

# the cognitive consequences of bilingual education in northern Belize

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Identifying the effects of the bilingual experience on individual cognitive functioning has proven to be one of the most difficult tasks in the study of bilingualism. Early theoretical and empirical work suggested that bilinguals suffer a profound handicap in general intellectual functioning (for example, Jones and Stewart 1951). This general deficit approach dominated the study of bilingualism up to the early 1960s. Since 1962, Wallace Lambert and his associates have been studying French-English and English-French bilingualism within the context of a theoretical approach that suggests that the bilingual experience yields highly differentiated, stable cognitive structures (Peal and Lambert 1962; Lambert and Anisfeld 1969; Lambert and Tucker 1972; Lambert 1974, 1977). More recently Ben-Zeev (1972, 1975, 1977) has attempted to specify the ways in which bilingualism affects intellectual functioning, by focusing upon the impact of bilingualism on language-learning strategies.

This paper examines the impact of Spanish-English bilingualism upon the cognitive functioning of fifty-six children in Corozal Town, Belize, Central America.<sup>1</sup> The emphasis of this study differs from that in the work of Ben-Zeev and Lambert in that the effects of the bilingual experience are viewed as primarily dependent on the structure of the situation in which the second language (L<sub>2</sub>) is acquired. As such, it may be seen as an adjunct to the lines of investigation developed in their work.

Many aspects of the environment, ranging from variations in sociolinguistic rules in the speech community to differences in opportunities for structured language training, may have an impact on the nature of L<sub>2</sub> acquisition. This paper examines the effects of only a small number of these, and this limitation should be kept in mind. The next section of the paper presents a brief sketch of education in Corozal Town. Both institutional and noninstitutional variation is described and related to language learning. A second section describes the methods, measures, and sample used in the study. A third section presents the formal data collected during the research. A final section discusses these data in light of the environmental conditions described in the first section of the paper. It is useful, however, to characterize the main findings of the study at the outset. Briefly, the data from Northern Belize suggest that when L<sub>2</sub> is acquired in a highly stressful environment, predictable depressions occur in the complexity of the organization of semantic knowledge in L<sub>2</sub>.

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*Interest in the consequences of bilingualism has been long standing in anthropology and psychology. Recent work has emphasized the value of bilingualism and reported that the experience yields highly differentiated, stable cognitive structures. This paper argues that the effects of the bilingual experience are in large measure situation specific. Using data from Belize, Central America, it shows that bilingualism acquired in a stressful environment results in predictable decrements in the patterning of semantic knowledge.*

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## education in Corozal Town

Belize (formerly British Honduras) is a small British colony on the eastern coast of the Central American isthmus, bordered on the north by Mexico and on the west and south by Guatemala. Schooling in Belize has historically been associated with church activities. The earliest schools were established under the auspices of churches, although some received public support in addition. From this beginning, a system of dual church and government control of education developed and continues to exist today (Ashcraft and Grant 1968; Dobson 1973). This system of dual control has resulted in the uneven development of the schools of different denominations (Ashcraft and Grant 1968; Rubinstein 1976), and has been the focus of criticism in several special reports on education in the colony (Easter 1935; Dixon 1936; UNESCO 1964). Due to the peculiar settlement history of Belize, differences in religious affiliation largely correspond to ethnic distinctions recognized within the colony (Dobson 1973; Waddell 1961; Bolland 1977). These ethnic distinctions, in turn, correspond in important ways to differences in language usage throughout the colony.<sup>2</sup>

**institutional variation** All schools in Corozal Town are affiliated with churches. In 1975–1976, five primary schools (maintained by the Adventist, Anglican, Methodist, Nazarene, and Roman Catholic churches) and two secondary schools (one Methodist, the other Roman Catholic) served the community. School attendance is compulsory for children between the ages of six and fourteen. However, because the schools in Corozal reflect the general patterns of church-school development noted above, there is some variation in the quality of educational resources to which children have access during their schooling. This is due principally to variation in the physical plant of each school, to differences in the relative percentage of trained teachers on each school's faculty, and to the availability of teaching supplies and resources (Rubinstein 1976, 1978).

The language of the classroom is not, however, a factor that shows such variation. In large part, this is due to a ruling of the Ministry of Education making English the only allowable language of instruction in Belizean schools. Young (1973:285–295) discusses some of the difficulties that this creates for education in Belize City, an area of the colony where children are most likely to bring a knowledge of Belize Creole to the classroom. The situation is particularly difficult in Corozal Town, where the majority of the population speaks Spanish. The problem is compounded by the general evaluation of Spanish as the “best,” “most useful” language by most members of the community. Thus, there is a sharp distinction between the linguistic world of the school and that of the community. Any hope that continuity between the two realms of the children's experience can be established by having the teachers act as a bridge between them is unfounded. This is so because schools in Corozal Town are staffed by faculties that are predominantly non-Spanish speaking. In answer to questions in a structured interview, only 3 percent of teachers in Corozal indicated that they had any command of Spanish, and only 2 percent reported ever using Spanish in the classroom (however, 70 percent reported using Belize Creole). This was despite the fact that 50 percent said that they thought Spanish to be the most useful language in Corozal. Thus, for the Spanish-speaking child in Corozal, it is generally the case that the linguistic skills and abilities developed prior to entering school and highly prized in day-to-day life are devalued and actively discouraged in the classroom.<sup>3</sup>

In addition to the discontinuity between school and home language environments created by national language policies, instructional strategies used in the schools tend to exacerbate, rather than correct, the problem. Language instruction is often by means of repetition and rote learning. Rather than examining the rules underlying particular

language patterns or explicating particular paradigms in English with the students, lessons proceed through mimicry (compare Young 1973; Labov 1970). A brief excerpt from classroom observation notes illustrates this:

The students in standard 5 (seventh grade) turn to face the teacher by sitting on their desks.

