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The effect of African-American acculturation on neuropsychological test performance in normal and HIV-positive individuals

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Abstract

Two studies were conducted to examine the relationship of acculturation to neuropsychological test performance among (1) medically healthy, neurologically normal African Americans ($N = 170$); and (2) HIV positive (HIV+) subgroups of African Americans and Whites (Ns $= 20$) matched on age, education, sex, and HIV disease stage. Acculturation was measured through self report for all participants, and linguistic behavior (Black English use) was assessed in a subset of medically healthy individuals ($N = 25$). After controlling for the effects of age, education, and sex, medically healthy African Americans who reported less acculturation obtained lower scores on the WAIS–R Information subtest and the Boston Naming Test than did more acculturated individuals. Black English use was associated with poor performance on Trails B and the WAIS–R Information subtest. HIV+ African Americans scored significantly lower than their HIV+ White counterparts on the Category Test, Trails B, WAIS–R Block Design and Vocabulary subtests, and the learning components of the Story and Figure Memory Tests. However, after accounting for acculturation, ethnic group differences on all measures but Story Learning became nonsignificant. These results suggest that there are cultural differences within ethnic groups that relate to neuropsychological test performance, and that accounting for acculturation may improve the diagnostic accuracy of certain neuropsychological tests. (*JINS*, 1998, *4*, 291–302.)

Keywords: African-American acculturation, Neuropsychological testing

INTRODUCTION

Few neuropsychological measures have been properly validated for use among ethnic minorities, and lack of such validation may account for the fact that, based on neuropsychological test performance, ethnic minorities are judged to be cognitively impaired more often than non-Hispanic White persons. For example, Roberts and Hamsher (1984) found that neurologically normal Whites obtained significantly higher scores on a measure of visual naming ability than did normal African Americans, even after correcting for education level. Using the standard cutoff, 22% of these normal African Americans would have been classified as impaired on the basis of their naming performance, significantly more than the White group. Lichtenberg et al. (1994) also found that urban-dwelling African Americans scored significantly below a group of well-matched urban Whites on the Boston Naming Test. Discrepancies in test performance remain, even when ethnic groups are matched on socioeconomic variables, as was demonstrated through investigation of the WAIS–R standardization sample (Kaufman et al., 1988; Reynolds et al., 1987).

Culture-related differences have been reported on measures of nonverbal abilities as well. Jacobs et al. (1997) found that Spanish-speaking elders scored significantly lower than age- and education-matched English speaking elders

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on a measure of nonverbal abstraction (i.e., the Identities and Oddities subtest from the Mattis Dementia Rating Scale), multiple choice matching and recognition formats of the Benton Visual Retention Test, as well as on the verbal measures of category fluency and comprehension. Bernard (1989) reported that young male African Americans scored lower on a nonverbal measure of abstraction (Category Test) and higher on a measure of auditory attention to detail (Seashore Rhythm Test) than did Whites and Hispanics matched on age and education. Miller et al. (1993) showed that after accounting for age and educational differences, African Americans and Hispanics scored significantly lower than Whites on computerized tests of simple and choice reaction time. Heverly et al. (1986) reported that African-American children scored lower than White children on a measure of tactile–visual discrimination.

Taken together, previous studies of ethnic group differences in neuropsychological test performance among neurologically normal individuals have shown that substantial discrepancies between scores of ethnic minorities and Whites persist, despite equating groups on other demographics such as age, education, sex, and socioeconomic background. These discrepancies cause attenuated specificity of neuropsychological tests when used among individuals with possible neurocognitive impairment, such that cognitively normal ethnic minorities are more likely to be diagnosed as impaired (Adams et al., 1982; Klusman et al., 1991; Stern et al., 1992; Welsh et al., 1995).

Most previous research on ethnicity effects has classified participants on the basis of physical appearance or self-identified racial–ethnic classification, rather than measuring those cultural variables that accompany ethnic group membership. However, as suggested by Helms (1992), specification of experiential, attitudinal, or behavioral variables that distinguish those belonging to different ethnic groups, and which also vary among individuals within an ethnic group, may allow investigators to understand better the underlying reasons for the relationship between ethnic background and cognitive test performance.

Level of acculturation is one way in which social scientists have operationalized within-group cultural variability. Acculturation is defined as the level at which an individual participates in the values, language, and practices of his or her own ethnic community *versus* those of the dominant culture. Previous studies have identified ideologies, beliefs, expectations, and attitudes as important components of acculturation, as well as cognitive and behavioral characteristics such as language and customs (Berry, 1976; Moyerman & Forman, 1992; Negy & Woods, 1992; Padilla, 1980). Acculturation has traditionally been measured among immigrant groups such as Hispanic and Asian Americans, and not African Americans; however, Landrine and Klonoff (1995, 1996) recently reported the development of a reliable and valid measure of African-American acculturation. This African American Acculturation Scale has been found to assess key dimensions in this groups' cultural experience, including traditional childhood experiences; religious beliefs and practices; preferences for African-American music, media, and people; and preparation and consumption of traditional foods.

