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Semantic differences as a function of type of bilingual and cognitive development.

Ana Isabel Alvarez
University of Massachusetts Amherst

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Semantic Differences
as a Function of Type of Bilingual
and Cognitive Development

A Thesis Presented

By

Ana Isabel Alvarez

Submitted to the Graduate School of the
University of Massachusetts in partial
fulfillment of the requirements for the degree of

Master of Science

September

1976

Psychology

SEMANTIC DIFFERENCES AS A
FUNCTION OF TYPE OF BILINGUAL
AND COGNITIVE DEVELOPMENT

A Thesis

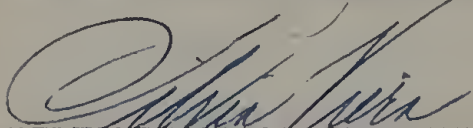
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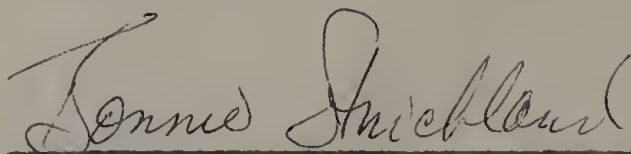
Dalton Jones, Chairperson of Committee



Silvia Viera, Member



Marvin Daehler, Member



Bonnie Strickland, Chairperson,
Psychology

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Dedication

A todos los que tienen fe en mí.

To all those who had faith in my potentialities.

Abstract

The present study attempted to determine the existence of variation in the cognition of semantic differences between two types of bilinguals. It also examined the effect of two different experiences of language acquisition in bilinguals (coordinate vs. compound) and the level of cognitive development in the cognition of semantic differences.

Coordinate and compound Spanish-speaking bilingual children were compared according to their responses to 20 Spanish target words that had two or more English corresponding meanings. Afterwards, the subjects responded to a Piagetian Conservation Test.

The results indicated that the Piagetian Conservation Test is an accurate tool to assess cognitive development for this sample. Furthermore, a measure of variability in cognition of semantic differences was obtained. Nevertheless, although those differences in response are not statistically significantly related to type of bilingual nor level of cognitive development, the coordinate bilinguals in the operational level vary more in their responses than the compound bilingual in the operational level. This suggests, as predicted, that differences in cognition of semantic differences are related to type of bilingual. Suggestions are made for a model of semantic processing which might account for these differences.

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Introduction

What is bilingualism?

In recent years an increasing amount of research interest has been focused on bilingualism as a psychological process (see reviews by Lambert, 1966; McNamara, 1967; Haugen, 1956). Previously, bilingualism was studied mainly by linguists. Today interest in bilingualism has expanded to include psychologists, sociologists, and educators, thereby, accounting for a much broader context for our understanding of the various contributions of social, cognitive, and developmental factors to bilingual processes.

There is considerable discrepancy in the definition of bilingualism. A monolingual possesses up to two encoding (conversion of meanings into signs) skills: speaking and writing; and two decoding (conversion of signs back into meanings) skills: listening and reading. For each of these skills there are semantic, syntactic, lexical and phonemic aspects. Bilingualism involves encoding and decoding skills for each language and plurilingualism, multilingualism or polyglotism involves these capacities in more than two languages (McNamara, 1967). The problem, for a cognitive or psycholinguistic model of bilingual processing, arises because not all bilinguals possess all four skills, or do not have the same mastery in all skills. This suggests that bi-

lingualism is a continuum, which varies among individuals along a whole variety of dimensions. For these reasons Haugen (1956) states that the term "bilingual" is a "cover term for people with a number of different language skills having in common only that they are not monolinguals."

The need to establish dimensions is evident. Haugen (1956) suggests two main dimensions: (1) the speaker's knowledge of each language and (2) language distance ¹. Nevertheless, there is a generally accepted notion of bilinguals as persons who have at least one of the language skills, even to a minimal degree, in their second language (McNamara, 1967).

