Artiola i Fortuny et al. 1999)]. Because letter fluency is less clearly related to natural language production than semantic fluency, dual-language testing with both letter and semantic fluency, or other semantically driven language production tasks, such as picture naming (e.g., Rosselli et al. 2002 recommends using the Boston Naming Test; BNT), may ultimately prove to be even more useful for providing objective measures of bilingual status. A challenge in this approach is the lack of measures standardized for bilinguals, and it is difficult to match tests for difficulty in the two languages. When standardized versions are not available, some modifications can be helpful, such as administering the entire BNT from beginning to end to allow for the possibility that item difficulty in a non-English language will not correspond to the order designed for testing in English (Kohnert et al. 1998). Also important, if possible, is evaluation of academic achievement in both languages. In Spanish, this can be done with the Woodcock–Muñoz Language Surveys; the Woodcock Language Proficiency Batteries; or the Word Accentuation Test (Kreuger et al. 2006; Llorente 2008). For other languages, it should at least be possible to obtain information about the extent of formal education in the two languages and to consider this information in test interpretation.

The results of this linguistic proficiency evaluation should in most cases yield one of three possible outcomes (Pontón 2001). The first outcome is that the client is an English-dominant bilingual based upon reporting greater English-language usage and preference, and with better performance in English on the objective measures. This client can be evaluated in English by an English-speaking neuropsychologist with limited assistance from a bilingual examiner (for the purpose of establishing the degree of bilingualism with objective tests [fluency and picture naming] and conversational interview). Interpretation of test scores should be considered in light of data showing that English-dominant bilinguals are often disadvantaged relative to monolinguals on a variety of language measures even when such bilinguals are tested exclusively in their more dominant language (as reviewed above). Here it may be useful to

consider that bilingual disadvantages are greatest when bilinguals are asked to produce low-frequency words (Gollan et al. 2008; Ivanova and Costa 2008) and in tasks that increase interference between languages such as production in the less dominant language. Finally, recent evidence suggests that some language-based tests, even some challenging verbal list-learning tests, do not reveal an effect of testing language (e.g., CVLT; Gasquoine et al. 2007), and as such can perhaps be used with bilinguals with greater confidence.

In a second outcome, the client is dominant in a non-English language. Such individuals should be primarily evaluated in the target language (Spanish, French, etc.) by a bilingual neuropsychologist fluent in the target language. With regard to test selection and administration, some useful measures for this population include the Bateria III Woodcock–Muñoz (Spanish version of the Woodcock–Johnson-III), *Bateria Neuropsicologica en Espanol* (Artiola I Fortuny et al. 1999), *Neuropsychological Screening Battery for Hispanics* (NeSBHIS; Pontón et al. 1996), *NEUROPSI* (Ostrosky-Solís et al. 2007) and the Spanish and English Neuropsychological Assessment Scales (SENAS; Mungas et al. 2005). It should be noted that individuals immersed in a language that is not their dominant language are more likely to be, or to eventually become, bilingual at least to some degree and such individuals may underestimate the extent to which they are able to function in their nondominant language (e.g., see Acevedo and Lowenstein 2007; Bialystok and Craik 2007; Gollan and Fennema-Notestine 2007). In addition, when interpreting self-rated proficiency level, it is important to consider that when young and older adults are matched for degree of bilingualism on objective measures, older bilinguals tend to underestimate their own proficiency levels in both languages (Gollan et al. 2008). As such, individuals who do not report themselves to be bilinguals may nevertheless turn out to be bilingual by objective standards.