Previous research among immigrant groups indicates that language use is the most revealing indicator of acculturation level (Biondi, 1975; Cook, 1975; Marin, 1987). For example, Marin (1987) found that language use (i.e., Spanish *vs.* English) was the strongest predictor of Hispanic acculturation. Linguistic research also suggests that among African Americans, the transition from Black English to use of pronunciation and grammar consistent with mainstream American English coincides with attempts to participate in mainstream American culture (W. Edwards, 1992; Garner & Rubin, 1986).

Few studies have examined the relationship of cognitive test performance to within-group ethnic or cultural factors independent of those associated with socioeconomic status. One study (Asbury et al., 1987) found a significant relationship between aspects of African-American ethnic identity and performance on the Wechsler Intelligence Scale for Children–Revised (WISC–R) among adolescents. The authors found that identification with African-American community and language style was related to lower scores on the Wechsler "verbal comprehension" subtests (i.e., Vocabulary, Information, Comprehension, and Similarities subtests).

To our knowledge, only one study has examined the relationship of acculturation to performance on other neuropsychological tests. Arnold et al. (1994) reported the relationship between Hispanic acculturation and performance on selected tests of the Halstead–Reitan Battery (HRB) among college students. Participants ($N = 150$) were classified into Mexican, Mexican-American, and Anglo groups based on language use and surname, and group membership was confirmed through scores on the Acculturation Rating Scale for Mexican Americans (ARSMA; Cuellar et al., 1980). After controlling for the effects of age, education, and sex, Anglos scored significantly higher than the Mexican group on three measures from the Tactual Performance Test (dominant hand, nondominant hand, and total time). Anglos had fewer errors on the Category test than did both the Mexican and Mexican-American groups. Interestingly, the Mexican-American group scored higher than the Mexican and Anglo groups on the Seashore Rhythm Test. There were no differences between the groups on tests of motor functioning, incidental memory tasks, or the Trail Making Test. The authors suggested that culturally based differences in problem solving and differential expectations regarding the testing situation may account for the effect of acculturation on measures of motor speed and abstraction, and that increased sensitivity to auditory information (due to the demands of bilingualism) may explain the higher scores on the test of auditory attention among Mexican Americans. While these results suggest that level of acculturation is a significant determinant of neuropsychological test performance, further investigation of these factors is needed among non-college-students and other ethnic groups.

The aim of the current research was twofold. The first objective was to determine how measures of acculturation level were related to neuropsychological test performance within medically healthy, neurologically normal African Americans, after accounting for age, education, and sex. The aim of the second study was to determine if acculturation level accounted for observed ethnic group differences among HIV-seropositive (HIV+) individuals, who are at risk for disease-related cognitive impairment.

In Study I, we examined the relationship of self-reported degree of acculturation to performance on formal neuropsychological tests among a group of African Americans who took part in a study on the development of neuropsychological test norms. The relationship of test performance to an objective measure of African-American acculturation (Black English use) was investigated among a subgroup of these participants. We hypothesized that African Americans who (1) reported more traditional African-American experiences, beliefs, and practices; and (2) used more Black English would obtain lower scores on measures of attention–working memory, abstraction, speed of information processing, learning, memory, visuospatial ability, and verbal skills. It was hypothesized that performance on measures of motor skill and sensory ability would be unrelated to self-reported and linguistic acculturation, since these tasks are theoretically less sensitive to variation in cultural experience.

In Study II, we investigated the relationships between acculturation, ethnicity, and test performance among matched samples of Whites and African Americans who had a medical condition—infection with the human immunodeficiency virus (HIV)—that put them at risk for disease-related cognitive impairment. We predicted that cultural experience would have the same effect on test performance among individuals at risk for neurocognitive impairment; therefore, we hypothesized that level of acculturation would account for any existing neuropsychological differences in test performance between the matched African-American and White HIV+ groups.

METHODS

Research Participants

Study I

A sample of neurologically normal African Americans was drawn from participants in the African American Neuropsychological Test Normative Project (AANP). The current sample participated in the AANP between November 15, 1993 and March 1, 1996. The aim of the San Diego based AANP is to develop age, sex, and education-based normative standards for African-American adults on a broad range of neuropsychological measures commonly used to assess cognitive functioning. The main cohort, from which the current sample was selected, was recruited from the San Diego community using 1990 census data and multiplicity sampling techniques (Sudman et al., 1988), both of which ensured that participants were representative of the various age, education, and socioeconomic levels among African-American adults in San Diego county. Individuals were excluded from the AANP if they met DSM–III–R criteria for drug or alcohol dependence in the past year, reported a history of serious mental illness (e.g., schizophrenia, bipolar disorder, or major depression), or were currently using psychoactive medication. Exclusionary criteria also included report of a history of head trauma with loss of consciousness greater than 5 min and/or diagnosis of a neurological or medical condition likely to affect NP test performance. Urine toxicology was performed the day of testing, and individuals who screened positive for substances known to affect test performance (e.g., ethanol, amphetamines, barbiturates, benzodiazepines, cocaine, methadone, opiates, phencyclidine, and marijuana) were dropped from the study. Of 179 individuals tested between November 15, 1993 and March 1, 1996, 9, or 5%, were dropped from the study due to positive urine toxicology.

Sample characteristics. A total of 170 neurologically normal African Americans were selected from AANP participants using the procedures described above. Mean age of the sample was 37.7 years (SD = 12.3) with a range of 20 to 64 years. Participants ranged from 9 to 20 years of formal education, with an average of 13.5 years (SD = 2.5). The sample was 53% female.