The problem of who is bilingual and to what extent, generated a series of categories to qualify and classify bilingualism. The balanced-dominant person is one who is said to be equally skilled in all aspects of two languages. These are, as Fishman points out (1964), bilinguals without diglossia, in other words, bilinguals whose vocabulary is equally rich in both cultural contexts. But the terms "dominant" and/or "balanced" present some other difficulties. This system implies competition between the two languages, therefore limiting its descriptive applicability to the inclination to use one of the two languages where the two languages are equally suitable, and the tendency for the syntactic, phonological, semantic, and lexical systems of one

language to intrude on those of the other one (McNamara, 1967). The term degree of bilingualism is preferred, because it avoids these limitations by not implying either of these tendencies.

Rating scales have been used to determine language background. These instruments require the subject to estimate the extent to which each of his/her languages is used in his/her home. Although the reliability of those measures is quite high, it is not clear how accurately they describe linguistic background or how information about linguistic background can be used to predict language skills. Another form of self-rating scale used is for language skills. However, these scales are less powerful than richness-of-vocabulary tests (McNamara, 1967). In addition, fluency tests, which measure the speed of responding to verbal stimuli or speed of verbal production in two languages, have been used to diagnose degrees of bilingualism (Lambert, 1955). These time-measures correlate highly with years of experience in the two languages, however it remains to be seen how well they correlate with more direct measures of language skills (McNamara, 1967). The flexibility tests include: (1) richness-of-vocabulary test (McNamara, 1967) and (2) word detection test (Lambert, 1955). Both tests are based on the assumption that bilinguals seem to have far more ways to express a concept in their strong language than in their

weaker language. A dominance test is one in which a bilingual faces an ambiguous stimulus (which could belong to either of two languages) and is asked to pronounce or interpret it. It is assumed that the stronger language is the most frequently used (McNamara, 1967). Thus, all these assessment instruments classify bilinguals in the balance-dominant system ².

Coordinate vs. Compound Bilinguals

The second chief distinction among bilinguals is that between coordinate and compound bilinguals, originally created by Weinreich (1953) and further elaborated by Ervin and Osgood (1954). This distinction refers essentially to the semantic aspects of language and to the importance of language acquisition contexts. This construct points to the distinction in the way the two language systems of the bilingual interact: whether they are coordinated or compounded. The coordinate system would be developed through experience in different linguistic communities where languages are rarely interchanged. This system implies that the two languages are learned in linguistically distinctive acquisition contexts, as for example, when the second language is learned at some later, post-infancy period. The coordinate bilingual essentially makes use of two functionally independent language systems.

On the other hand, the compound system develops when

the two languages are learned originally in linguistically mixed acquisition contexts. In these fused contexts, a speaker uses both languages interchangeably to refer to the same environmental events, as is typical of infant bilingualism. The compound bilingual uses two functionally dependent linguistic systems. Ervin and Osgood (1954) suggest that the alternative meaning symbols in the compound's two languages have a single meaning, while the coordinate bilingual develops separate meanings for each of his alternative symbols. The most obvious contribution of this construct is that this distinction helps in understanding how two systems, which are so highly correlated because the same repertoire of environmental events are referred to with words from both languages, are kept from becoming mixed up for the coordinate bilinguals. However, it makes it more difficult to explain how compound bilinguals do so. Still the most interesting contribution is that it points to cultural context and differences as essential variables in the phenomenon of bilingualism.

A given language form implies a relationship with the corresponding social structure. Language forms are tools with which social structure is made sensible to the members of that linguistic group (Luhman, 1973). Consequently, a language form involves a culture. Thus bilingualism, consisting of two language forms, presupposes biculturalism

(two cultures or social contexts). Bilingualism is not only "languages in contact" but also cultures in contact. In other words,

"At the microlevel, language forms can be viewed as tools with which social meanings are constructed and communicated, each utterance thereby containing an information aspect (which is obvious) and a more general social aspect. At the macro level, language forms become markers of the relation between and among complex social groups and, in this sense, reflect the more purely sociological concerns of class and stratification. (Luhman, 1973)"

Attitudes Towards Bilingualism

If we review the different attitudes throughout the world toward bilingualism, we can extrapolate, with high reliability, the nature of the relations between the social groups involved. For example, people from Central and Eastern Europe, the Mediterranean area and Scandinavia would enforce bilingualism strongly. This attitude reflects social groups with high cultural tolerance and exchange. Nations (like some countries in Africa, and Puerto Rico) where prestigious languages have been imported will probably suspect bilingualism as a hidden form of linguistic colonialism. In the United States, for example, there has been constant intolerance toward bilingualism although the variety of cultural groups that constituted the nation is great (Lambert and Tucker, 1972).

