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Bilingualism

SONIA MANUEL-DUPONT, ALFREDO ARDILA,
MONICA ROSSELLI, AND ANTONIO E. PUENTE

Approximately half of the world's population is bilingual or multilingual at some level of proficiency. Despite these numbers, there is little agreement among researchers concerning the cerebral representations and/or functions of multiple languages in any one individual. The reason for this lack of agreement is basically the dearth of systematically collected data available on both normal and brain-damaged multilingual language users (Paradis, 1987).

While several authors have produced excellent reviews of available historical data, theories, and experimental evidence (Albert & Obler, 1978; Vaid & Lambert, 1979; Vaid & Genesee, 1980; Ojemann & Whitaker, 1978; Vaid, 1986; Paradis, 1987, 1989; Solin, 1989; Zatorre, 1989), these overviews have best served as a means of demonstrating conflicting evidence and raising new issues rather than answering basic questions.

The purpose of this chapter will not be to answer these questions but to review arguments suggesting that multilinguals should be treated and tested as a very distinct population from monolinguals and to present some interesting linguistic performance data by Spanish–English-speaking Cuban Americans on Spanish and English versions of the Bilingual Aphasia Test (Paradis, 1987).

Among the many different issues discussed by authors of the previously cited reviews, it is clear that the most important finding is that bilinguals do not form a homogeneous group. They vary along a number of dimensions including:

1. Sociolinguistic background/support for bilingualism
2. Types of bilingualism
3. Degree of proficiency/communicative competence

SONIA MANUEL-DUPONT • Departments of Communicative Disorders and English, Utah State University, Logan, Utah 84322-1000. ALFREDO ARDILA and MONICA ROSSELLI • Instituto Columbiano de Neuropsicologia, Bogotá, Colombia. ANTONIO E. PUENTE • Department of Psychology, University of North Carolina at Wilmington, Wilmington, North Carolina 28403-3297.

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4. Age and sequence of language acquisition
5. Method of acquisition
6. Language-specific factors
7. Anatomical dimensions

THEORETICAL AND NEUROBIOLOGICAL ISSUES

Sociolinguistic Background and Support for Bilingualism

For our purposes, the most critical issue arising from all the studies that have been conducted on bilinguals is understanding not only the location and behavior of the second language in the brain, but also the bilingual speaker's attitude toward second language acquisition and retention in reference to his/her social milieu.

Given the state of affairs for the latter issue, Miller (1984) argues that until recently the academic world has labored under various misconceptions involving bilingualism that have clouded the issue of when, how, and why bilingualism occurs. In particular, he cites linguists and psychologists who have simplistically treated bilinguals as humans with two languages in their brains without attention to the use and function of any one individual's bilingualism.

This oversight reduces the study of bilingualism to one of anatomical properties and functions which ignores the status and function of both languages in the individual's context. The relative status of one language in relation to the other is usually the consequence of complex historical and social interactions which may involve any or all of the following: the community's tie to religious heritage, cultural and political legacies, trade relations or economic trends, and demographic characteristics. In areas where bilingualism is politically and socially encouraged, a different set of learning expectations and individual speaker participation in the learning process will occur relative to areas in which there is active suppression of a language, strict adherence to cultural and social norms and economic constraints placed on bilingual individuals. The speaker who learns two languages in the latter situation will have vastly different needs, motives, and perceptions than the first, some determined by social norms and ideals, while others are determined by individual needs and expectations. In addition to the role of cultural and societal influences on the acquisition of two languages, bilingualism itself is rarely the compartmentalization of one language from the other. Miller (1984) notes that the exchanges between bilinguals are commonly typified by utterances that are not analyzable by reference to one grammar of either language. Rather, the utterances contain features of both languages triggered by individual preference to express concepts in one particular language over another. These preferences can be triggered by topic selection, place of interaction, type of interlocutors, status of in-group/out-group member interchange, and/or the speaker's willingness to comply with or deny the linguistic conventions that would normally operate in the

presence of any of these factors. This type of "language-mixing" is called code-switching. As a normal linguistic process, it has been grossly misunderstood by researchers, not the least of whom are those purporting to analyze the linguistic behavior of bilingual aphasic individuals.

Types of Bilingualism

Perhaps the misunderstanding of language-mixing has arisen from the blind application of Weinrich's (1953) early research on the three types of bilingualism. According to Paradis (1978), Weinrich discovered three types of bilingualism in his extensive review of bilingual literature. Type A (coordinate bilingualism) is characterized by separate signs (sound images and meaning units) for each language. This means that this type of bilingual speaker has two sets of meaning units and two sets of corresponding sound images or words (one for each language). Type B (compound bilingualism) is characterized by one unit of meaning with two units of sound images (one for each language). Thus, this type of bilingual speaker draws upon one merged set of meanings from the two languages, but has the capability of expressing himself/herself with the sound images (words) from both languages. The final category, Type C (subordinate bilingualism), is characterized by the meaning unit of the mother tongue with the corresponding sound image in the mother tongue and an equivalent unit of expression in the second language. Like the compound bilingual, the subordinate bilingual has only one set of meaning units and two sets of sound images. Unlike the compound bilingual, the subordinate bilingual draws from only the mother tongue units and has the sound images of the second language as rough translation quasi-equivalents of the mother tongue units.