Teacher says: Tigers kill  
Class responds: Tiger kills  
T: Cats eat  
C: Cat eats  
T: Ladies smile  
C: Lady smiles  
T: Choirs sing  
C: Choir sings  
T: Ministers preach  
C: Minister preaches  
T: Teachers teach  
C: Teacher teaches  
T: Lions roar  
T: Lion roars

(This exercise continues for five minutes.)

Reading, too, is most frequently conducted in groups, the teacher providing a model of the material and then observing for “word control,” the proper pronunciation of words from the lesson. It is not unusual to see a teacher provide a reading group with a model and then leave them to repeat the “reading” again and again while he/she attends to another group of students.

Young (1973:287–294) discusses the debilitating effects of this type of English language instruction for the Belizean Creole-speaking child, suggesting a number of remedies. Clearly, the situation is no better, and is perhaps much worse, for the Spanish-speaking child in school in Corozal Town. There are at least two reasons why this situation proves debilitating for the mestizo child. First, the child is likely to be classed as slow or lazy in school if he/she fails to keep apace of his/her classmates in the acquisition of English language skills. This classification carries with it a whole range of implications: the child’s belief in the importance of his/her efforts vis-à-vis the school environment and his/her self-evaluation may ultimately result in school failure or school leaving. Second, for those students who do stay in school through standard 6 (eighth grade), the real control they are able to exercise over English is often minimal and quickly lost. One adult female informant, who could not speak English at the age of fifteen, explained: “well, you could be 15 and just getting out of standard 5 or 6 and not understand English because you only learned to parrot it. You ‘read’ in English after the teachers.”<sup>4</sup>

Before turning to an examination of the sociolinguistic impact of some noninstitutional aspects of education in Corozal Town, it is useful to consider briefly the growing importance of schooling for life in Belize in general. For a major portion of its history, life in Belize centered on the extraction of timber—first logwood, then mahogany—from the interior of the colony. Together with the vicissitudes of small-scale farming, the seasonal nature of timber extraction served to establish a pattern that dominated life in Belize well into the twentieth century (Ashcraft 1973). This pattern included, among other things, high rates of school absenteeism during certain times of the year. With the increasing movement toward independence, the decreasing isolation of the colony from its neighbors in the Caribbean and Latin America, and the active attempts of the government to encourage large-scale agricultural enterprises and manufacturing programs, formal education is becoming more important in the colony. The advantages that are assumed to accompany education, and the note accorded those people who pursue postgraduate work are all recognized in the community. As a result, parents often encourage their children to attend

elementary school, and many even urge them to attend college (high school) in situations where not long ago absenteeism would have been common. These general attitudes about education are often communicated to children at a surprisingly early point in their schooling. For many, this appears to create a "high pressure" environment where both internal and external evaluations suggest that success in later life is dependent on success in school.

**noninstitutional variation** There are several aspects of life outside school, too, that have an important influence on language learning in Corozal Town. Among these, two are of particular consequence. First, although children are not constrained by national language policies or instructional strategies outside school, English is still the language associated with the politically, socially, and economically dominant groups in the colony. And even when Spanish is thought of as the "best" language within the community, it is recognized that access to the broader political, social, and economic structures of the colony is dependent upon having some facility in English. What has resulted from this contact situation is the creation of a kind of "pidgin," in which many English forms are imposed on a Spanish base. The effect of this development is seen in the syntactic and lexical components of the Spanish spoken in Corozal Town.

Sentences (1), (2), and (3) show the most common forms in which lexical substitution occurs.

- |                        |                       |
|------------------------|-----------------------|
| 1) Tu estas light boy. | (= "You are dumb")    |
| 2) Haces sewing.       | (= "You are sewing")  |
| 3) ¿Hay steak?         | (= "Is there steak?") |

Sentence (1) illustrates the inclusion of a Creole idiom in a Spanish utterance; (2) the formation of the verbal particle by combining "hacer" and an English verb; and (3) the simple substitution of an English word in lieu of its Spanish equivalent. On the syntactic level the most frequently observed indication of the influence of English on Spanish is the inversion of the standard noun-adjective order of Spanish, as in sentence (4) below, to the order in sentence (5).

- |                              |                                  |
|------------------------------|----------------------------------|
| (4) ¿Hay fosforos colorados? | (= "Are there colored matches?") |
| (5) ¿Hay colorados fosforos? | (= "Are there colored matches?") |

When children are exposed to "English" outside school, it is usually to this "pidgin" or to Belizean Creole. Rather than providing them with an opportunity for exposure to a broader corpus of English materials, this experience tends to muddle the already small sample of standard English to which they have been exposed in school.

Second, observation of patterns of interaction in the community shows, in general, that there is a high correlation between persons' inclusion in social networks and their linguistic abilities. Indeed, group formation in the schools tends to conform to this general pattern. During any recess period, schoolchildren can be seen congregating in groups the members of which are predominantly from the same ethnic/linguistic background. During these periods, predominantly mestizo groups speak in Spanish, while their creole counterparts converse in Belizean Creole.

Sociometric data collected from children between the ages of nine and twelve, in standards three through six of the primary schools, indicate that there is a very high tendency for children to pick individuals whose first language is the same as their own for friends (see Table 1). This suggests that children in Corozal Town are likely to be involved in linguistically homogeneous peer groups, both in and out of school.

As Labov (1970; Labov et al. 1968) has shown, the linguistic patterns and norms of a child's preadolescent peer group, more than any other aspect of his/her environment, af-

Table 1. Relationship of language to choice of friends among children aged 9–12 in Corozal Town.

First language of respondent	First language of person chosen	
	Spanish	Creole
Spanish	76	34
Creole	42	126
$N = 278; \lambda = .72; \chi^2 = 51.1; p < .001$		

fect the pattern of language usage that the child ultimately maintains. Thus, the formation of linguistically homogeneous peer groups among children in Corozal Town can be expected to have significant impact on language development there. This is indeed the case, and it is particularly through the norms attendant to English speaking that this occurs.