All of these different attitudes suggest that a language form is not only a way of communicating symbols but also it is a means to and a symbol for resources, prestige, and power. Therefore the access to those resources is marked by the access to language forms. Hence the rejection of bilingual groups, i.e., bilingualism (like the immigrants) is a defensive act and an affirmation of power simultaneously. It is a defensive act in the sense that it is a social group (monolinguals) defending the control they have over social resources; and an affirmation of power because this behavior communicates the control over the resources by the monolingual group; the pressure is to be monolingual, i.e., to adopt the language form of the dominant group. There is a resistance to formally acknowledge the legitimacy of other language forms by the refusal to be a bilingual society (or a multilingual nation). If this bilingual behavior is not abandoned a series of stigmas are imposed on the bilingual group. This happened in this country to different ethnic groups, among them Blacks, Mexican-Americans, and Puerto Ricans. Some of the assumptions believed by the public and supported by research were: a bilingual will always be at a linguistic disadvantage (Luhman, 1973); the vocabulary of bilinguals is below standard (Smith, 1949); low I.Q. in bilingual samples is the result of low socio-economic level and bilingualism (Anastasi and Córdova, 1953); bilinguals

construct shorter, incomplete, less complex sentences, unusual word order, etc.; bilingualism results in retardation in educational progress such as reading and school maladjustment, bilingualism produces emotional instability and schizophrenia (Jensen, 1962), and bilingualism is a threat for national security.

Therefore, language forms, such as bilingualism, can be used as a means for political resistance (like the French-Canadians); as a means of belonging to a new culture (as for many immigrants); or as a political imposition resulting from political dependence (like in the case of Puerto Rico, Haugen, 1956).

The fallacies imputed to bilinguals were perpetuated by the educational system, too. Schools worked under an assumption, supported by linguists, that there was one "pure" style of language. This is to say that there was one-to-one correspondence between "culture" and language, which in this country, for example, is Standard American English. Based on this belief, schools which are the means used by society to educate its members were in charge of ensuring that all its members use the standard language form. Those individuals or collective cases in which the educational system failed, were evaluated as having "handicaps" or "disadvantages". This is one of the aspects that actively contributed in the creation of the "culturally-intellectually deprived children myth".

This myth, with all the stigmas that it generated, became a self-fulfilling prophesy, resulting in bilingual and/or bi-dialectic children dropping-out (Bernstein, 1972).

The educational system appears to be only responsible to and an advocate of the values and culture (language) of a majority group which controls the resources. Education, in this context, does not respond to all the members of that society or to the children it serves. The operating assumption seems to be that if some groups have a different language and/or culture, although they are part of the society schools serve, those groups have to change their language and their culture. Being "different" becomes a problem for that group instead of a challenge to Education, because in this way the society communicates to the bilingual child that it thinks the child's language, values, and culture are worthless. It seems education is not as equitable and impartial as it claims.

It was not until the early 60's that dissatisfaction with the existing situation began to be felt in the country. Increasing pressure on legislators from minority groups such as Blacks, Puerto Ricans, Native Americans, and Mexican-Americans who were awakening to a newly found pride in their ethnicity and to the realization of the effects the school system was having on their children, both educationally and psychologically, began to press for bilingual education. Adding

bicultural education to the language aspect, the thrust for

"Bilingual-bicultural education is not merely using the first language of the pupils as a bridge to the second language and then eliminating the first as proficiency in the second language is attained. Rather, it is the total development of the pupils bilingually so that they can function to the best of their own capabilities in two languages: their native language and the target language. Bilingual-bicultural education does not cut the curriculum. It comprises a complete program with the added use of two languages as a means of instruction in any or all parts of the curriculum. And since language is related to people's culture, it follows that a bilingual education program will include the study of two cultures - a bicultural component - in its activities (Board of Education of the City of Chicago, 1974)."