In the third outcome, the relatively balanced, bilingual client reports similar usage and preference for both languages and performs comparably on the objective measures. Examination of level of US acculturation can be useful in helping to determine in which language the balanced bilingual client should be evaluated such that those with low US acculturation may be more appropriately examined in Spanish, while those with high US acculturation may be more readily evaluated in English (Pontón 2001). Regardless of the primary language in which a bilingual client is evaluated, whenever possible it is best to have bilingual examiners evaluate bilingual clients (including balanced and unbalanced bilinguals) in both languages rather than just one, in order to capture information that is more readily available in one language or the other (Malagy and Constantino 1998; Paradis 2008). Balanced bilinguals in particular seem to attain highest levels of performance when allowed to use both languages during testing (Gollan and Silverberg 2001; Gollan et al. 2007; Kohnert et al. 1998). However, this benefit may be restricted to untimed tasks in which the costs associated with language switching, and deciding which language to use, have limited effect on performance (Gollan and Silverberg 2001; Gollan and Ferreira, 2007). In cases of Spanish-dominant and relatively balanced bilinguals, however, testing in both languages during the neuropsychological evaluation is going to be especially important, but even for English-dominant bilinguals, dual-language testing provides a more comprehensive assessment of functioning. Given the possibility of interference between languages, as reviewed in detail above, it would also seem ideal to separate testing in each language into different testing blocks, and to avoid and discourage language mixing in timed tasks that require the bilingual to speak.

Examiners—The second task in evaluating a bilingual client is determining whether the examiner's linguistic proficiency is sufficient to examine the bilingual client (Pontón 2001). Training and competency guidelines within the field of neuropsychology fail to provide much needed explicit guidance on parameters of linguistic and professional competency necessary for ethical and competent neuropsychological evaluation of bilinguals and non-English

speaking clients (American Academy of Clinical Neuropsychology, 2007; The Houston conference on specialty education and training in clinical neuropsychology guidelines, 1998; for further discussion, see Rivera Mindt et al. 2008b). Subsequently, neuropsychologists must turn to the literature for further guidance on assessing their own boundaries of competence in terms of working with linguistic minorities.

A few investigators have offered useful discussion (e.g., French and Llorente 2008) and in one case a decision tree (Pontón 2001, pp. 45–46) to assist neuropsychologists in determining whether a language barrier exists between the client and the examiner. One limitation of these schemas is that they do not offer competency-based suggestions to assist neuropsychologists in determining their own linguistic proficiency. For example, Llorente (2008) advises that it is up to the neuropsychologist to intuit whether her/his level of professional competency is adequate to evaluate a bilingual or non-English speaking client in the target language. Similarly, Pontón suggests that neuropsychologists should ask themselves whether or not they are native Spanish-speakers, English-speakers, or balanced bilinguals. However, native Spanish-speaking clinicians who have been raised and educated in the US are not necessarily competent to administer an entire neuropsychological evaluation in Spanish, although they may be competent to conduct some aspects of an evaluation. At the same time, some non-native Spanish-speaking clinicians may have gained a level of proficiency that is appropriate for conducting all aspects of an evaluation. Thus, a more nuanced perspective that is competency based seems important.

Artiola i Fortuny and Mullaney (1998) provide a comprehensive discussion of the ethics and problems involved in nonfluent neurospychologists and technicians evaluating Spanish-speaking clients, and much of the discussion generalizes to other languages as well. Basically, in order to test someone in a non-English language, the authors assert that neuropsychologists must first verify their own (and their technicians') proficiency in the target language, and offer a “rule of thumb” in which a neuropsychologist should ask her/himself if s/he could enroll in a foreign university's graduate or professional program and successfully engage in all academic activities (reading, writing, listening, and thinking) at an advanced level (p. 121). Linguistic proficiency should be at the level of one who has “completed advanced studies in the target language,” and such persons who have “usually lived and studied in country of target language for some years” (p. 121). However, the authors also state that a clinician who speaks the target language, but not at the level of an educated native, may be able to collect factual information about the client, such as clinical interview and history. Artiola i Fortuny et al. (1999) further emphasize that a neuropsychologist providing direct assessment should possess advanced native fluency in the language of the client.