Among children in mestizo groups, there is a tension between the recognition of the importance of English for colony-wide socioeconomic purposes and the high valuation of Spanish in the context of the day-to-day life of the community. Because identification as a group member rests in large part on the use of Spanish outside school, and because many mestizos control some Belizean Creole, which serves as the lingua franca in most of the rest of the colony, it is usually the case that the use of English is frowned upon in mestizo groups. The unusual mestizo child who uses English outside the school often reports that this behavior is negatively sanctioned, either explicitly or implicitly, by his/her peers. The following conversation is typical:

- Child: You know, around my friends if, well, I try to speak English they laugh at me or something like that, you see.
- Researcher: They laugh at you? Well . . . why would they laugh at you?
- C: Because sometimes I try, you know, to progress in your English like that. Suppose you use some vocabulary word, then they always laugh and say if you know the meaning of it and make a lot of jokes come out.

Because English instruction in the schools tends to emphasize rote memorization, the opportunities open to mestizo children for discovering underlying patterns in the language are largely restricted to those times outside school when they can experiment with the English materials to which they have been exposed. Such experimentation, a natural part of normal first and second language acquisition (Hakuta and Cancino 1977), is discouraged by the peer group, and the corpus of English upon which mestizo children might experiment is distorted by general sociolinguistic processes in the community. Thus, the discontinuity experienced by mestizo children between school and home language environments is widened.

## materials and methods

In order to explore the effects of the educational and sociolinguistic environment in Corozal Town on L<sub>2</sub> acquisition more fully, and to examine the relationship between linguistic and nonlinguistic development in this context, ethnographic fieldwork was supplemented by the administration of two psychological and linguistic instruments to children during the school year. This section of the paper describes the sample and instruments used in this part of the study. The following section reports the data gathered by these techniques.

**characteristics and representatives of research sample** A sample of Spanish-speaking children ( $N = 56$ ), between the ages of five and seventeen, stratified by sex, was selected using a table of random numbers from a complete listing of all children attending primary and secondary schools in Corozal Town. This sample was then randomly divided into two subsamples, each of which was stratified by age and sex. Subsample 1 consists of twenty-eight children who were interviewed and tested in Spanish, while Subsample 2 consists of twenty-eight children who were interviewed and tested in English.

As indicated earlier, education at the primary school level is compulsory throughout Belize. The official estimate of the school-aged children who actually attend school is 95 percent. This figure seems to be a fairly reliable estimate of the percentage of school-aged children in Corozal Town who actually attend primary school. As a result, the sample can be considered quite representative of the general mestizo population between the ages of five and fourteen.

The upper portion of the sample (ages fifteen to seventeen) must be considered less representative than the lower portion because it is drawn only from those mestizo children attending secondary school in Corozal Town. This limitation is introduced by the fact that the selection of children for entrance into secondary school reduces the number of children in the school population by about 85 percent (see Rubinstein 1978). Thus, including children from the secondary school population in the sample (even though the selection process is random) results in drawing the upper portion of the sample from a population that is already skewed (presumably) in the direction of greater facility with "abstract" thought.

The reliability of the sample, therefore, needs to be understood as being relative to the purposes for which the data developed from it are to be put. As a basis of generalization for mestizo population in Corozal Town, only the lower portion of the research sample may be considered representative. For general theoretical purposes, as in a discussion of the relation of nonverbal cognitive development to the acquisition of referential semantics, however, both the upper and lower portions of the research sample may be considered useful.

**psychological and linguistic measures** The general theoretical orientation of the present study is cognitive-developmental, and, when dealing with the growth of nonverbal intelligence, the approach taken is explicitly Piagetian in nature. This view of cognitive growth sees intellectual development beginning at a stage of undifferentiated globality and passing through an invariant sequence of progressively more complex stages of thought to the highly abstract "formal operation" stage. Piaget has proposed that this progression—sensorimotor intelligence, to preoperational thought, to concrete operational thought, and finally to formal operational thought (see Flavell [1963] and Furth [1969] for complete descriptions of each of these stages, and of the Piagetian system as a whole)—in the growth of intelligence is a human universal.

Recently, the universality of the development of these qualitative stages of thought has been challenged on the grounds that it is an essentially Western construct and that not all people reach the level of formal operational thought (see especially Greenfield 1976; Buck-Morss 1975). Indeed, the cross-cultural literature suggests that not all people reach formal operational thought, and Piaget (1972) has himself revised his position to allow for this possibility. Nonetheless, cross-cultural work has shown that much of the Piagetian position is useful for the analysis of the growth of analytic reasoning (see Dasen 1972, 1977 for excellent critical reviews of this literature), especially in areas where children are extensively exposed to formal, Western-style education. As a result, it forms a useful approach to the study of nonverbal intellectual development in Northern Belize, where, as I have said, schooling is compulsory between the ages of six and fourteen.<sup>5</sup>

For purposes of this study, the *Feldman Colored Blocks Test of Basic Cognitive Level* (CBT) was used to assess the Piagetian level of nonverbal cognitive development at which a child was functioning, and the *Semantic Strategies Test* (SST) was used to determine the complexity of an individual's organization of referential semantics. Both of these measures are described in detail elsewhere and will only be briefly characterized here.

**CBT** Feldman (1974; Feldman and Stone 1978; Feldman et al. 1974) reports on the development and reliability of a test of nonverbal cognitive development designed to be a useful research tool in a variety of cultural settings. Introduced to the child as a "learning game," the CBT is designed to be as free as possible from dependence on verbal instructions. Because the test is designed so that the child receives a minimal amount of information concerning wrong answers and because differential reinforcement for correct and incorrect responses is disallowed in the administration procedure, young children experience very low levels of frustration with the test (Feldman 1974:3-4).