It would be naive to think that these were the only change agents. A few bilingual programs were already in existence in the Southwest at the time, and bilingual needs had already been documented. Also, research in the field in the late 50's and early 60's, as well as the forces mentioned, produced an introduction of bills in Congress. Massachusetts' Transitional Bilingual Education Act, G. L. Ch. 71 A was enacted in 1971 (Rivera, 1976).

Cognitive and Linguistic Studies of Bilinguals

As mentioned above, research in the field contributed to initiate bilingual-bicultural education and also removed many doubts pertaining to the benefits of bilingualism.

Some of the main aspects of bilingualism research were: code-switching, interference, word association, language acquisition, semantic satiation, and semantic shift.

Code-switching and interference were the first aspects of bilingualism that captured the attention of linguists and psycholinguists. How can a bilingual change from one linguistic code to the other without any effort? How does a bilingual individual manage to keep his languages essentially unilingual?

Code-switching occurs when a bilingual introduces a completely unassimilated word from another language into his speech, that is, the alternate use of two languages (Haugen, 1956). Interference is...

"the rearrangement of patterns that result from the introduction of foreign elements into the more highly structured domains of language, such as the bulk of the phonemic system, a large part of the morphology and syntax, and some areas of the vocabulary (Weinreich, 1953)".

In other words, it is the overlapping of two languages when item A has not been accepted into language B. Therefore, in a sense, interference is a kind of unstructured code-switching. When an auditory bilingual version of the Stroop Test is used, which requires code-switching, subjects are unable to ignore the semantic aspects of stimuli, even though they have no difficulty in keeping their two language codes functionally apart. Errors in the choice of language hardly

occur. Although physical characteristics of the stimulus words result in some interference, the major source on interference are the semantic aspects of the stimuli (Hamers and Lambert, 1972).

McNamara (1971) explored the bilingual's capacity to interpret linguistically mixed passages. He designed four experiments involving different aspects of code-switching. The first study required the subjects to read continuous paragraphs in English and French, and the time spent in reading was measured. The overall result was that the language switching took an observable amount of time. The second and third of these experiments required the participants to judge the truth or falsehood of written sentences. Responses to unilingual sentences in the subject's native tongue tend to be faster than responses to unilingual sentences in his second language. Besides, responses to mixed sentences were slower than to unilingual ones and the effects of increasing the number of switches is roughly additive. The last study asked the subjects to judge the truth or falsehood of spoken sentences. These findings correspond closely to those of the previous experiments. The author concludes that the input-switch is "indeed automatic" and that "attempts to bring it under voluntary control only disrupt its functioning".

For a long time code-switching was considered to be chaotic and with no specific pattern. As suggested above

(McNamara, 1971), code-switching functions differently between the input and output codes. Furthermore, McClure and McClure (1974), McClure and Wentz (1975a, 1975b) and Wentz and McClure (1975) conducted a series of studies on the development of code-switching among Mexican-American children. Linguistic (i.e., semantics, syntax, morphology and phonology) and sociolinguistic (e.g. topic, setting, scene and participant's activity) parameters of code-switching were considered. This study, not only confirmed what others (Rubin, 1972; Ervin-Tripp, 1964; Gumperz, 1964) already pointed out, that is, that code-switching occurs under specific conditions; but also established that children can "select freely from two codes which they control to convey social meaning" and that switching based on participants, the first type to develop, appears "as soon as the child can separate the two codes (McClure and McClure, 1974)". In another experiment the authors (McClure and Wentz, 1974a) concluded that "children's code-switching is not random" although no single parameter or sets of parameters can predict code-switching with absolute reliability. Metaphorical switching ("alternation which enables allusion to more than one social relationship among the same participants in an interaction, the situation remaining constant (McClure and Wentz, 1974a)") is ruled by a set of norms in the same way as situational switching. Moreover the phrase "marked

code choice" used by Ervin-Tripp (1972) applies only to code-switching for affective purposes.