Sample characteristics—substudy of Black English use. Language samples from 25 randomly selected neurologically normal AANP participants were analyzed in order to investigate the relationship of linguistic acculturation (degree of Black English use) to neuropsychological test performance. Demographics of these participants were comparable to those of the larger AANP sample. Their mean education was 13.0 years (SD = 2.5), the average age was 37.9 years (SD = 10.5; range = 20–58), and the subsample was 36% female.

Study II

White and African-American HIV+ individuals matched on age, education, sex, and HIV disease stage were recruited from the HIV Neurobehavioral Research Center (HNRC) cohort. The HNRC is a longitudinal study whose overall objective is to define the phenomenology, determinants, and natural course of HIV-associated neurological and neuropsychological complications. The main cohort, from which the present sample was selected, was recruited from the civilian community in San Diego and the military community at the U.S. Naval Medical Center, San Diego. Participants were excluded if they had a history of non-HIV-related neurological disorder or medical disorder that could confound interpretation of neurological or neuropsychological findings, such as history of intravenous drug use, head injury with loss of consciousness exceeding 30 min, or primary diagnosis of schizophrenia. The HNRC protocol is described further in Heaton et al. (1995).

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Sample characteristics. African-American ($N = 20$) and non-Hispanic White ($N = 20$) participants were well matched on age, education, sex, and HIV disease stage. African-American participants had a mean age of 35.3 years ($SD = 5.7$) and a mean education of 13.7 years ($SD = 2.1$). Sixty percent of the African-American group was medically asymptomatic (CDC stage A), 25% had past or present mild HIV-related disease (CDC stage B), and 15% had had an AIDS-defining illness (CDC stage C). Non-Hispanic White participants had a mean age of 32.0 years ($SD = 4.9$) and an average of 13.9 years of education ($SD = 2.3$), and the group was 45% asymptomatic, 45% mildly symptomatic, and 10% had AIDS. There were 2 women in each group. African-American participants were, on average, slightly older and less advanced in disease stage than were the Whites; however, none of these differences was significant when evaluated using *t* tests and Chi-square comparisons.

Instruments

Neuropsychological measures

Participants in both studies were administered the Halstead–Reitan Neuropsychological Battery (HRB; Heaton et al., 1991; Reitan & Wolfson, 1993), the Wechsler Adult Intelligence Scale–Revised (WAIS–R; Wechsler, 1981), and additional measures of attention, speed of information processing, learning, memory, and verbal skills. From this battery (described more fully in Heaton et al., 1995), measures were selected that assessed performance in nine ability areas: (1) *abstraction* [Category Test and Trail Making Test–Part B (Trails B)], (2) *verbal skills* (Boston Naming Test and WAIS–R Information or Vocabulary subtests), (3) *visuospatial ability* (WAIS–R Block Design subtest), (4) *speed of information processing* [Trail Making Test–Part A (Trails A) and WAIS–R Digit Symbol subtest], (5) *attention–working-memory* [WAIS–R Digit Span subtest and Digit Vigilance or Paced Auditory Serial Addition Test (PASAT)], (6) *memory–retention* (Story and Figure memory), (7) *learning* (Story and Figure learning) (8) *sensory ability* (Sensory Perceptual Exam), and (9) *motor skills* (Grooved Pegboard Test, dominant and nondominant hands). An attempt was made to select two measures within each ability area that assessed different modalities of the broad cognitive categories. For example, within the attention–working-memory domain, both auditory (Digit Span) and visual (Digit Vigilance) attention were represented. Within the verbal domain, measures that have a strong association with past educational or cultural experience (WAIS–R Information and Vocabulary) were paired with a measure that is relatively less related to past experience (Boston Naming Test). The neuropsychological batteries administered at the HNRC and the AANP varied slightly; different measures were selected to assess attention–working-memory (Digit Vigilance *vs.* PASAT) and education-based verbal skills (WAIS–R Information *vs.* Vocabulary) in each sample. The current study used data from each participant's baseline visit, or their first exposure to the neuropsychological tests.

Acculturation measures

African American Acculturation Scale–short form. Each participant's level of acculturation was measured using the short form of the African American Acculturation Scale (AAAS; Landrine & Klonoff, 1995, 1996). Each of the 33 items, assessing traditions, values, beliefs, assumptions, and practices specific to African-American culture, requires respondents to rate themselves on a Likert scale ranging from 1 (*I totally disagree, this is not at all true of me*) to 7 (*I totally agree, this is absolutely true of me*); scores on the AAAS have a possible range of 33 to 231.

AAAS measures acculturation on a unidimensional continuum, such that high scores represent low acculturation (traditional African-American lifestyle), and low scores are expected from individuals who are acculturated to the American mainstream. Individuals with middle-level AAAS scores are considered to be bicultural, or holding beliefs, values, and practices that come from both African-American and mainstream cultures.