Materials for the CBT include a set of thirty-two wood blocks (four red squares, four red circles, four red triangles, four red diamonds, four yellow squares, four yellow circles, four yellow triangles, and four yellow diamonds), one set for the tester and one for the child, and a series of cards that the tester uses in combination with the blocks to generate problems for the child to answer with his/her blocks. During the third section of the test, a series of twelve half-inch cubes, which act as logical operators, are introduced (these are three each of red, yellow, green, and blue cubes).

The CBT is administered with the tester and the child seated side by side and proceeds through a series of sections designed to tap increasingly more complex and advanced cognitive skills. The CBT is divided into two parts. The first part, consisting of the sort and the first six sections of the test, can be used to assess the basic abilities described by the Piagetian stages of the ontogenesis of human cognition. The sort is used to ascertain that the child recognizes the critical dimensions of his/her set of blocks. As Feldman (1974:2-3) states,

the sections can be characterized as requiring: (1) operations with actual objects (colored blocks), (2) operations on stimulus dimensions (coordinating the blocks into a  $2 \times 2$  array of colors and shapes), (3) simple operations on the relationship among blocks (learning a rule concerning changing the color or shape relationship of a pair of blocks from same to different), (4) operating on one relationship between two blocks (e.g., color) while holding constant a second relationship (e.g., shape), and (5) combining these operations (Feldman 1974:2-3).

The second part of the CBT is "designed to assess the extent to which a subject could generalize the basic skills he has shown to slightly different contexts" (Feldman 1974:2). This second part of the test is not necessary for stage level assessment and is not reported on here.

**SST** The SST is an open-ended testing procedure used to assess the complexity of the strategies an individual uses to organize referential semantic knowledge. Data derived from the test are scored into a set of categories that represent strategies of increasing complexity for approaching the organization of semantic knowledge. Rubinstein (1976) provides a detailed description of the materials and administration procedures for the SST and presents a discussion of the theoretical tradition in which the SST is grounded.

Materials for the SST consist of a series of sixty-four color pictures of items from several domains, each on a  $3 \times 5$  inch card.

Divided into three sections, the SST is administered in the following order: section 1, naming task; section 2, triads test; section 3, spontaneous sort. During the naming task forty-eight of the illustrations are shown to the child for identification. The naming task serves to introduce the child to the medium of the test and allows the identification of the

child's lexical labels for each card. During this task the researcher separates out twenty pre-selected cards to be used in section three of the test and places them face down out of the child's field of vision.

During the second section of the test, the remaining sixteen cards are displayed for the child in a series of ten triads. As each triad is presented, the child is asked to identify each item and then to indicate which two items go together best. The child's reasons for grouping the two items are recorded and scored later.

The third section of the SST consists of a spontaneous sorting task. The child is presented with the twenty cards removed from the original pack of forty-eight presented during the first section of the test. The child is asked to sort the cards into as many groups and sub-groups as he/she wishes. After the child has completed sorting the cards, the researcher elicits explanations for the inclusion of the items together in the group. These explanations are recorded and analyzed later.

Scoring of the SST requires that the observed organizational strategies be scored into one of the four following categories: (1) global strategies, (2) concrete strategies, (3) functional strategies, and (4) abstract strategies. These may be illustrated by looking at one triad from the SST. If we consider triad 5 and take some responses to it as exemplars, the relative complexity of the strategies from each category may be illustrated. Triad 5 presents the child with the pictures of a bird's nest, a broom, and a house and asks that he/she group the two which go together best, and that he/she explain the grouping.

A *global strategy* for grouping of these items together is manifest in a response of the following type.

- Researcher: Which one goes best?
- Child: None goes best.
- R: Why not?
- C: They are all equals; they are all the same.

A response pattern of this type characterizes the response of an individual who only makes gross distinctions between things in his/her environment. The major functional distinction upon which the individual rests his/her organization of semantic materials is an "I" versus "It" distinction (compare Schroder, Driver, and Streufert 1967). This gross distinction, introduced by the recognition of self as an object with its own structural integrity distinct from other objects in the child's physical world, is the first level of complexity used to organize semantics.

A *concrete strategy* response pattern for this triad might have the form of the following sequence.

- R: Which two go together best?
- C: The broom and the nest.
- R: Why do the broom and the nest go together best?
- C: Because they are both made from straw.

In this response sequence, the distinction operationalized for the organization of the linguistic material rests on the physical, or concrete, characteristics of the items under consideration. Thus, the items are grouped together, as in the case presented above, because they are made of the same material, are the same color, have the same shape, and the like.

A response pattern characteristic of a *functional strategy* in the organization of semantic knowledge might take the form of the following sequence.

- R: Which two go together best?
- C: These two, the house and the broom.
- R: Why is that?
- C: The broom is used to sweep the house.

The distinctions used to group items in the above response sequence rest on the establish-



ment of a functional relationship (either real or imagined) between the items that are placed in the same set. Thus, in the case above, the broom functions on the house.

*Abstract strategies* displayed in response to the presentation of triad 5 can be represented by the following sequence.

- R: Which two go together best?
- C: The nest and the house.
- R: Why do the nest and the house go together?
- C: Because they are both places to live; birds live in this and people live in this.

In this response the child has utilized an abstract criterion for partitioning the items displayed in the triad. Although concrete in that the child identified both the house and the nest as places, the overriding criterion for the partitioning is, however, the conceptual category of a domicile.

The entire SST is open ended, and no time limits are placed on the subject. At no point in the administration of the SST is there differential reinforcement given to subjects based on the complexity or lack of complexity of their sorting strategies. The summary score for the SST is obtained by averaging the mean score on the triads section with the mean score on the spontaneous sort section.