In an attempt to explain why many of these analyses failed to find organization in some bilingual data, Wentz and McClure(1975b) conducted another study which led them to conclude that this failure is the result of the incapacity of scientists to make the distinction between the two kinds of code-switching: code-mixing and code-changing. Although both are code-switching, code-mixing requires "conflicts between the grammatical systems involved, which are resolved generally by syntactic principles which take both systems into account"; while code-changing "is characterized by long segments of switched material, and it seems to entail a complete shifting of grammatical 'gears', as it were".

A review of the literature suggested a close relationship between code-switching and interference. Lambert and Rawlings (1969a) put both aspects together when he asked compound and coordinate bilinguals to search out core concepts such as table, when given mixed-language clues, such as chaise, food, desk, bois, manger. Both groups of subjects have essentially the same score for both English and French problems, but coordinates made more errors on both English and French problems. This verified the idea that coordinated language codes have a greater functional independence and mixed-language presentations of cues would be more distract-

ing and confusing resulting in greater interference; on the other hand, compound linguistic codes are benefited by each language's functional dependence.

It is evident that the history of language acquisition affects many linguistic skills in bilinguals. Therefore, a better understanding of the process of language acquisition of bilingual children, will facilitate our understanding of this phenomenon. Although there is very little research available in this area, some studies have been initiated very recently.

Research shows that bilingual children develop linguistic skills in a stage, i.e., step by step, manner. By the time the children reach the second stage in both their languages, around the age of three years, the ability to differentiate between languages is well established. Similarities and differences among English and Spanish development tend to stem from structural similarities and differences between the two languages (Padilla and Liebman, 1975). The perception of these similarities and differences become more sophisticated as children get older. As we have seen, the awareness of the distinction between language codes emerges very early. It seems reasonable, as the coordinate - compound distinction suggests, that the absence or presence of this awareness will influence the way in which bilinguals experience their environment.

Experiences in bicultural acquisition contexts do appear to affect the semantic aspects of the bilingual's two linguistic codes. By analyzing conditions that are presumed to affect both the separate use of the bilingual's two languages and the interference between languages, Lambert, Hanelka, and Crosby (1967) indicate that those bilinguals who acquired their languages in separated contexts "exhibit a significantly greater difference in meanings of translated equivalents than did those who acquired both languages in fused context". In the same manner, studies involving semantic satiation suggest that coordinates behave in an opposite way from compounds by exhibiting a "generation" of meaning instead of satiation (Jakobovits and Lambert, 1961). Using mixed-language lists and reaction time, it was found that bilinguals generalize their responses to within and other languages synonyms, besides, semantic properties provided a more important clue than language of the test words, especially for coordinates (Segalowitz and Lambert, 1969). Semantic categorizing is an important principle for all bilinguals; but while coordinates place significantly more emphasis on this way of categorizing, compounds place more importance on the language principle. This corroborates Lambert's (1969) conclusion elsewhere: "Language is an auxiliary means of organizing information in memory when compared with semantic categories, which appear as powerful organizational schemas".

In summation, several aspects of bilingualism have been explored. Nevertheless, only language acquisition and code-switching have been studied from a developmental point of view. Furthermore, although the educational environment of our bilingual children has improved, the new bilingual programs are faced with an immense amalgam of problems. Most Spanish-speaking children are often characterized as poor performers and drop-outs. These children face the cultural/attitudinal conflicts on the part of teachers, i.e., the unrelenting pressure of formal institutions (including schools) to have the child change, rather than to adopt a bilingual acceptance by designing cognitive linguistic curricula, hiring Spanish-speaking teachers, etc. The difficulties children experience are multi-level, ranging from cognitive processing between two language systems to personal attitudes held by teachers, to national policy as a form of political power regulating the child's chances to achieve and succeed. The major purpose of the present study was to obtain some data on the cognition (a general term covering all the various modes of knowing) of semantic differences among bilingual children. The nature of the present study is exploratory; the theoretical basis of the investigation is weak and the investigator's intuition played a leading role in its formulation. Therefore, questions with unpredictable answers are plentiful. Nevertheless, it is expected that this

and the resulting future studies will contribute to clarify some bilingual cognitive processes of the bilingual child and will strengthen and enrich our bilingual programs.