The short form AAAS measures acculturation across 10 dimensions: preference for African-American music, arts, and people; religious beliefs and practices; traditional foods; traditional childhood experiences; superstitions; interracial attitudes–cultural mistrust; falling out (knowledge and experience of a folk disorder); traditional games, family values, and family practices. The four AAAS subscales which accounted for the most variance in the Landrine and Klonoff (1995) standardization sample were preferences (e.g., "Most of the music I listen to is by Black artists"); foods and food practices (e.g., "Sometimes, I cook ham hocks"); religious beliefs and practices (e.g., "I am currently a member of a Black church"); and traditional childhood experiences (e.g., "I grew up in a mostly Black neighborhood").

Landrine and Klonoff (1995, 1996) reported that among their standardization sample, AAAS subscale scores were independent of current income, social class of family of origin, and education level. In terms of concurrent validity, the authors found that non-African Americans scored significantly lower than African-American counterparts from the same geographical regions, and that the scale distinguished between African Americans currently living in an African-American neighborhood (a likely indicator of level of exposure to African-American culture) *versus* those living in integrated or mostly White neighborhoods.

Black English use. For a subset of AANP participants, a language sample was recorded during the administration of the Story Memory Test. As described in Heaton et al. (1991), each participant heard a tape recorded story, which lasted approximately 1 min. Participants were then asked to recall as many details from the story as possible. Learning trials were administered until at least 15 points were obtained on a single trial, or until the story had been played five times, whichever came first. Approximately 4 hr later, the participants were asked to recall as much of the story as they could remember. The language samples used in the current study consisted of tape recordings of

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verbal responses on each of the learning trials and the delay trial.

Recordings were then transcribed using a modified orthography, which was supplemented to include clear description of certain phonological aspects of Black English. Language samples were transcribed using methods as described by J. Edwards (1993). From the transcriptions, a sample of 50 utterances from each participant was used for the current study, and were reviewed by two transcribers. A language sample of 50 utterances is adequate for analysis of most linguistic variables (Darley & Moll, 1960).

After the transcriptions were complete, the samples were coded for the presence and absence of Black English variants. The criteria for the selection of linguistic variables to be used for the study were (1) the variables had Black English variants that were previously identified by multiple linguistic researchers as being characteristic of Black English (see references below), (2) the Black English variants could be easily distinguished from their Mainstream American English counterparts by individuals untrained in linguistics, and (3) the frequency of the Black English variants in the speech of non-African Americans was essentially zero. Nine phonological (word sound) and syntactic (grammatical) variants that met these three criteria were identified in the literature (Burling, 1973; Dillard, 1972; Gay & Tweeney, 1976; Labov, 1972; Moulton, 1976; Seymour & Seymour, 1979; Smitherman, 1994), and are shown in Table 1. Each of the language samples was coded for the presence of these nine Black English variants, as well as each instance when the speaker used Mainstream American English in a context where a Black English variant could have been used.

A single variable that represented "amount of Black English use" was then created. Nine ratios were calculated, in which the number of times the speaker used each Black English variant was divided by the total number of opportunities the participant had to use the Black English variant within 50 utterances:

$$\text{Black English summary score} = \frac{\text{number of instances in which Black English variant was present}}{\text{total number of opportunities to use Black English variant}}$$

A summary score was derived by adding the ratios calculated for each variable. As with the AAAS, high scores on this Black English summary variable represented high levels of Black English use and hypothesized low acculturation (traditional African-American lifestyle), while low scores represented less Black English use and hypothesized acculturation to the mainstream.

Analysis of reliability was based on agreement of two coders on presence or absence of each of the nine Black English variants identified for this study. Most disagreements involved the /th/ variable (i.e., voiceless /th/ becomes /f/, and voiced /th/ becomes /d/). However, the great majority of /th/ cases were agreed upon, with a straight reliability of 95% and a Kappa (Cohen, 1960) of 85%. Disagreements were resolved in a meeting of the two coders, in which the original tape recordings were listened to again, and a consensus reached.

Statistical Methods

Because the exact relationship of demographic variables to test performance among African Americans is yet unknown, analyses of the relationship between test performance and acculturation used raw test scores as dependent variables, with age, education, and sex serving as covariates. Age, education, and sex-corrected *T* scores (Heaton, 1992; Heaton et al., 1991), and standard cutoffs for impairment (1 *SD* below the mean) were used only to describe rates of "impairment" using the existing normative data.

Prior to analysis, all demographic, acculturation, and neuropsychological variables were screened for univariate outliers, normality of distribution, and potential multicollinearity, and transformations were performed to attempt to correct nonnormal distributions. Among the community sample, logarithmic transformations normalized the distribution of Trails B time and the Boston Naming Test (number correct). However, the Figure memory test (percent loss) and Sensory Perceptual Exam error distributions were severely skewed and recalcitrant to transformation in this normal population. Among the HIV+ participants, the positively skewed distribution of the Sensory Perceptual Exam (errors) was normalized using a square root transformation. The

Table 1. Black English linguistic variants and examples

Variant	Example
Absence of past tense morpheme (*-ed*)	"after a year he *decide* to travel"
Differences in verb agreement with respect to number	"he and a friend *was* arrested"
Absence of word final /t/	"the *firs'* time, I *don'* know"
Absence of word final postvocalic /l/	"attended preparatory *schoo'*"
Absence of word final postvocalic /r/	"I don't *rememba', afta'* a *yea'*"
Absence of possessive morpheme ('*s*)	"the *guy* name was Jim"
Absence of initial syllable in words beginning with vowels	"'*tending* school"
Simplified consonant clusters	"*prob'ly, tha's, din't, sompt'n*"
Final (voiceless) /th/ becomes /f/, voiced /th/ becomes /d/	"went *wif* him, ride *da* rails"

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distribution of scores on the delayed retention component of the Figure Memory Test was recalcitrant to transformation; nevertheless, it was determined that the statistical procedure used in the analysis of these data (ANOVA) would be robust to normal distribution violations. In both Study I and II samples, none of the demographic and acculturation variables were correlated above .70, the suggested limit for eliminating variables due to potential multicollinearity (Tabachnick & Fidell, 1989).