Given the differing roles of the meaning units and sound images in these three types of bilinguals, Paradis (1977, 1978) notes that only the coordinate bilingual could function as a native speaker of each language, drawing the appropriate sound image from the appropriate meaning unit of each language. The compound bilingual would not function as a native speaker of either language, since his/her units of meaning would represent a merging of content from both languages disallowing for appropriate retrieval from either language's sound images to meaning units. In a similar fashion, despite having native speaker abilities in the mother tongue, the subordinate bilingual would not speak his/her second language like a native speaker as it would be filtered through the meaning units of the mother tongue. While this model provides an analysis of three very different types of bilingual speakers, and is widely accepted by psychologists and neuropsychologists engaging in bilingual research (see Paradis, 1977, 1985; Albert & Obler, 1978; Vaid & Genesee, 1980), most researchers have misinterpreted Weinrich's types as mutually exclusive. Bilingual speakers have been treated as being purely coordinate, compound, or subordinate with no regard for actual language usage. This misinterpretation has caused further misunderstanding as researchers have chosen to lump

compound and subordinate bilinguals together thus arriving at a coordinate versus compound (or native speaker-like versus non-native speaker-like) dichotomy.

Degree of Proficiency/Communicative Competence

The important distinctions obscured by this dichotomy include the degree and type of language competence exhibited by each of these kinds of individuals. Canale and Swain (1980) and Canale (1981) have argued that communicative competence is an essential part of actual communication. This competence includes knowledge about the language and other aspects of communication in addition to the skill that underlies actual communication in a systematic and necessary way. Given this interpretation, if a speaker is a "competent" or "proficient" speaker of a language, one must look at not only his/her grammatical knowledge and skills, but also his/her sociolinguistic, discourse, and strategic competencies. These additional competencies include knowing not only when and where to speak but which language or combination of language features (i.e., code-switching) is appropriate for the situation, knowing how to connect a series of utterances to form a meaningful conversation, and being able to compensate for breakdowns in communication. Thus, an understanding of an individual's degree of proficiency in any language must take the sociocultural setting into account as well as the behavior of the individual to judge if the linguistic behavior has adequately met the constraints of the communicative situation.

To further complicate the issue of communicative competence, one must measure the linguistic abilities of bilinguals in relation to the cultural and societal demands of the current environmental situation. As stated earlier, the community in which the multilingual child or adult acquires his/her languages will greatly influence the degree of competence and usage of each language. One such influence will be on the spheres of knowledge a speaker will be required to acquire in each language. It is indeed a rare situation in which one individual is required to express the entire content of his/her knowledge in both languages. A far more common situation is for experiences, ideas, spheres of knowledge, etc. to be language-specific. It is indeed not unusual for a person to learn all work-related jargon, scientific language, or argot in one language but not the other, or to learn the vocabulary of a particular setting or event (i.e., religious prayers, hymns, songs, oaths, etc.) in one language but not another.

Judging degree of language proficiency in a bilingual, therefore, is a much more complicated task than it is in a monolingual. To adequately assess a bilingual's linguistic skills, the examiner must know which languages correlate with which spheres of knowledge and which sociocultural situations. To simply blindly test all spheres of knowledge in both languages is to guarantee that gaps will be produced. Once these gaps are found, it is an extremely difficult and time-consuming task to separate naturally occurring, socially appropriate gaps from deficiencies caused by insult or injury to the brain.

Age and Sequence of Language Acquisition

To separate the naturally occurring gaps from the injury-related gaps, one of the first areas of inquiry should concern the age and sequence of language acquisition of each of the languages. Lamendella (1977) and Whitaker (1978) (as cited in Vaid and Genesee, 1980) have noted that if two languages of a bilingual are acquired successively rather than simultaneously, one might expect some differences in their underlying neural organization insofar as the maturational state of the brain differs during the time of the acquisition of the first language versus the second. They postulate that the effect of these two factors—neurological age and cognitive maturity—should give rise to a pattern of hemispheric involvement more closely resembling that of monolinguals of the same age the earlier the second language is acquired. It will differ from that of monolinguals the later the second language is acquired. These differences, often referred to as simultaneous versus sequential or successive bilingualism (Miller, 1984), have ramifications for the actual language learning process.

Method of Acquisition

It has been postulated by several researchers that the strategies used by language learners in the beginning stages of second language acquisition are more compatible with the linguistic capabilities of the right hemisphere than the left (Galloway, 1979). Vaid and Genesee (1980) note that this argument has been supported by research demonstrating that the early utterances of the second language learners tend to be highly contextualized (Scarcella, 1979), and that speech comprehension relies more on content than on function words, prosodic rather than phonetic features, and pragmatic rather than syntactic information (McLaughlin, 1978). These findings led several researchers to further postulate that right hemisphere processing would be more evident in the initial than final stages of second language acquisition (Krashen & Galloway, 1978; Silverberg, Bentin, Gaziel, Obler, & Albert, 1979).

Vaid and Genesee (1980) have reviewed nearly 20 studies attempting to support this theory using dichotic listening and tachistoscopic procedures. While the majority provide evidence that the left hemisphere is dominant for language functioning, the majority failed to show greater right hemisphere involvement in the earlier stages of second language acquisition. Some studies showed equivalent left hemisphere involvement in the first and second languages of nonproficient bilinguals (Albert & Obler, 1978; Gordon, 1980; Piazza & Zatorre, 1981) while others showed greater left hemisphere participation in the less proficient as compared to the more proficient language (Rogers, TenHouten, Kaplan, & Gardiner, 1977). Vaid and Genesee concluded that there was little evidence that right involvement was more likely in the beginning than in the advanced stages of second language acquisition. Rather they postulated that right hemisphere participation was more likely the later the second language

was acquired relative to the first, and the more informal the exposure to the second language.