**appropriateness of measures** A consistent difficulty in the cross-cultural study of psychological and linguistic development has been the construction of culturally appropriate, reliable research instruments (for example, Cole et al. 1971). Simply put, if the data they produce are to be useful, we must be able to show for any research instrument that it measures the phenomenon of concern, and that the people to whom it is administered understand at least in a general way the tasks that the instrument asks them to perform. The ability of the CBT and SST to provide information about particular aspects of human intellectual development has been discussed at length elsewhere (see Feldman et al. 1974; Rubinstein 1976). Here, therefore, I shall only briefly discuss some aspects of schooling in Corozal, of the CBT, and of the SST that tended to ensure that the measures were not differently interpreted by the researcher and the informants.

All of the children to whom the CBT and SST were administered attended primary or secondary school in Corozal Town. During the course of their school careers, children in Corozal are periodically examined by their teachers (for both aptitude and achievement) to determine their class standing. These examinations are usually similar to academic tests administered in the United States. Indeed, at several times during the study, teachers were seen to draw class exams from locally available copies of standardized tests and textbooks from the United States and Canada (for example, *Barron's How to Prepare for High School Entrance Examinations* [Peters et al. 1972]). Because of these testing experiences, the children in the research sample seemed to be fully aware of the situational requirements of the interview/testing session. In addition, before being released from class to participate in the interview, pupils were often instructed by their teachers that the researcher would be testing them, and that they should do the best that they could on the tests they would be given.

Aside from these features of schooling in Corozal Town, compatibility of researcher and informant definitions of the tasks involved in the CBT and SST interview was ensured by aspects of each of the measures. As has already been noted, the initial sections of the CBT consist of a series of questions designed to check whether or not the individual being tested was attending to the distinctions necessary to complete the tests items; each series of test items is preceded by one or more training items. Any individual who failed to complete the initial, orienting sections of the CBT successfully (and thus indicated that they were not making the appropriate distinctions) was automatically disqualified from further testing. As

a result, only those children who recognized both the critical dimensions of the test materials and the evaluative nature of the interview were tested. (But no child had to be disqualified because he/she failed to be successful on the orientating of the CBT.)

As for the SST, the test is designed so that the researcher is made aware of the processes underlying the subject's construction of the meaning of the test. The SST is concerned with the examination of the processes used by children to respond to the questions it poses, rather than simply with the answers themselves. Thus, the SST avoids the problem, noted by Mehan (1978:51), of making "decisions about students on the basis of product measures that do not reveal the way in which these products are constructed." In short, both the CBT and SST were appropriate for use in the research setting.

## nonverbal cognitive development and the acquisition of semantic knowledge in L<sub>1</sub> and L<sub>2</sub>

The data derived from the CBT and SST are presented in this section of the paper. First, the data on nonverbal cognitive development are presented. Next, the data on the acquisition of semantic knowledge in L<sub>1</sub> and L<sub>2</sub> are presented.

**nonverbal cognitive development** The CBT data from both of the subsamples show interesting and significant patterning. The data from each subsample are first presented individually, then the data from each subsample are related to the data from the other subsample, and the overall patterning of the data is discussed.

**subsample 1: Spanish-Spanish** The results of the CBT for subsample 1 (see Table 2) reveal a strong positive relationship between age and level of nonverbal cognitive functioning ( $r = .836$   $p < .001$ ). The broad range of ages represented in the subsample has resulted in a fairly even distribution of individuals between preoperational, concrete operational, and formal operational thought. Thus, 32 percent of the sample shows preoperational thought, 39 percent shows concrete operational thought, and 29 percent shows formal operational thought. The data also clearly show the emergence of these three levels of nonverbal cognitive functioning in the order predicted by Piagetian theory. In addition, the

Table 2. Relationship between level of nonverbal cognitive development and age: Spanish-speaking children tested in Spanish.

Age	Level of nonverbal cognitive development			
	Preconceptual	Preoperational Intuitive	Concrete operational	Formal operational
5	2	—	—	—
6	2	—	—	—
7	—	1	1	—
8	—	2	—	—
9	—	2	—	—
10	—	—	3	—
11	—	—	2	—
12	—	—	1	1
13	—	—	1	2
14	—	—	1	1
15	—	—	1	1
16	—	—	—	2
17	—	—	1	1

$N = 28$      $r = .836$      $p < .001$

data from subsample 1 suggest the occurrence of an abrupt shift from preoperational thought to concrete operational thought at around nine years of age among children in Corozal Town. A similar, though less pronounced, shift seems to occur around thirteen years of age from concrete operational to formal operational thought.

**subsample 2: Spanish-English** Inspection of the results of the CBT for subsample 2 (see Table 3) reveals much the same patterning as for subsample 1. Subsample 2 shows a strong positive relationship between age and level of nonverbal cognitive development ( $r = .945$   $p < .001$ ). The distribution of the data vis-à-vis level of nonverbal cognitive development is adequate to show the ordering of the stages, but it lacks the kind of “center of gravity” observable in subsample 1, 46 percent of the subsample showing preoperational thought, 21 percent showing concrete operational thought, and 32 percent showing formal operational thought. In subsample 2, the shift from preoperational thought to concrete operational thought occurs at about ten years of age, and the shift from concrete operational thought to formal operational thought occurs at about thirteen years of age.

**the subsamples compared** Intersubsample comparisons were made to determine the statistical significance of the observed variation in the distribution of individuals between the three levels of nonverbal cognitive functioning in the data collected from children tested in their L<sub>1</sub> and children tested in their L<sub>2</sub>. Statistical tests reveal no significant differences in the patterning of data from subsample 1 and subsample 2 ( $D = .146$   $p > .05$ ). Hence, it is legitimate to neglect the differences in “center of gravity” and “age of shift” and consider the data from the two subsamples as derived from a single sampling unit with respect to nonverbal cognitive development among mestizos in Corozal Town.<sup>6</sup>

**the acquisition of semantic knowledge** The data from the two subsamples are presented here to illuminate the relationship between nonverbal cognitive development and the development of language, particularly the acquisition of semantic knowledge. This is done by relating the data on semantic strategies, collected using the SST, to the previously discussed CBT data.

Table 3. Relationship between level of nonverbal cognitive development and age: Spanish-speaking children tested in English.