In Study I, correlational analyses were performed in order to examine the association of both AAAS scores and the Black English use summary score to demographic variables (age, education, and sex). To determine the relation of acculturation level to neuropsychological test performance, regression analyses were performed in which acculturation level (AAAS subscales or Black English use summary score) was used to predict each neuropsychological test score. To determine whether acculturation accounted for a significant amount of variance in test score above and beyond the effects of demographics, a second set of regressions was performed in which demographic variables (age, education, and sex) were first entered as a covariate set, and then acculturation variables were entered as a second step. An alpha level of .01 was adopted for statistical significance to correct for multiple comparisons and to reduce the likelihood of Type I error in all regression analyses.

In Study II, ANOVAs were performed to compare the performance of matched African-American and White groups on each neuropsychological test. In order to determine if acculturation would account for any observed group differences, ANCOVAs were performed, in which AAAS score was used as a covariate, and then the "acculturation corrected" test scores of African-American and White groups were compared. Due to the complexity of using multiple covariates within ANCOVA, it was decided that scores on the four previously identified AAAS subscales (Preferences, Religion, Food Practices, and Traditional Childhood) would be summed in order to represent acculturation level in Study II analyses.

RESULTS

Study I

Relation between demographic variables and acculturation

Individuals with fewer years of education reported significantly more traditional African-American childhood experiences ($r = -.27$, $p < .01$) and more traditional food practices ($r = -.23$, $p < .01$); however, years of education was not significantly correlated with the Preferences ($r = -.03$, $p = .67$), or Religion ($r = -.05$, $p = .50$) subscales of the AAAS. Younger individuals reported having more traditional African-American preferences ($r = -.33$, $p < .01$), while older participants reported having more traditional food practices ($r = .37$, $p < .01$) and childhood experiences ($r = .20$, $p < .05$). Women reported significantly more traditional African-American food practices [$t(168) = 2.68$, $p < .01$] and religious beliefs [$t(168) = 2.95$, $p < .01$] than did men. Individuals with fewer years of education tended to report more traditional African-American experiences overall, as measured by the AAAS summary score [$r = -.16$, $p < .05$]. The AAAS summary score was not significantly related to age ($r = .13$, $p = .08$), or sex [$t(168) = 1.52$, $p = .13$].

Relation of neuropsychological test performance to acculturation

We first examined rates of "impairment," as determined by *T* scores derived from existing normative data that adjust for age, education, and sex (Heaton, 1992; Heaton et al., 1991). It was discovered that a large proportion of our neurologically normal African-American sample scored more than 1 standard deviation below the normative mean (*T* score less than 40) on many of the measures. With the exception of the delayed retention component of the Figure Memory Test, each of the 16 measures selected for this study had unacceptably high rates of impairment. Table 2 shows that 10 out of

Table 2. Rates of "impairment" among all Study I participants ($N = 170$)

Neuropsychological test	Percent impaired using Heaton (1992) and Heaton et al. (1991) norms
Abstraction	
Category Test (errors)	30
Trails B time	32
Verbal	
WAIS–R Information	33
Boston Naming Test	65
Visuospatial	
WAIS–R Block Design	38
Speed of information processing	
Trails A time	27
WAIS–R Digit Symbol	21
Attention–working memory	
WAIS–R Digit Span	23
Digit vigilance–time	18
Learning	
Story learning	45
Figure learning	62
Memory–retention	
Story loss	35
Figure loss	7
Sensory	
Total sensory–perceptual errors	29
Motor	
Grooved pegs–dominant	35
Grooved pegs–nondominant	41

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the 16 measures had impairment rates over 30%. The measure with the highest rate was the Boston Naming Test; 65% of the sample would be rated as impaired according to the existing norms.

Table 3 shows that when entered together as one step, and using an alpha level of .01, the four identified acculturation subtests (Preferences, Religion, Food, and Childhood) accounted for a significant amount of variance in performance on the Category Test, Trails B time, WAIS–R Information, Boston Naming Test, WAIS–R Block Design, Trails A time, WAIS–R Digit Symbol subtest, learning components of the Figure and Story Memory Tests, and Grooved Pegboard (dominant hand). Table 3 also shows that after demographic variables were added into the equations as a covariate set, less acculturated individuals still obtained lower scores on the WAIS–R Information subtest ($p < .01$) and the Boston Naming Test ($p = .01$).