Krashen (1977) defines informal language learning—language acquisition—as that which is acquired in naturalistic communication settings where the user's attention is directed more to the content than the form of linguistic utterances. Formal language acquisition—language learning—on the other hand, is characterized by emphasis on rule isolation and error correction which makes the learner aware of the language as an abstract, rule-governed system.

Lamendella (1977) proposed that language acquisition and language learning have different neural representations with respect to the involvement of the limbic system. He argued that when a second language is acquired in a natural environment, it is better integrated into the individual's communication hierarchy with greater participation of the limbic structures. When it is learned in a formal setting through rule learning, it is more like any other subject matter than involves mainly neocortical structures.

In discussing limbic system involvement, Paradis (1985) has argued that while the limbic system is involved in the learning process in several critical ways from establishment of neurofunctional mechanisms to attain automatic fluent production of speech to the provision of empathy and integrative attitudes, this involvement will vary with the age of the learner, the degree of emotional involvement of the learner, the motivation to learn the second language, and the relative prestige of the two languages in addition to the learning situation—informal versus formal.

Given these different learning experiences, Vaid and Genesee (1980) proposed a model to best account for the relationship between age, stage and manner of acquisition, and the participation of each hemisphere in the learning process. They proposed that the right hemisphere involvement will be more likely the later the second language is learned relative to the first, the more informal the exposure to the second language, and possibly the earlier the stage of language acquisition. In contrast, left hemisphere involvement will be more likely the earlier the second language is learned relative to the first, the more formal the exposure to the second language, and the more advanced the stage of acquisition. In addition, the more similar the conditions of the first and second language acquisition, the greater is the likelihood that bilinguals will show comparable patterns of hemispheric involvement in processing their two languages. Conversely, the less similar the conditions of language acquisition, the greater is the likelihood of dissimilar patterns of hemisphere involvement.

Language-Specific Factors

While the model of Vaid and Genesee accounts for many different variations in the language learning/acquiring process, there is yet another factor that may affect hemisphere involvement. Vaid and Genesee (1980) argue that different languages may require different perceptual/cognitive processes which may depend on intra- or interhemispherically distinct cortical systems. The areas of

language-specific factors they address include differences in language-related thought patterns, visual field preferences, characteristics of vowels, tonality, and direction of script.

Several researchers have suggested that languages that elicit appositional versus propositional modes of thinking should yield differential patterns of hemisphere involvement (Hynd & Scott, 1980). However, EEG alpha wave activity testing and dichotic listening tests have not consistently demonstrated this difference (see Vaid and Genesee, 1980, for a review). Further, there are many problems associated with the theoretical assumptions that languages differ in the degree to which they serve as instruments for appositional versus propositional thought. Visual field asymmetries in the processing of verbal material have been subject to several interpretations (Vaid and Genesee, 1980). The two areas that have received the most attention include a cerebral laterality effect and a scanning effect that accounts for visual field preferences in terms of directional postexposural scanning mechanisms that develop from reading habits (Heron, 1957). Most experimental studies involve tachistoscopic measurements comparing left-to-right versus right-to-left visual modalities. Some studies have indicated the presence of a scanning effect (LVF preference under unilateral presentation for languages read from right to left), while others have demonstrated an overriding cerebral laterality effect (RVF superiority) especially under conditions where the scanning effects are minimized, as when words are presented vertically for shorter exposure durations or with a central fixation control. In addition, it has been suggested that proficiency and order of language learning may reinforce certain scanning effects (Vaid and Genesee, 1980).

For the third factor it has been proposed by a number of researchers that vowels of different languages will be processed in different hemispheres. Tsunoda (1971) has suggested that this difference is due to the fact that listeners will perceive vowels more analytically in languages in which they often form meaningful words as compared to languages in which consonants are more salient. The former rely more on left hemisphere processing. The outcome of several experiments testing this theory are equivocable.

A fourth factor has been postulated suggesting that when tonal changes carry changes in meaning, tones will be processed more efficiently in the left hemisphere. There is supporting evidence from Thai–English studies (Van Lancker & Fromkin, 1978), Chinese–English studies (Naeser & Chan, 1980), and Vietnamese–French studies (Hecaen, Mazars, Rannier, Goldblum, & Merienne, 1971). But Benson, Smith, and Arreaga (1974) indicate that the difference merges only when the tones are presented in a linguistic context.

For the fifth factor, the sound–symbol correspondence of different writing systems has been tested in bilingual aphasics to determine if site of lesion has a greater effect on phonetic or ideographic orthographies. It was found that lesions in the temporal cortex have been associated with greater impairment of reading and/or writing of scripts that are phonetically based (de Agostini, 1977; Hinshelwood, 1902; Luria, 1960; Peuser & Leischner, 1980; Sasanuma & Fuji-

mura, 1971) while lesions in the posterior occipito-parietal cortical areas have been associated with greater impairment in reading and/or writing of scripts with an ideographic or irregular phonetic basis (Lyman, Kwan & Chao, 1938; Newcombe in Critchley, 1974; Sasanuma, 1975).

Anatomical Dimensions

Specifically involved in the discussions of these dimensions is the question of where the second language is found in the bilingual's brain. Paradis (1985, p. 12) offers the following summary of possible sites for the second language (L2) of a bilingual:

1. L2 is in the right hemisphere.
2. L2 is represented bilaterally.
3. L2 is less lateralized than the first language (L1), and although both are subserved by the left hemisphere, there is relatively greater participation of the right hemisphere for L2.
4. Both languages are less lateralized.
5. Both languages are equally lateralized to the left and there is no difference between bilinguals and monolinguals.