Age	Level of nonverbal cognitive development			
	Preconceptual	Preoperational Intuitive	Concrete operational	Formal operational
5	2	—	—	—
6	2	—	—	—
7	—	2	—	—
8	—	2	—	—
9	—	3	—	—
10	—	2	1	—
11	—	—	2	—
12	—	—	2	—
13	—	—	1	1
14	—	—	—	2
15	—	—	—	2
16	—	—	—	2
17	—	—	—	2

$N = 28$      $r = .945$      $p < .001$

**semantic development in L<sub>1</sub>** Inspection of the data from subsample 1 (see Table 4) shows that 25 percent of the subsample employs abstract strategies, 43 percent uses functional strategies, 23 percent employs concrete strategies, and no one in the subsample uses global strategies to organize semantic information. The patterning of these SST data in relation to the CBT materials for subsample 1 is clear. There is a strong association ( $r = .960$   $p < .001$ ) between preoperational thought and the use of concrete strategies to organize semantic knowledge, between concrete operational thought and the use of functional semantic strategies, and between formal operational thought and the use of abstract strategies.

These data suggest that during first language acquisition there are some identifiable ways in which nonverbal cognitive development forms the necessary infrastructure upon which linguistic (or at least semantic) structures are based and from which linguistic structures are elaborated.<sup>7</sup> Specifically, the data show that semantic knowledge is not organized in ways superior to those shown in nonverbal cognitive performance. Thus, the employed semantic strategies may mirror the information-processing capacities of the stage of nonverbal operational thought at which a person functions (see Schroder, Driver, and Streufert 1967; Flavell 1963), or they may show characteristics of earlier stages of nonverbal cognitive development, but they appear never to reflect more highly structured information-processing capacities than have been obtained in nonverbal cognitive functioning.

**semantic development in L<sub>2</sub>** The SST data for subsample 2 (see Table 5) show that about 45 percent of the children tested in L<sub>2</sub> use global strategies, 22 percent use concrete strategies, 22 percent use functional strategies, and 11 percent use abstract strategies to organize semantic knowledge. Again, there is a clear relationship between the SST data and the CBT data ( $r = .914$   $p < .001$ ). For the L<sub>2</sub> subsample, however, the patterning of CBT-SST correspondence is very different from the patterning of the data from the L<sub>1</sub> subsample. In L<sub>2</sub> there is a strong association between preoperational thought and global semantic strategies, between concrete operational thought and concrete semantic strategies, and between formal operational thought and functional and abstract semantic strategies. Comparison of the data patterning shows a statistically significant difference ( $D = .446$   $p < .01$ ) in the distribution of the data from the L<sub>1</sub> and L<sub>2</sub> subsamples across semantic strategies. This difference may be characterized by noting that, in comparison to the L<sub>1</sub> data, the L<sub>2</sub> data are skewed toward lower levels of structural complexity.

The remainder of this paper considers a process that may underlie this skewing and discusses why these data appear to be inconsistent with some earlier work on L<sub>2</sub> acquisition.

Table 4. Relationship of semantic strategy to level of nonverbal cognitive development: Spanish-speaking children tested in Spanish.

Level of nonverbal cognitive development	Semantic strategy			
	Global	Concrete	Functional	Abstract
Preoperational	—	9	—	—
Concrete operational	—	—	11	—
Formal operational	—	—	1	7

$N = 28$      $r = .960$      $p < .001$

Table 5. Relationship of semantic strategy to level of nonverbal cognitive development: Spanish-speaking children tested in English.

Level of nonverbal cognitive development	Semantic strategy			
	Global	Concrete	Functional	Abstract
Preoperational	12	1	—	—
Concrete operational	—	5	—	—
Formal operational	—	—	6	3

$N = 27$      $r = .914$      $p < .001$

## environment and cognitive functioning

Cognitive development is an interactive process (Piaget 1971). In order for development to proceed, the physical and social environments must offer minimally adequate amounts of stimulation to the individual. Deficits in the environment may result in the retardation of cognitive development. It is relatively easy to conceptualize this process when the deficit is caused by a lack of complexity in the structure of the environment; as, for example, when retardation of cognitive development is due to an insufficient nutritional base (compare Greene 1977). The process is more difficult to conceptualize, perhaps because of its counterintuitive nature, when the deficit is due to the environment's being complex in the extreme. The data from the present study contribute to an expanded understanding of this latter type of environmental deficit.

**environmental stress and cognitive development** The complexity of an environment depends on a number of variables, acting alone or in combination with each other. For instance, an environment may be more or less complex depending on the amount of redundancy and informational diversity incorporated into its structure (Garner 1962, 1974), the intensity of environmental stimuli (Saltz 1971; Neisser 1967), the possible positive or negative outcomes for the individual (McManus 1979), and the threat or uncertainty that the environment holds for the individual (Schroder and Suefeld 1971).

Schroder and his associates (Schroder, Driver, and Streufert 1967; Schroder and Suefeld 1971; Schroder 1971; also McManus 1979) have shown that there is a relationship between environmental complexity, an individual's level of cognitive structuring, and his/her ability to handle the environmental complexity. They have suggested that this relationship can be adequately represented by an inverted U-curve. The U-Curve Hypothesis, as they call it (Schroder, Driver, and Streufert 1967), suggests that as the complexity of the environment increases, the capacity of an individual to deal with the environment increases to an optimal point. After this point is reached, the individual's information-processing ability, vis-à-vis the environmental complexity, decreases as the complexity of the environment continues to increase. In addition, Schroder, Driver, and Streufert (1967) have shown that the amount of environmental complexity an individual can handle before reaching his/her point of diminishing information-processing capacity is determined by the complexity of his/her cognitive structuring; higher levels of structuring are capable of handling greater environmental complexity.