Table 3. Variance in neuropsychological test scores accounted for by self-reported acculturation (1) alone and (2) after covarying for demographics among Study I participants ($N = 170$)

	Analysis 1		Analysis 2	
Neuropsychological test	R^2	p	$R^2\Delta$	p
Abstraction				
Category Test (errors)	.20	<.001	.04	.05
Trails B time	.18	<.001	.03	.08
Verbal				
WAIS–R Information	.15	<.001	.09	<.001
Boston Naming Test	.14	<.001	.06	.01
Visuospatial				
WAIS–R Block Design	.18	<.001	.04	.10
Speed of information processing				
Trails A time	.17	<.001	.03	.12
WAIS–R Digit Symbol	.19	<.001	.03	.15
Attention–working memory				
WAIS–R Digit Span	.08	.006	.03	.20
Digit vigilance–time	.05	.08	.00	.98
Learning				
Story learning	.10	.002	.05	.08
Figure learning	.12	<.001	.04	.15
Memory–retention				
Story loss	.03	.37	.02	.49
Figure loss	.01	.76	.01	.70
Sensory				
Total sensory–perceptual errors	.08	.01	.02	.48
Motor				
Grooved pegs–dominant	.14	<.001	.02	.28
Grooved pegs–nondominant	.04	.21	.01	.91

Note. Required alpha = .01. Analysis 1: R^2 = percent of variance accounted for by acculturation variables (Preferences, Religion, Food, and Childhood subscales) when entered as a set. Analysis 2: $R^2\Delta$ = percent of variance accounted for by acculturation variables after entering in age, education, and sex as covariates.

Substudy on Black English Use

Relation of Black English use to demographic variables and AAAS

The Black English use variable was not significantly correlated with years of education ($r = -.32$, $p = .12$), or age ($r = .15$, $p = .48$). Degree of Black English use did not differ by sex [$t(23) = .89$, $p = .38$]. Black English use was correlated with the Traditional Childhood Experiences subscale of the AAAS ($r = .50$, $p < .05$), but not significantly correlated with the Preferences ($r = -.27$, $p = .27$), Religion ($r = .15$, $p = .55$), or Food ($r = -.06$, $p = .81$) subscales, or the total AAAS summary score ($r = -.12$, $p = .63$).

Black English and neuropsychological test performance

Performance on each of the 16 neuropsychological measures was first regressed on the Black English use summary score alone. With a required $p < .01$, these analyses revealed significant relations between linguistic acculturation and Trails B time, the WAIS–R Information subtest, and the learning component of the Story Memory Test. Table 4 shows that after the effects of age, education, and sex were accounted for, participants with more Black English use obtained lower scores on the Trails B test, the WAIS–R Information subtest, and the learning component of the Story Memory Test, although these relations did not quite meet our $p < .01$ significance criterion.

In summary, the results of Study I suggest that both self-report and behavioral measures of acculturation explained some unique variance in performance on several neuropsychological tests. In Study II, we examined whether adjusting for acculturation would eliminate the apparent differences between African Americans and Whites on neuropsychological tests.

Study II

Statistical considerations of using acculturation level as a covariate

As expected, AAAS summary scores differed significantly among non-Hispanic White ($M = 39.2$, $SD = 11.9$) and African-American ($M = 86.4$, $SD = 20.5$) groups [$t(30.4) = 8.91$, $p < .01$]. Although the summary score had acceptable distributions in both White and African-American groups, there was minimal overlap in the scores. However, this fact does not invalidate the use of acculturation as a covariate in the analyses. Rather, the two requirements of a covariate are as follows: (1) the covariate should have a significant relationship with the dependent variable, and (2) the homogeneity of regression assumption must be met: There must be no interaction between the covariate (acculturation) and the grouping variable (ethnicity) on the dependent variable (neuropsychological test score).

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Table 4. Variance in neuropsychological test scores accounted for by Black English use (1) alone and (2) after covarying for demographics among a subset of Study I participants ($N = 25$)

	Analysis 1		Analysis 2	
Neuropsychological test	R^2	p	$R^2\Delta$	p
Abstraction				
Category Test (errors)	.01	.64	.00	.89
Trails B time	.33	.003	.17	.01
Verbal				
WAIS–R Information	.26	.009	.13	.04
Boston Naming Test	.15	.06	.06	.21
Visuospatial				
WAIS–R Block Design	.09	.14	.02	.37
Speed of information processing				
Trails A time	.10	.13	.07	.16
WAIS–R Digit Symbol	.11	.10	.01	.64
Attention–working memory				
WAIS–R Digit Span	.04	.33	.05	.27
Digit vigilance–time	.04	.36	.00	.88
Learning				
Story learning	.26	.009	.24	.01
Figure learning	.09	.14	.02	.50
Memory–retention				
Story loss	.01	.65	.01	.60
Figure loss	.00	.97	.00	.90
Sensory				
Total sensory–perceptual errors	.12	.10	.08	.18
Motor				
Grooved pegs–dominant	.01	.61	.06	.10
Grooved pegs–nondominant	.01	.71	.00	.90

Note. Required alpha = .01. Analysis 1: R^2 = percent of variance accounted for by degree of Black English use alone. Analysis 2: $R^2\Delta$ = percent of variance accounted for by degree of Black English use after entering in age, education, and sex as covariates.