For the purpose of this study, in order to assess differences in semantic processing between coordinate and compound Spanish-speaking bilinguals, children varying in age and level of cognitive development were given a word spoken in Spanish and asked to select one of two or three pictures which represented its meaning. The target words were selected for their potential multiple meanings in English. The following hypotheses were tested.

Experimental Hypothesis

1. Based on the previous research of Lambert (1969), Hamers and Lambert (1972), variation in the cognition of semantic differences is expected. More specifically, it is predicted that:

- a. Coordinate bilinguals will show more variation in the selection of the English corresponding meaning to the Spanish target word, than the compound bilinguals.
- b. Compound bilinguals will select almost the same sole English corresponding meaning to the Spanish target word.

2. It is hypothesized that the cognition of semantic differences will be stronger as children are in higher lev-

els of cognitive development. Based on the results obtained by Padilla and Liebman (1975) it is predicted that cognitively advanced children will show more differentiated patterns of response, pointing out a stronger cognition of semantic differences. In particular it is expected that children at the transitional level of cognitive development will exhibit a pattern of response more differentiated than the children at the pre-operational level; but less differentiated than those at the operational level of cognitive development.

Method

Subjects

Forty-eight bilingual children from Amherst and Holyoke in Western Massachusetts participated. Children ranged from 5 to 12 years of age and were Puerto Rican.

The subjects in Amherst, a total of 8, were recruited by personal contact of the experimenter with the parents. The rest of the sample, 40 subjects, were from the West Street School of Holyoke⁴. The supervisor of the bilingual program of the Public School System of Holyoke was contracted and informed about the nature of the study. The experimenter was referred to the Superintendent of Schools, who approved the participation of the children of that school in this study.

The school provided a testing room.

There were six treatment groups (factorial combinations of two independent variables, one with two levels and another with three levels). Twenty-four of the total of 48 subjects were coordinate bilinguals and the other 24 were compound bilinguals. In order to group the children in this way, a list of students was obtained from the teacher and the participants were selected on the following criteria: age at which each language began to develop; the context in which each language was acquired; the extent of the current usage; and the settings in which each is used currently. This history of language acquisition enabled the experimenter to group the subjects into either the coordinate or the compound bilingual classifications. The Piagetian Conservation Test, which was administered after the experimental task was finished, was used to group the subjects in the three different levels of cognitive development.

Due to this grouping procedure, the experimenter actually ran 65 subjects. The extra 17 subjects were not used because the evaluation of the Piagetian Conservation Test would assign them to groups already formed.

These two procedures generated a design which contained 24 coordinate bilinguals and 24 compound bilinguals; and sixteen subjects in each level of cognitive development, eight of each type of bilingual (see Table I). The cutoff

TABLE 1
Experimental Design

Cognitive Development	Non-Verbal Condition	
	COOB*	CB*
1. pre-operational level	8	8
2. transitional level	8	8
3. operational level	8	8

*COOB - Coordinate Bilingual

*CB - Compound Bilingual

scores for the different levels of cognitive development were as follows: from 0 to 4 points for the pre-operational level of cognitive development, 5 to 8 points for the transitional level, and 9 to 12 points for the operational level of cognitive development. The number of subjects in the various cells is equal.

The experimenter was a Puerto Rican female, also a coordinate bilingual.

Procedure

Design

The study was conducted using individual sessions for each subject. The testing for all the 48 subjects took a week and a half. The individual sessions ranged from 20 minutes, for the older children, to 40 minutes for the younger ones. The experimental task took an average of 3 minutes and the Piagetian Conservation Test ranged from 15 minutes to 35 minutes.

Stimulus materials

The Recuento de vocabulario de pre-escolares (Rodríguez-Bou, 1966) was used as the basis for the selection of the vocabulary in the list of target words. The Spanish target words were chosen as follows: the most frequently occurring responses in everyday vocabulary that have more than one pos-

sible meaning in English were listed with their corresponding English meanings. Words with heavy cultural meanings were not included. In all, there were 20 Spanish target words, 7 of which had 3 different English meanings and the other 13 had 2 different English corresponding meanings. Thus, the list of words was structured in such a way that for each target word in Spanish there were 2 or 3 corresponding meanings in English. In other words, there were 2 or 3 different English meanings for each Spanish target word (see Appendix A). The corresponding English meanings are completely different from one another, and involve different semantic classifications. English meanings for each drawing were written under it with a black magic-marker. Cards of 6 X 8½ inches were used for the drawings in total.