When the environment exhibits greater complexity than an individual can optimally handle, we can speak of the environment being noxious, stressful, or deficient in relation to the individual's cognitive development. Moreover, at the point where the environment becomes stressful for an individual, the integrity of their cognitive structures is en-

dangered. This is because the system becomes functionally inoperative, its adaptive capability is reduced to a minimum, and its ability to cohere as a structural unit is threatened by external pressures (Tart 1975; McManus 1979).

Because any cognitive system will have a tolerance limit beyond which it cannot maintain itself, even complex systems will experience disintegration or collapse under stressful conditions. This systemic collapse will involve the progressive disintegration of an individual's cognitive structures so that their functioning approximates the functioning of lower levels of structural organization (Schroder, Driver, and Streufert 1967; Laughlin and d'Aquili 1974; McManus 1979; Laughlin and Brady 1978). If the stressful conditions within the environment are intense or prolonged, the individual's cognitive system may experience systemic collapse to the point where its functioning approximates the relatively unstructured functioning of the sensorimotor period.

Stress may be general or limited to a specific aspect of an individual's environment (Laughlin and d'Aquili 1974; Tart 1975). In situations where stress is limited to a particular aspect of the environment, the attendant systemic collapse may be confined to the cognitive subsystem that deals, primarily, with that sector of the environment. Discussions of the effects of stress within an individual's linguistic environment have tended to focus on the resultant decrements in the individual's ability to store linguistic units, over both the short term and the long term (see Ervin-Tripp 1973; Saltz 1971; Neisser 1967). Perhaps because the structural basis of linguistic subsystems has been left largely unexplored, these shifts in storage ability have been treated as isolated responses to the stressful conditions in the linguistic environment (Rubinstein 1976). Data from the present study suggest, however, that these shifts may be the partial expression of more general systemic processes designed to maintain as much of the structural integrity of an individual's cognitive (sub)system as possible in the face of a continued or increasingly noxious environment.

**education, environmental stress, and L<sub>2</sub> acquisition in Corozal Town** If the skewing of the semantic data from the L<sub>2</sub> sample toward lower levels of structural complexity is to be accounted for by the notion of systemic collapse, those aspects of the environment that contribute to its noxiousness need to be identified.<sup>8</sup> In addition, it is important to understand why the results of the present study appear to be inconsistent with the findings of other studies of bilingual education (for example, Lambert 1977; Tremaine 1975).

Recent work on bilingual education suggests, in general, that cognitive and linguistic development is facilitated by the bilingual experience. Lambert (1974; Lambert and Tucker 1972) reports this to be the case for English-French bilingualism in the St. Lambert School in Canada, and Tremaine (1975) reports similar findings in her work with Canadian French-English bilinguals (see also Tenezakis 1975). In order to be able to compare and contrast their reports with the present study, a brief consideration of the environments from which their samples are drawn is necessary.

Tremaine (1975) suggests that just as the syntax used by children in the concrete operational category is qualitatively different from the syntax used by children in the preoperational category during L<sub>1</sub> acquisition, so is the syntax qualitatively different during L<sub>2</sub> development. Thus, she argues for a certain equivalence between L<sub>1</sub> and L<sub>2</sub> acquisition, and her data show such a similarity. Under what circumstances does this equivalence occur? The children in Tremaine's sample are drawn from a population of schoolchildren who are participating in a highly structured program aimed at promoting French-English bilingualism. The nature of the learning environment in this case is likely to be highly supportive. In addition, her description of the program and the sample makes it clear that individuals who encountered difficulties with the program are excluded from the sample because they were "retracked" into less intensive bilingual instruction. As a result, only

children who are successful during L<sub>2</sub> acquisition are included in the sample. Because her sample is both skewed in favor of individuals with some facility for L<sub>2</sub> acquisition, and because the learning experience is highly structured and supportive, Tremaine's data might best be considered as providing information about the nature of L<sub>2</sub> acquisition and its relation to L<sub>1</sub> acquisition, when it occurs under particularly favorable conditions.

Similarly, the data from the St. Lambert School (Lambert and Tucker 1972) also reflect the nature of L<sub>2</sub> acquisition in an environment that facilitates bilingual development. This favorable environment is not only created by the use of French language immersion classes taught by experienced and developmentally sensitive instructors, but also results from the extremely careful design and management of classes within the school (see Lambert and Tucker 1972: appendix B). In addition, the program participants were selected from students whose home environments do not place a negative value on the second language (English) or harbor antagonistic feelings about the members of the group that uses English as its first language (compare Kjolseth 1977). Again, then, the positive relationship between L<sub>1</sub>, L<sub>2</sub>, and cognitive development found by Lambert and his associates must be seen, in part, as descriptive of bilingualism experienced under highly facilitating circumstances.

The environment in which mestizo children in Corozal Town learn English as their second language is, in contrast, debilitating. As is evident from the ethnographic sketch of education presented earlier, the learning environment is harsh indeed; this is so for a number of reasons. First, because the instructional techniques used in language teaching are insensitive to the children's need to be taught the rules underlying English in a systematic fashion, and because it is in school that children are primarily exposed to English during the school day, the children must function in an unstructured, diverse, and complex linguistic environment. Second, at the same time that the children find themselves confronting an environment that incorporates many new linguistic forms in an unstructured and alien fashion, they must also deal with the keen linguistic stimulation of the classroom. Third, schooling has a positive value within the community in general and is linked in the value system of the community to success in later life, even among children. Failure in school, then, is often stigmatized or viewed as carrying other highly negative outcomes for the child. Fourth, mestizo children learning English in a setting where their Spanish is ignored or devalued have a major aspect of their self-image (ethnic group identification) threatened. In short, for the mestizo child in Corozal Town the educational environment stresses the cognitive system in general, and the linguistic system in particular.<sup>9</sup> This stress results in the systematic depressions in the complexity of semantic organization observed in L<sub>2</sub>.