The first option is closely tied to the language-specific effect hypothesis, which argues that structures of certain languages lend themselves to more right hemisphere participation than other languages. The second hypothesis is tied to the age hypothesis, which argues that languages acquired after a particular point in time will involve more right hemisphere participation than languages acquired earlier. The third alternative involves the second language hypothesis, which states that a second language acquired after a first has been learned will find more right hemisphere participation than the first did. The fourth possibility involves the stage hypothesis, which argues that the right hemisphere will be more involved in the language acquisition process in the beginning stages than in the end. Finally, the fifth option involves the bilingual type hypothesis according to which coordinate bilinguals keep their two languages separate, and store them in different ways, with a greater involvement of the right hemisphere for one of the languages.

Paradis notes that within these five theories are direct contradictions. The stage hypothesis predicts that as the second language becomes more nativelike, it will gradually shift to the left hemisphere, while the bilingual type hypothesis predicts that the more nativelike the two languages are, the more separate they are to be kept, thus the greater the possibility of right hemisphere participation for the second language.

While there have been numerous proponents and opponents of each of these theories, most agree that these models are too simplistic to answer neuroanatomical questions. In addition, Paradis (1987) notes that available data support neither theories postulating that multiple languages have completely separate neurophysiological representations nor ones postulating completely

merged representations. In attempting to account for the available data (1987, p. 9), he argues convincingly that "bilinguals have two subsets of neural connections, one for each language . . . while at the same time they possess one larger set from which they are able to draw elements of either language at any time." This hypothesis successfully accounts for data that indicate that some elements of both languages are undifferentiated in their representation while others, because they normally occur in mutually exclusive environmental contexts, are stored separately and subserved by a different network of neural connectors. This theory again supports the argument that each individual bilingual speaker will have a neuroanatomical configuration for language that best represents his/her sociocultural speaking environments as well as his/her linguistic and educational past experiences.

At this point, it is tempting to postulate that since no two individuals will have identical linguistic and educational experiences nor identical sociocultural environments, attempts to determine language characteristics of a specific group of multilingual speakers would be futile. To determine if it would be possible to find shared language characteristics among a group of bilingual speakers, Spanish and English versions of the Bilingual Aphasia Test (BAT) were given to a small group of bilingual (Paradis & Ardila, 1989*a*,*b*) Cuban-Americans residing in Miami, Florida.

SPANISH–ENGLISH BILINGUAL APHASIA TEST RESULTS

As Paradis (1987) and others have noted, the single greatest hindrance to understanding the neuroanatomical constructs of multiple languages in an individual is the dearth of systematically collected data on both normal and brain-damaged individuals. To this end the BAT (Paradis, 1989) was chosen as an instrument to describe the linguistic performance of a group of non-brain-damaged Spanish–English bilinguals.

The BAT (Paradis, 1987, p. 19) was designed to cover in a nonexhaustive manner a number of language structures (phonemic, phonological, morphological, syntactic, lexical, semantic) and some language usage characteristics (comprehension, repetition, judgment, propositionizing, reading, and writing) in most modalities (auditory, visual, oral, and digitomanual) with the word, sentence, and paragraph as units of analysis. The BAT is a test of language performance that excludes nonlinguistic means of communication and language-mixing as communicative strategies. The Spanish and English versions of the BAT have been administered to other non-brain-damaged controls "to ensure that every fluent speaker of each language met criterion on each section" (Paradis, 1987, p. 43).

There are three sections on the BAT. Part A contains 50 questions on the history of bilingualism. Part B is a test of a specific language with sections on spontaneous speech, verbal comprehension, pointing, commands, verbal auditory discrimination, syntactic comprehension, semantic categories, synonyms,

antonyms, grammaticality judgment, semantic acceptability, repetition, series, verbal fluency, naming, sentence construction, semantic opposites, derivational morphology, morphological opposites, description, mental arithmetic, listening comprehension, reading words aloud, reading sentences aloud, reading a paragraph for comprehension, copying, dictation, reading comprehension for words and sentences, and spontaneous writing.

A special section, Part C, evaluates the ability to translate and the recognition of grammaticality errors resulting from grammar interference between both languages. This section requires the subject to recognize words, translate words and sentences, and make grammaticality judgments.

This particular test was chosen because of its breadth and depth of evaluation procedures. The purpose of using this test was to probe the linguistic characteristics of normal Cuban-American Spanish–English bilinguals.

Sociocultural Background

While Cuban immigration to the United States dates back to the 19th century, the most recent immigrant waves in the early 1960s and 1980s have had the strongest influence on southern Florida communities in Dade County (Diaz, 1983). The Cuban wars of independence from 1868 to 1895 fostered the first waves of immigrants who settled mainly in the Tampa and Key West areas. These immigrants established the tobacco industry in southern Florida, eventually constituting a significant portion of the labor force. After the wars of independence, scores of other immigrants moved to the United States for better economic opportunities. Due to the proximity of Florida to Cuba, many of these immigrants traveled back and forth bringing knowledge of American technology to Cuba while providing a strong link with Cuban religious, political and linguistic institutions for Cubans living in the United States.