Correlational analyses revealed that the acculturation summary score was significantly related to performance on the Category Test ($r = .43$, $p < .01$), Trails B ($r = .48$, $p < .01$), WAIS–R Vocabulary ($r = -.41$, $p < .01$), Boston Naming Test ($r = -.40$, $p < .05$), WAIS–R Block Design ($r = -.65$, $p < .01$), Story ($r = -.36$, $p < .05$) and Figure ($r = -.39$, $p < .05$) Learning Tests, and Grooved Pegboard nondominant hand ($r = .33$, $p < .05$). Therefore, those measures that were not significantly related to acculturation (Trails A, WAIS–R Digit Symbol and Digit Span, PASAT, Story and Figure Retention, Sensory Perceptual Exam, and Grooved Pegboard–dominant hand) were excluded from analyses in which acculturation was used as a covariate.

Hotelling's T^2 was used in order to statistically test the homogeneity of regression assumption for all 16 measures that were administered. The Ethnicity × Acculturation interactions were clearly nonsignificant for all neuropsychological tests but the Boston Naming Test [$F(1,32) = 10.84$, $p < .01$] and the Digit Symbol [$F(1,34) = 4.14$, $p = .05$] subtest. In other words, the regression lines representing the relations between most of the neuropsychological measures and AAAS score had essentially the same slopes for both White and African-American participants. In summary, for 6 out of the 16 measures administered (Category, Trails B, Vocabulary, Block Design, Story Learning, Figure Learning, and Grooved Pegboard–dominant hand) the assumptions of analysis of covariance were met.

Relation of ethnicity–acculturation to neuropsychological test performance

ANOVAs were first performed to determine on which measures the matched groups differed. Table 5 shows that using the alpha = .01 criterion, African Americans scored significantly lower on measures of abstraction (Category Test and Trails B), verbal skills (WAIS–R Vocabulary), visuospatial ability (WAIS–R Block Design), speed of information processing (Trails A), attention–working memory (PASAT), and verbal and nonverbal learning (Story and Figure Learning Tests).

For those measures that met the statistical assumptions, ANCOVAs, were performed to determine if ethnic group differences could be accounted for by level of acculturation. Table 5 shows that when the AAAS summary score was first entered as a covariate, the ethnic group differences on the Category Test, Trails B time, Vocabulary, Block Design, and the Figure Learning Test, became nonsignificant. The group difference on the Story Learning Test remained significant, even after correcting for acculturation level.

DISCUSSION

In Study I, we found that among neurologically normal African Americans, traditional African-American practices, beliefs, and experiences were significantly associated with lower scores on neuropsychological measures of verbal ability (WAIS–R Information subtest and Boston Naming Test), even after accounting for age, education, and sex. These findings cannot be attributed to poor learning capacity or lower general intellectual ability among unacculturated individuals, since we found no relation between acculturation and performance on measures of learning, memory, and other cognitive skills after correcting for age, education, and sex.

The Information subtest has been described as measuring "general knowledge normally available to persons growing up in the United States" (Lezak, 1995, p. 555). Performance on this test is generally thought to be related to learning capacity, verbal skill, and remote memory; however, the current study lends support to the hypothesis that this may only be true among individuals who are routinely exposed to this information (mainstream Whites and more acculturated ethnic minorities) through educational and cultural experiences.

Lack of previous exposure to stimuli may also explain our finding that those reporting less acculturation obtained lower scores on the Boston Naming Test. The Boston Naming Test consists of items that range in familiarity and frequency within the mainstream culture. Although the measure

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Table 5. Study II: Analysis of variance of African-American ($N = 20$) and White ($N = 20$) HIV+ participants on neuropsychological measures (1) before and (2) after covarying for acculturation

Neuropsychological test	African American (M)	White (M)	ANOVA F	ANCOVA F
Abstraction				
Category Test (errors)	53.2	31.9	14.1*	4.4
Trails B time	78.7	55.2	15.9*	3.6
Verbal				
WAIS–R Vocabulary	42.9	51.6	8.3*	1.1
Boston Naming Test	72.1	78.4	6.3	NP
Visuospatial				
WAIS–R Block Design	20.4	32.9	29.2*	4.6
Speed of information processing				
Trails A time	32.2	23.2	9.6*	NP
WAIS–R Digit Symbol	51.6	57.6	2.6	NP
Attention–working memory				
WAIS–R Digit Span	15.0	17.0	2.9	NP
PASAT	101.0	126.4	8.1*	NP
Learning				
Story learning	9.2	14.8	16.6*	10.8*
Figure learning	6.6	11.0	9.4*	2.3
Memory–retention				
Story loss	18.9	12.8	2.3	NP
Figure loss	12.6	11.2	0.1	NP
Sensory				
Total sensory–perceptual errors	6.1	4.7	1.5	NP
Motor				
Grooved pegs–dominant	71.6	66.5	2.5	NP
Grooved pegs–nondominant	79.6	70.5	4.8	0.5

Note. ANCOVA uses AAAS summary score for the Preferences, Religion, Food, and Childhood Subscales as a covariate. NP = not performed due to violation of statistical assumptions underlying ANCOVA.
*$p < .01$.

was intended to assess the ability to retrieve high and low frequency words at will, these findings suggest that unacculturated African Americans may have had little or no exposure to the low frequency words, and therefore have nothing to retrieve. Although the mean difference in Boston Naming Test score between HIV positive African-American and White participants was not significant, this finding is likely due to our relatively small sample size in Study II.