## **conclusion**

The impact of bilingualism upon individual cognitive functioning has been the focus of research for many decades. Recently, several studies have suggested that the bilingual experience facilitates language acquisition and cognitive development. This study presents data relating nonverbal cognitive development to the acquisition of semantic knowledge that suggest that this facilitation is not always the case. Consideration of the process underlying the lack of structural complexity in L<sub>2</sub> semantic organization among mestizo children in Corozal Town indicates that any attempt to understand the impact of bilingualism upon the individual must be sensitive to the environmental context in which L<sub>2</sub> is acquired. It suggests, in addition, that while bilingualism acquired in a supportive structured environment may indeed be highly beneficial, bilingualism acquired in a stressful environment may result in serious and predictable deficits in linguistic, and perhaps cognitive, functioning.

## notes

<sup>1</sup> This is an expanded version of a paper read in the symposium "Socialization/Enculturation in School Settings" at the annual meetings of the Southern Anthropological Society, April 12–15, 1978. I wish to thank William L. Ballard, Robert L. Blakely, Dell H. Hymes, Wallace E. Lambert, Charles D. Laughlin, Jr., H. Stephen Straight, and James M. Wallace for their thoughtful criticisms of an earlier draft of this paper. The data upon which this paper is based were collected during ethnographic field research conducted between July 1975 and June 1976. The support of this research by the Research Foundation of the State University of New York, and the Department of Anthropology, State University of New York at Binghamton, is gratefully acknowledged.

<sup>2</sup> The major ethnic groups in Belize and their linguistic affiliations are: (a) Creoles, people of African origin, usually the descendants of slaves brought to the colony by the British early in its history, whose first language is a creolized English, very similar to that spoken in Jamaica, called Belize Creole (Young 1973); (b) mestizos, persons of Hispanic origin, usually descendants of refugees from the Caste War of Yucatan, whose home language is Spanish; (c) Mayan Indians (Dobson 1973), Yucatecan in the north, Mopanero in the west, and Ketchi in the south, all of whom speak some dialect of Maya as their first language; and (d) black Caribs (*Garifuna*), mostly descendants of escaped slaves from the Windward Islands whose presence in Belize was first noted in the early 1800s. Their first language is Carib (Bolland 1977).

<sup>3</sup> This, of course, reports the predominant case. On occasion, children from Spanish-speaking families that have accepted the "official linguistic line" learn the importance and prestige that speaking English may secure elsewhere in the colony. Two notable cases of this type were observed during by fieldwork. In the first, one six-year-old from a Spanish-speaking family refused to respond when addressed in Spanish. This was despite his parents' indication that he did indeed comprehend them, and despite the fact that his siblings and parents spoke predominantly Spanish in their home (but not outside it). The second case is from informal conversation with an eight-year-old. The conversation went in part as follows:

Researcher: . . . y, que lenguajes hablas?  
Child: Inglés.  
R: Solo el inglés!? No puedes hablar español?  
C: No, solo inglés.

However, several of the schools expressly forbade their students to speak Spanish at any time during the school day, even during recess.

<sup>4</sup> The recent creation of a Curriculum Development Unit in the Ministry of Education, together with a growing awareness of the value of the diverse linguistic resources in the colony, provides a potential means through which this situation may be remedied.

<sup>5</sup> For a number of reasons I have only suggested the outlines of the controversy surrounding the application of Piagetian theory to non-Western cultures. First, a thorough review of this literature requires more space than is available here, and several excellent, extended, and up-to-date reviews are already available (for example, Dasen 1977). Second, while there is considerable critical discussion of Piaget's qualitative stages, the basic direction of development—from undifferentiated globality to highly differentiated thought—is generally accepted (compare Schroder, Driver, and Streufert 1967; Rubinstein 1976), as is Piaget's suggestion that development results from the interaction of the individual with the environment and the resultant equilibration of cognitive structure (Piaget 1977). Finally, while the instrument used to assess nonverbal cognitive development in this study provides a measure of Piagetian stage, it has also been shown to conform to standard non-Piagetian psychometric measures in a reliable fashion (Feldman et al. 1974; Feldman and Stone 1978).

<sup>6</sup> Although the CBT data show the emergence of levels of nonverbal cognition in the order predicted by Piagetian theory, it should be noted that there is a good deal of variance between the CBT data reported here and the presumed norms for the ages at which shifts from one developmental stage to the next occur. This situation is not unusual in cross-cultural Piagetian work (see Dasen 1972; Munroe and Munroe 1975). Much of the "developmental lag" observed in these data may be accounted for by the widespread occurrence of protein calorie malnutrition among children in Corozal Town (Lawrence 1972:28–31). In addition, the general environmental stress discussed below (and see Rubinstein 1976, 1978) may contribute to this overall "developmental lag."

<sup>7</sup> Additional evidence for the existence of these relationships during L<sub>1</sub> acquisition is provided by Rubinstein (1976). In a sample ( $N = 30$ ) of Belize Creole-speaking children between the ages of five and seventeen, 47 percent of the children were at the preoperational stage of nonverbal development and used concrete strategies; 27 percent were at the concrete operational stage of nonverbal cognitive development and used functional strategies; 3 percent were formal operational and used functional strategies; and 23 percent were formal operational and used abstract strategies.

<sup>8</sup> Actually, using the notion of systemic collapse to account for the skewing of the L<sub>2</sub> data toward



lower levels of structural complexity requires, in addition, that the growth of semantics be viewed as a structural, rather than an additive, process. This "structural elaboration" view of developmental semantics is developed in Rubinstein (1976).

<sup>9</sup> Lambert (personal communication) has suggested that this may be a case of "subtractive" bilingualism. It is important to note that the conditions surrounding the case examined here are different from those described by Lambert (1977) in his discussion of "additive" and "subtractive" bilingualism. This suggests that if these concepts are to play a useful role in the study of bilingualism, it will be necessary to distinguish among different types of "subtractive" bilingualism, to identify the processes underlying each, and to specify the environmental conditions under which each occurs.

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