With the establishment of the Castro regime in the 1960s another wave of skilled, professional white-collar workers left Cuba. These immigrants represented a largely educated, middle-class group accustomed to an urban-professional standard of living. However, by the late 1960s and early 1970s a larger group of students, children, housewives, and older persons from lower socioeconomic strata were being airlifted into the United States (Diaz, 1983). These groups were not as accustomed to an urban life-style and often had few transferable job skills. Finally the last large wave of immigration occurred in the summer of 1980 when 125,000 Cubans immigrated to the United States by private and chartered boat (Diaz, 1983). This last group was largely male, with a median age in the low 30s and with lower educational and skill levels than previous immigrants had had. This last group of immigrants spoke little or no English and had little familiarity with the American way of life.

As a result of these different waves of immigration in the 1990s we find that the current generation of Cuban-Americans, born in the United States, account for almost 20% of the Cuban community (Diaz, 1983) and that one in every five Cubans has attended an American school. Despite this exposure to the U.S.

educational system and the use of English as the medium of instruction, it is still the case that Cubans overwhelmingly prefer to speak Spanish at home. While English language usage is found in the work force, at school, and with print and electronic media, even many Cuban college graduates choose to speak Spanish over English in many social situations. This Spanish language usage does not appear to be fostered through formal instruction—over 80% of Cuban children attend the Dade public school system. It is nourished through the Spanish media and a "ghetto economy" system of stores and businesses, owned and operated by Cubans, which precludes the use of English (Diaz, 1983).

While Cubans can be found at every socioeconomic level and in every profession, the largest populations are found in Miami, Sweetwater, and Hialeah and there is a dearth of Cuban professionals in many white-collar professions, particularly education.

Recent surveys in the Cuban communities of Dade County show that learning English ranks among the most important needs felt by this group (Diaz, 1983). At the same time, many Cubans maintain strong cultural (and linguistic) ties with their native homeland because the large, strong Cuban communities in the United States make them feel "at home" in Dade County but not in other American communities. In addition, many feel that their immigration is only temporary and that they will eventually return to Cuba.

Linguistically, one finds that many Cuban children are taught to read and write in Spanish before attending English-medium schools. Technical subjects such as science, math, and literature are generally known in English but not Spanish. Despite this technical knowledge in English, many children experience some word finding difficulties, and difficulties exist with the use and understanding of complex syntax. Code-switching and borrowing phenomena are evident. Some examples include:

- I think *que de todas maneras voy a enviar la* letter
- When I was testing the patient, *comenzo a protestar*
- *Muchos libros en la* library *estan* reserved
- Yard →/jarda/
- Gang → /ganga/
- Key West → /kajo weso/

Interestingly, the Spanish-speaking second generation often uses English as a base language when speaking among themselves. This may be due to two reasons: they know English better than Spanish (Spanish is only spoken in the home), and they have a stronger identification with the Anglo culture than with the Hispanic culture. As such, language often becomes a source of family conflict. Sometimes, parents are forced to speak English with their children or they may force their children to speak Spanish to them. Sometimes schoolchildren use English to confuse parents and grandparents, making family communication a difficult task.

Because of this interesting mixture of English and Spanish linguistic and cultural traditions in this group, it was felt that this group would make an

excellent test group to determine language usage patterns in a bilingual population.

Method

Subjects

A sample of 14 subjects (7 males, 7 females) was selected. All of them were born in Cuba, and arrived in the United States during early childhood as native Spanish speakers. They began using English when they started school (average age 4.8; S.D. 0.77; range 4–5), but they continued using Spanish at home. At the time of testing the average age was 25.46 (S.D. 5.3; range 17–35). All of the subjects were students or professionals with an average educational level of 14.5 (S.D. 2.65; range 11–19) and without any history of neurological or psychiatric pathology.

Procedure

The BAT English version (Paradis, Hummel, & Libben, 1988), Spanish version (Paradis & Ardila, 1989*a*), and English/Spanish bilingualism section (Paradis & Ardila, 1989*b*) were given individually to each subject in two sessions. The order of evaluation (English–Spanish, or Spanish–English) was balanced. All of the subjects were nonpaid volunteers, and were informed about the purpose of the testing.

Research Question

Since the BAT has been designed to allow all non-brain-damaged subjects to reach criterion on most subtests, it was assumed that this group of subjects would not perform significantly differently on the English versus the Spanish version of this test.

Results

Table 7.1 shows the means and standard deviations for each subsection of the Spanish and English versions of the BAT. As can be seen, there were few statistically significant results between the languages. The few significant differences included sentence construction, number of words, morphological opposites, and reading.

In another measure, it is interesting to note that in the Spanish version of the test the mean scores for these subjects were below the error range expected for normal subjects for repetition, series, semantic opposites, derivational morphology, mental arithmetic, and dictation. In the English version, scores were lower than the expected error range for derivational morphology and morphological opposites.