While professionally-trained native speakers are, of course, the ideal, it should not be a prerequisite. Artiola i Fortuny and Mullaney (1998) have set high [and still somewhat aspirational] expectations for the linguistic proficiency of neuropsychologists, and certainly these expectations would reasonably result in the provision of neuropsychological services that is on par with the standard of care for linguistic-majority clients. A practical extension of these linguistic proficiency expectations would be to use the guidelines provided by the American Council on the Teaching of Foreign Languages (ACTFL 1999a). The ACTFL proficiency guidelines provide a comprehensive taxonomy for measuring functional linguistic competency.

Briefly summarized, the ACTFL taxonomy ranges from the highest level of proficiency, the *Superior* level (i.e., speakers “are able to communicate in the language with accuracy and fluency in order to participate fully and effectively in conversations on a variety of topics in formal and informal settings from both concrete and abstract perspectives….”), to the *Advanced High* level (i.e., speakers “perform all Advanced-level tasks with linguistic ease,

confidence, and competence…"), and all the way through to varying echelons of *Advanced, Intermediate, and Novice* levels (i.e., *Novice Low* speakers have no real functional ability; may be able to exchange greetings and identity themselves, but are unable to participate in a "true conversational exchange"; cf. ACTFL 1999b). While the minimal level of linguistic proficiency required for a valid, detailed neuropsychological evaluation remains an important empirical question, it would seem that neuropsychologists in *Superior* and *Advanced High* levels of proficiency are likely adequately proficient for the task at hand. Neuropsychologists in the *Advanced* levels of proficiency are likely to be able to adequately collect factual information and determine whether dual-language testing is needed. Readers are strongly encouraged to review the ACTFL 1999 guidelines for greater detail.

Finally, sociocultural competency is as important as linguistic proficiency. Examiners with advanced levels of linguistic proficiency in a non-English language are likely to (but do not necessarily) have a high level of sociocultural competency in the target language's culture. Several resources within and outside of our field provide guidance on this matter. Within psychology, APA's Multicultural Guidelines on Education, Training, Practice, Research and Organizational Change for Psychologists (APA 2003) offers practical guidance on sociocultural competence and many other matters relevant to this discussion. Outside of psychology, the National Standards for Foreign Language Learning in the 21st Century (NSFLL; ACTFL 1999) and linguistic research (Savignon 2007;Savignon and Sysoyev 2002) have great potential to inform neuropsychology's guidelines on sociolinguistic competency.

Current Practice and the Issue of Translators

The dearth of bilingual neuropsychologists and psychometrists has compelled many well-intentioned neuropsychologists with varying levels of fluency to administer non-English language neuropsychological evaluations. Echemendia et al. (1997), Echemendia and Harris (2004) reported in their national survey of neuropsychological practice with Latino clients that only 11% of neuropsychologists (*N*=911) reported Spanish language fluency in the "adequate" to "fluent" range. Over 50% of the surveyed neuropsychologists reported using translators with monolingual Spanish-speakers, and 80% of these reported using translators with no formal psychological or neuropsychological training. These results indicate that a great deal of current practice in the use of translators within the field falls short of APA's ethical standards (2002), presents significant validity problems, and from a health disparities perspective, is not in keeping with the standard of care afforded to linguistic-majority clients (i.e., English-speakers).

Professionally trained bilingual and sociolinguistically competent neuropsychologists and psychometrists should be utilized whenever possible to evaluate bilinguals. If such examiners are unavailable, then the bilingual client should be referred out to such an examiner. Of course, it is not always possible to find such a referral due to a lack of availability, geographic constraints, etc. When professionally trained bilingual examiners are unavailable, neuropsychologists should utilize trained, professional interpreters (preferably with a background in psychology or healthcare) in order to provide services (Paradis 2008). It is up to the neuropsychologist to educate the professional interpreter on the neuropsychological evaluation and expectations of translation. Thus, great time and care must be invested if a neuropsychologist is to work with a translator, and Pontón and Corona-Lomonaco (2007, p. 270) offer practical guidelines for effectively working with translators. The use of non-professional interpreters is not a desirable option as they are fraught with significant drawbacks, including potential secondary motivations to aid or hinder the client's performance, poor grasp of the language, reticence to translate sensitive material, and many others (Paradis 2008). The

use of relatives (particularly children), friends, or untrained volunteers as interpreters is especially discouraged.