Our results suggest that other abilities are also related to differences in cultural experience. For example, we found that Black English use was significantly correlated with Trails B performance, over and above the effect of age, education, and sex. Moreover, acculturation level accounted for the ethnic group difference in Trails B performance among our matched HIV+ groups. Culture-related differences in psychomotor speed may not adequately explain this finding, since there were no significant relationships between acculturation and other measures involving psychomotor speed such as Grooved Pegboard and the WAIS–R Digit Symbol subtest. Perhaps acculturated individuals are more familiar with the set shifting and conceptual tracking demands of Trails B. In other words, it is possible that our finding that unacculturated African Americans took more time to complete Trails B is related to lack of saliency of this type of timed sequencing task within traditional African-American culture.

Acculturation level accounted for ethnic group differences in Category, Block Design, and Figure Learning performance among our HIV+ participants, who were matched on demographics and disease stage. As discussed in Arnold et al. (1994), perhaps these nonverbal measures tap culturally based approaches to problem solving, or differences in emphasis on speed and accuracy. Although acculturation accounted for ethnic group differences on these measures in Study II, these measures were not significantly related to acculturation in Study I. It is possible that culturally related differences in problem-solving are significant only when comparing Whites and African Americans when differences in cultural experience are more extreme than within each ethnic group.

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The ethnic group difference on Story Learning performance was particularly resistant to "correction" based on self-reported acculturation. Since the HIV+ groups were well matched on age, education, sex, and disease stage, it is unlikely that the ethnic group discrepancy on this measure can be accounted for by other demographic variables. African-American participants may have put more emphasis on recalling the gist or main essence of the story, as well as retelling the story creatively (e.g., Heath, 1983); however, recall of story details is required to score well on such tests (e.g., Houston, 1968; Lewnau, 1986). It is possible that the acculturation measure did not capture the cultural factor(s) that influence performance on this test; specifically, the AAAS does not assess use of Black English, which we found to be related to performance on measures of verbal learning within medically healthy African Americans.

Our *a priori* hypotheses regarding the association between acculturation and performance on measures of attention–working memory, speed of information processing, and memory–retention were not supported in the current study. Perhaps the skills assessed by these measures have equal relevance across levels of cultural experience. Our findings suggest that these measures can accurately assess attention, psychomotor speed, and retention among African Americans regardless of their cultural experience.

Use of separate ethnic group norms for African Americans would be an improvement over the current use of demographic corrections based on mainly White samples. However, the current study suggests that prediction of performance based on ethnic group membership and demographics (such as age, education, and sex) would be less accurate than if acculturation was taken into account as well. In addition, Study II suggests that accounting for within group cultural differences may improve the specificity of our neuropsychological tests, since unacculturated African Americans will be less likely to be misdiagnosed as impaired if scores are corrected for acculturation level.

Additional research is required to determine if assessment of Black English use will improve our understanding of the relationship between cultural background and test performance among African Americans. Degree of Black English use was assessed in the current study in order to obtain an observable representation of African-American acculturation, in addition to the self-report AAAS. Dialectical distinctions are subtle, and it is more difficult to discriminate the features of Black English from mainstream American English than it is to distinguish between two languages, such as English and Spanish. Nonetheless, this effort must be weighed against the fact that language is a core aspect of culture, and therefore, language use represents the acculturative process of all ethnic minority groups. Future research might refine the measurement of Black English use, include larger samples than used in the current study, and investigate additional neuropsychological measures that involve verbal abilities. Results may vary for research conducted in diverse geographical regions of the United States, which may differ in the degree to which African-American residents experience mainstream *versus* relatively segregated cultural environments.

The scope of the current study is limited because possible underlying factors for the association between acculturation and test performance were not measured. Future study should examine the relation of acculturation to comfort within the testing environment, familiarity with task demands, level of everyday salience of the ability being measured, and the influence of culturally specific problem-solving techniques.

It is possible that acculturation serves as a proxy for an educational construct not reflected in the *years of education* variable. The significant association of acculturation with measures that are strongly associated with achievement in traditional educational settings, such as WAIS–R Information and Vocabulary, suggests that quality of education may be a mediating variable in the relationship between African-American acculturation and neuropsychological test performance.

As suggested above, it will be important to examine acculturation level and test performance in other geographic regions of the country, as well as among more educationally diverse individuals. It is possible that acculturation level has a stronger association with test performance among African Americans living in rural or inner city environments, as well as for those with little formal education. In general, elderly African Americans have experienced more educational, occupational, and social segregation during their lifetimes; therefore, it is possible that the relation of acculturation to neuropsychological test performance may be stronger among African Americans above age 65.

It is possible that investigations of acculturation and qualitative features of test performance will lead to the development of measures that are less culturally biased, while at the same time maintaining good specificity and sensitivity to neurocognitive impairment. In addition, attempts to measure those cognitive skills more pertinent to the everyday lives of unacculturated ethnic minorities may improve our ability to accurately diagnose neurocognitive impairment, as well as increase our general understanding of the way in which cultural environment affects cognition.

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