TABLE 7.1. Means and Standard Deviations Found for the Different Subtests of the BAT for Spanish and English[a]

		Spanish		English			
Section	Max.	Mean	S.D.	Mean	S.D.	*t*	*p*
Pointing	(10)	10.00	0.00	0.00	0.00	—	—
Commands	(30)	29.35	1.64	30.00	0.00	1.44	NS
Auditory Disc	(18)	17.64	0.84	17.89	0.83	−1.00	NS
Syntactic Com	(87)	85.00	1.41	85.14	1.40	0.33	NS
Semant Cat	(5)	5.00	0.00	4.93	0.27	−1.00	NS
Synonyms	(5)	4.57	0.94	4.85	0.36	1.00	NS
Antonyms	(10)	9.21	0.89	9.42	0.75	0.90	NS
Gram Judgm	(10)	9.93	0.76	9.79	0.42	−1.00	NS
Sem Accept	(10)	9.64	0.63	9.71	0.82	0.32	NS
Repetition	(67)	64.85*	1.75	65.21	1.76	0.47	NS
Series	(3)	2.78*	0.42	3.00	0.00	1.88	NS
Fluency		24.00	7.28	28.26	7.77	1.54	NS
Naming	(20)	20.00	0.00	20.00	0.00	—	—
Sentence Const	(15)	14.14	0.77	14.79	0.58	−2.39	0.03
Number Words		58.14	3.03	48.86	2.41	3.51	0.004
Semantic Oppos	(10)	8.78*	0.89	9.36	0.93	1.66	NS
Deriv Morphol	(10)	7.14*	1.70	7.71*	1.49	1.00	NS
Morphol Oppos	(10)	8.43	1.40	7.43*	1.70	2.46	0.03
Ment Arithmet	(15)	12.93*	1.90	13.21	1.58	−1.17	NS
List Compreh	(5)	4.64	0.50	4.57	0.94	−0.23	NS
Reading	(26)	24.40	1.55	25.43	0.65	2.01	0.06
Copying	(5)	5.00	0.00	5.00	0.00	—	—
Dictation	(10)	8.85*	2.03	9.71	0.46	1.46	NS
Read Comp	(20)	19.42	0.93	19.21	1.31	−1.15	NS

[a]Maximum score for each subtest is shown in parentheses. t-test values and level of significance of the differences are also shown.
*The mean error is below the error range for normal subjects.

In the spontaneous writing portion (Part B) of both versions of the BAT, patterns such as number of words, number of errors, and types of errors were measured. The mean number of words used in the written description in Spanish was 64.35 (S.D. 24.12; range 25–104); in English, 93.00 (S.D. 30.49; range 52–168). The average number of errors in Spanish was 4.78 (S.D. 3.64; range 0–15); in English, 0.64 (S.D. 1.1; range 0–4). All of the writing errors in English were substitution spelling errors. In Spanish, besides orthographic errors, additions, omissions, and substitutions were frequently found (errors in accent marks were not considered).

In the Spanish writing sample, 10 of the 14 subjects demonstrated problems with number agreement between articles, nouns, adjectives, and verbs. The BAT labels these errors paragrammatisms. Borrowing from English was clearly evident in the alphabetic renderings of some words (e.g., telefono → telephono; diferente → differente).

Organizational patterns in the Spanish texts often showed some influence from English with numerous paragrammatical errors:

> *Hoy es un dia bonito* (n → n) *para trabaja* (trabajar). *A mi me gusto* (gusta) *medicina mucho* (word-order error) *porque puedo ayudar a los enfermo* ("s" omission; concordance error). *Como hoy esta el dia feo, es en* (un) *dia bueno para estar aqui en el trabajo. Medicina* (article omission) *te deja ayudar a los que necessita* (necesitan) *ayudar* (ayuda) (the whole sentence is agrammatical). *Como enfermero tu puedar* (puedes) *asuer* (hacer) *muchas cosas differente* (diferentes).

It is interesting to note that there were no instances of Spanish language interference in the English tests and few instances of paragrammatism in the English texts.

On Part C of the BAT, the translation portion of the exam, mean errors in translation from English to Spanish (5%) and Spanish to English (6%) were nearly equivalent. There were no significant differences between scores on word recognition, translation of words, and translation of sentences for the two versions of this test.

There were significant differences, however, between scores for grammaticality judgments for the two versions. On the Spanish-to-English test the mean score was 11.46 (S.D. 1.39) and on the English-to-Spanish test, 14.54 (S.D. 1.85) (see Table 7.2).

Discussion

On the three sections of tests given to these subjects, the BAT English version, the BAT Spanish version, and the Spanish/English bilingualism test, it is clear that these Cuban-American bilinguals offer a unique linguistic performance pattern. They do not use their two languages as "ideal or perfectly balanced" bilinguals (Bloomfield, 1953). Instead they demonstrate strengths and weaknesses directly tied to their linguistic and educational heritages.

In answer to the research question, these subjects do perform significantly differently in some areas of linguistic skills.

They have poorer performance in Spanish sentence construction, number of words, morphological opposites, and reading because they have learned

TABLE 7.2. Spanish/English Bilingualism[a]

		Spanish-to-English		English-to-Spanish			
Section	Max.	Mean	S.D.	Mean	S.D.	*t*	*p*
Word recogn	(5)	4.93	0.26	4.93	0.26	0.00	NS
Trans words	(10)	9.31	1.03	9.38	0.96	0.23	NS
Trans sent	(18)	16.92	1.44	17.15	1.40	0.79	NS
Gram judgm	(16)	11.46	1.39	14.54	1.85	5.18	0.001

[a]Spanish-to-English and English-to-Spanish translation in the first three sections, and grammaticality judgments in the fourth section.

primary literary skills in English in school. This is also reflected in the fewer words, more errors, and the strong English influence on spelling seen in the Spanish writing sample. Other academically related language skills that were weaker in Spanish included repetition, series, semantic opposites, mental arithmetic, and dictation. All of these areas may be partially described as pertaining more readily to the English-dominated world of academic study than the Spanish-dominated world of home and family communications.

The possible influence of academic training in English is also seen in results for Part C, the translation section of the exam. While subjects showed virtually equivalent abilities in isolated translating tasks, there were significant differences in their abilities to judge grammaticality in English and Spanish.