Other Practical Guidelines

Several resources are available to neuropsychologists evaluating bilinguals of a variety of different cultures and language combinations. In many cases, discussion of critical variables for one type of bilingual (see Wong and Fujii's (2004) for guidelines on the neuropsychological evaluation of Asian Americans) applies to non-US majority individuals of various backgrounds. For further information on cultural education and preparation to work with bilinguals, several researchers provide useful discussion and guidelines (Ardila 2003; Centeno and Obler 2001; Llorente 2008; Paradis 2003, 2008; Paradis and Libben 1987; Pontón and León-Carreón 2001; Rivera Mindt et al. 2008b; Wong and Fujii 2004).

For interpretation of test results, the determination of how relevant cultural factors are for a given client is an important issue for consideration, and can be discerned via the clinical interview and acculturation measures. Allowing the interview to take place fluidly in both languages may yield greater information than only conducting the interview in one language or the other (Malagy and Constantino 1998; Paradis 2008). This is especially relevant for the communication of emotionally laden information and expression of psychiatric symptomology in which the dominant language may be more illustrative, and to avoid overpathologizing a bilingual client (Paradis 2008; Santiago-Rivera and Altarriba 2002). In addition, a neuropsychologist must make clinical judgments about how well the measures used and available normative data apply to the bilingual client based on his/her degree of bilingualism. Since norms for bilinguals are not readily available, explicit comment within the report on the potential limitations of the norms used is indicated.

Finally, when writing evaluations of bilingual clients, it is important to incorporate the sociocultural experience into the case conceptualization, report, and recommendations. The following issues merit thoughtful assessment, consideration, and integration into the broader case conceptualization: acculturation, assimilation, education and quality of education, literacy, SES, nutritional history (has the client always had enough to eat?), immigration history and country of origin, housing issues, experience of stress and potentially racism, social support, and access to/utilization of healthcare services (Arnold et al. 1994; French and Llorente 2008; Manly et al. 1998, 2003, 2005; Kennephol et al. 2004; Llorente 2008; Llorente and Weber 2008; Paradis 2008; Pontón and León-Carreón 2001). Llorente (2008) includes a sample of a Spanish language report in the appendix of his book that incorporates many of the issues that we cite here. Lastly, caveats that are germane to working with any non-majority population apply here, including issues of construct validity, cultural equivalence and specificity of neuropsychological measures for use with the population of interest, adequacy of norms, etc. (Artiola i Fortuny et al. 2005; Cherner et al. 2007; Heaton et al. 2003; Helms 1992; Lange et al. 2006; Lichtenberg et al. 1994; Luria 1976; Manly et al. 1998; Norman et al. 2000; Roberts and Hamsher 1984; Wong and Fujii 2004).

Concluding Considerations

Bilingualism provides a unique opportunity to study the cognitive system by asking how processing is affected by the roughly doubled load associated with bilingualism. At the same time, differences between bilinguals and monolinguals present neuropsychologists with some challenges. In facing these challenges it is important to maintain multiple working hypotheses regarding possible sources of the differences between groups. Although there is a tendency in the field to attribute differences to one mechanism (interference), it is exceedingly unlikely that only one mechanism will explain all the observed differences between groups, and attempts to do so will provide an incomplete conceptualization of bilingualism and cognitive processing.

As research on bilingualism grows, what emerges is a better understanding the role of executive control and frequency of use in all language users, and improved ability to provide neuropsychological evaluations to bilinguals and monolinguals alike.

As a field, neuropsychology will move forward and elevate the standard of care for bilinguals and non-English speakers by developing professional standards for the provision of neuropsychological services to linguistic minorities, developing coherent training and minimum competency guidelines for working with this population, integrating these guidelines into board certification requirements, and increasing the availability of bilingual, sociolinguistically competent examiners into the field via targeted and coordinated recruitment and retention efforts by graduate, internship, and post-graduate programs (Rivera Mindt et al. 2008b).

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