Again it is not surprising that these bilinguals would demonstrate fewer problems judging English grammaticality errors than Spanish. These judgments are very academically oriented exercises that would have been learned and practiced in an English-dominated academic content. These bilinguals would have developed a greater "sphere of knowledge" and greater linguistic analytical skills in the language in which these skills were learned—English at school. This trend is also seen in the spontaneous writing sample (Part B of the BAT) where subjects who are more accustomed to formal writing tasks in English exhibit typical patterns (paragrammatisms) found in written language samples of primarily oral language users.

Since these subjects are more accustomed to speaking in both languages but writing formally only in English, more oral language patterns are found in Spanish writing samples. These patterns include concordance errors, spelling words phonetically as they sound, incorrect tense and aspect designations on verbs, and other inflectional errors. Overall, these bilingual subjects do not demonstrate equivalent linguistic skills in both languages in all areas of language aptitude and production.

SUMMARY

Today we live in a world where half of the population is bilingual or multilingual. While we have formally recognized that bilingualism exists, we continue to struggle to understand how bilinguals use and store their languages. Research from many sources points very conclusively to the fact that bilinguals can be considered neither to be like monolinguals nor to form a homogeneous group themselves. To fully understand the linguistic capacity and performance of any bilingual speaker, it is necessary to collect extensive information on that person's sociolinguistic background, his or her educational experiences, the methods of language acquisition, and the opportunities for usage of each language.

In the actual assessment process it is critical that the subject be tested in all applicable languages with instruments that are linguistically functionally equivalent, not mere translations of each other.

With the Cuban-American bilingual data collected in this study, it is clear that this small test group did not perform as was predicted by error norms on either the Spanish or English version of the BAT. Certain sociocultural constraints and academic training in English left these individuals with distinct strengths and weaknesses in each language that should be considered normal for this group of bilingual speakers.

What this finding suggests is a need to collect baseline data on large populations of normal bilingual speakers to establish basic trends in language usage for each group of speakers. It is not enough to norm a Spanish version of the BAT on one group of (e.g., Mexican-American) bilingual speakers. These trends may not be applicable to other Spanish–English bilingual groups.

Until we can work together as Paradis (1987) has suggested to *systematically* collect and analyze speakers, we will continue to struggle in our understanding of their language use and capacities.

Summary Highlights

1. Multilinguals do not demonstrate the same linguistic performance patterns as monolinguals.
2. Multilinguals do not form a homogeneous group themselves. While certain linguistic parameters may be shared by groups of multilingual speakers, each individual will have language usage patterns and preferences that will diverge from the group.
3. The degree of functional independence between the languages of a multilingual is dependent on the social constraints of language usage, the socioeconomic status and setting of the linguistic interchange, the educational methodology and level of attainment of the speaker, the age of the speaker when learning each language, the sequence of acquisition, the structure of each language, and the attitude of the speaker toward each language and its usage.
4. Multilinguals must be tested in each of their languages with instruments that are linguistically equivalent.
5. Each cultural/ethnic/social group of multilingual speakers is more likely to have a different pattern of strengths and weaknesses in each of their languages than a similar cultural/ethnic/social group. Language usage patterns should be determined for each group.
6. The home environment will produce language usage patterns that are different from academic environments. Language tests that require academic analytical skills will favor the languages most often used in academic settings.

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REFERENCES

Albert, M. L., & Obler, L. K. (1978). *The bilingual brain*. New York: Academic Press.

Benson, P., Smith, T., & Arreaga, L. (1974). Lateralization of linguistic tone—Evidence from Cantonese. *Bis Report*, Los Angeles: UCLA, pp. 19–20.

Bloomfield, L. (1953). *Language*. New York: Holt, Rinehart, & Winston.

Canale, M. (1981). From communicative competence to communicative language pedagogy. In J. C. Richards & R. Schmidt (Eds.), *Language and communication*. Clevedon, Avon, England: Multilingual Matters (pp. 1–47).

Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics, 1*(1), 1–47.

Critchley, M. (1974). Aphasia in polyglots and bilinguals. *Brain and Language, 1*, 15–27.

de Agostini, M. (1977). A propos de l'agraphie des aphasiques sensoriels: Etude comparative Italien-Français. *Languages, 47*, 120–130.

Diaz, G. (1983). Dade Cuban immigrants: Integration patterns and special education needs. In R. Samuda & S. Woods (Eds.), *Perspectives in immigrant and minority education* (pp. 128–136). Washington, D.C.: University Press of America.

Galloway, L. (1979). The cerebral organization of language in bilinguals and second language learners: Clinical and experimental evidence. Unpublished doctoral dissertation, UCLA.

Gordon, H. W. (1980). Cerebral organization in bilinguals. *Brain and Language, 9*, 255–268.

Hecaen, H., Mazars, G., Rannier, A., Goldblum, M., & Merienne, L. (1971). Aphasie croissee chez un sujet droitier bilingue (Vietnamien-français). *Revue Neurologique, 124*, 319–323.

Heron, W. (1957). Perception as a function of retinal locus and attention. *American Journal of Psychology, 70*, 38–48.

Hinshelwood, J. (1902). Four cases of word blindness. *Lancet, 1*, 358–363.

Hynd, G., & Scott, S. (1980). Propositional and appositional modes of thought and differential cerebral speech lateralization in Navajo Indian and Anglo children. *Child Development, 51*, 909–911.

Krashen, S. (1977). The monitor model for adult second language performance. In M. Burt, H. Dulay, & M. Finocchiaro (Eds.), *Viewpoints on English as a second language* (pp. 6–47). New York: Regents.

Krashen, S., & Galloway, L. (1978). The neurological correlates of language acquisition: Current research. *SPEAQ Journal, 2*, 21–35.

Lamendella, J. (1977). General principles of neurofunctional organization and their manifestations in primary and nonprimary language acquisition. *Language Learning, 27*, 155–196.

Lurai, A. (1960). Differences between disturbance of speech and writing in Russian and in French. *International Journal of Slavic Linguistic Poetics, 3*, 13–22.

Lyman, R., Kwan, S., & Chao, W. (1938). Left-occipital-parietal brain tumor with observations on alexia and agraphia in Chinese and English. *Chinese Medical Journal, 54*, 491–516.

McLaughlin, B. (1978). *Second language acquisition in childhood*. Hillsdale, N.J.: Erlbaum.

Miller, N. (1984). *Bilingualism and language disability*. San Diego: College-Hill Press.

Naeser, M., & Chan, S. (1980). Case study of a Chinese aphasic with the Boston Diagnostic Aphasia Exam. *Neuropsychologia, 18*, 389–410.

Ojemann, G. A., & Whitaker, H. A., (1978). The bilingual brain. *Archives of Neurology, 35*, 409–412.

Paradis, M. (1977). Bilingualism and aphasia. In H. A. Whitaker & H. Whitaker (Eds.), *Studies in Neurolinguistics, 3* (pp. 65–121). New York: Academic Press.

Paradis, M. (Ed.). (1978). *Aspects of bilingualism*. Columbia, S.C.: Hornbeam Press.

Paradis, M. (1985). On the representation of two languages in one brain. *Language Sciences, 7*(1), 1–39.

Paradis, M. (1987). *The assessment of bilingual aphasia*. Hillsdale, N.J.: Erlbaum.

Paradis, M. (1989). Bilingual and polyglot aphasia. In F. Boller & J. Grafman (Eds.), *Handbook of neuropsychology* (Vol. 2, pp. 117–140). Amsterdam: Elsevier.

Paradis, M. (1989). La lateralizacion cerebral diferencial en los bilingues: Basta, por favor! *Investigaciones Psicologicas, 7*, 95–106.

Paradis, M., & Ardila, A. (1989*a*). *Prueba de afasia para bilingues*. Hillsdale, N.J.: Erlbaum.
Paradis, M., & Ardila, A. (1989*b*). *Bilingual aphasia test. Part C. Bilinguismo Espanol/Ingles*. Hillsdale, N.J.: Erlbaum.
Paradis, M., Hummel, K., & Libben, G. (1988). *The bilingual aphasia test (English version)*. Hillsdale, N.J.: Erlbaum.
Peuser, G., & Leischner, A. (1980). Impairments of phonetic script in an aphasic. In M. Paradis (Ed.), *Readings on aphasia in bilinguals and polyglots*. Montreal: Didier.
Piazza, D., & Zatorre, R. (1981). Right ear advantage for dichotic listening in bilingual children. Unpublished manuscript, Brown University.
Rogers, L., TenHouten, W., Kaplan, C., & Gardiner, M. (1977). Hemispheric specialization of language: An EEG study of bilingual Hopi children. *International Journal of Neurological Sciences, 8*, 1–6.
Sasanuma, S. (1975). Kana and Kanji processing in Japanese aphasics. *Brain and Language, 2* 369–383.
Sasanuma, S., & Fujimura, O. (1971). Selective impairment of phonetic and nonphonetic transcription of words in Japanese aphasic patients: Kana vs. Kanji in visual recognition and writing. *Cortex, 7*, 1–18.
Scarcella, R. (1979). "Watch Up!" A study of verbal routines in adult second language performance. *Working Papers in Bilingualism, 19*, 79–88.
Silverberg, R., Bentin, S., Gaziel, T., Obler, L., & Albert, M. (1979). Shift of visual field preference for English words in native Hebrew speakers. *Brain and Language, 8*, 184–190.
Solin, D. (1989). The systematic misrepresentation of bilingual crossed aphasia data and its consequences. *Brain and Language, 36*, 92–116.
Tsunoda, T. (1971). The difference of the cerebral dominance of vowel sounds among different languages. *Journal of Auditory Research, 11*, 305–314.
Vaid, J. (Ed.). (1986). *Language processing in bilinguals: Psycholinguistic and neuropsychological perspective*. Hillsdale, N.J.: Erlbaum.
Vaid, J., & Genesee F. (1980). Neuropsychological approaches to bilingualism: A critical review. *Canadian Journal of Psychology, 34*, 417–445.
Vaid, J., & Lambert, W. (1979). Differential cerebral involvement in the cognitive functioning of bilinguals. *Brain and Language, 8*, 92–110.
Van Lancker, D., & Fromkin, V. (1978). Cerebral dominance for pitch contrasts in tone language speakers in musically untrained and trained English speakers. *Journal of Phonetics, 6*, 19–23.
Weinrich, U. (1953). *Languages in contact*. New York: New York Linguistics Circle.
Whitaker, H. A. (1978). Bilingualism: A neurolinguistics perspective. In W. C. Ritchie (Ed.), *Second language acquisition and research: Issues and implications* (pp. 21–32). New York: Academic Press.
Zatorre, R. J. (1989). On the representation of multiple languages in the brain: Old problems and new directions. *Brain and Language, 36*, 127–147.