In order to collect the subjects' responses an answering sheet with the Spanish target words and the English corresponding meanings was designed (see Appendix B). This sheet included such information as the name of the subject, age, type of bilingual, and the date of the testing.

For the Piagetian Conservation Test, the Concept Assessment Kit - Conservation, Form A (Goldschmid and Bentler, 1968), was used. This test was translated into Spanish. To diminish the effect of language dominance the test was administered in English and Spanish, arranging the different parts to be given in both languages. By counterbalancing in

this way, the possible effects of language dominance or language preference on the score of the test was controlled. The distribution of the different sections of the test allowed a perfect counterbalance, so that, the effects of language dominance or language preference would be reduced (see Appendix C).

Each child was taken from his/her classroom to the testing room where the experimenter read the instructions in Spanish (see Appendix D). The experimenter then proceeded to pronounce each of the 20 Spanish target words while simultaneously presenting the drawings with the alternative English corresponding meanings for each target word. The experimenter waited as much as necessary for the child to make his/her choice. When the task was finished, the experimenter gave the child a break of 2 to 3 minutes.

In order to reduce the bias resulting from this interaction between the experimenter's expectations and the knowledge of the child's level of cognitive development, the conservation test was administered after the child had responded to all the target words. The experimenter started the Piagetian Conservation Test, after explaining what both (subject and experimenter) were going to do (see Appendix E). When the testing was finished the experimenter thanked the child for his/her cooperation and talked about the test. In general all subjects enjoyed the task.

Results

In order to establish the relationship between age and level of cognitive development a Pearson correlation between the ages of all the subjects and the score in the Piagetian Conservation Test was performed. The results yielded a significant relationship between age and level of cognitive development of the subjects ($r = 0.461$, $df = 48$, $P = 0.001$). Two additional correlations were compiled, one for age of coordinate bilinguals and scores on the Piagetian Conservation Test, and another for age of compound bilinguals and score on the Piagetian Conservation Test. The results of these analyses yielded a significant relationship between age and score on the Piagetian Conservation Test for the coordinate bilinguals ($r = 0.490$, $df = 48$, $P = 0.01$), and for the compound bilinguals ($r = 0.430$, $df = 48$, $P = 0.01$). Given that for middle class monolinguals, with whom the test was standardized, there is a high correlation between age and score on the test (Goldschmid and Bentler, 1968), these results suggest that the Piagetian Conservation Test is an appropriate assessment tool for this sample.

General Statistical Procedures

A measure of variability was obtained for each word. For all the 7 target words with 3 English corresponding meanings a score of zero variability was computed. Mathemat-

ically, this theoretical score of zero variability is 2.67 responses per English corresponding meaning (given that there is a total of 8 possible subject responses and 3 alternatives). This zero variability score was subtracted from the actual responses collected by the experimenter for each English corresponding meaning. For example, bomba had 3 alternatives; the pre-operational coordinates selected alternative three 7 times. Subtracting 2.67 from these resulted in a variability score of 8.67. The three variability scores, one for each English corresponding meaning, were added. This total score is the total variability score for the 8 subjects of one cell of the experimental design for that target word. This procedure was repeated for each of the 7 target words with 3 English corresponding meanings.

After the total variability score per target word was computed for these 7 target words, a measure of variability was obtained for the remaining 13 words. For all these words with 2 English corresponding meanings a score of zero variability was computed. Mathematically, this score is 4 responses per English corresponding meaning (given that there is a total of 8 possible responses to 2 alternatives). This zero variability score was subtracted from the actual responses collected by the experimenter for each English corresponding meaning. The two variability scores, one for each English corresponding meaning, were added. This final

score is the total variability score for the 8 subjects for one cell of the experimental design for that target word. This procedure was repeated for each of the 13 target words with 2 English corresponding meanings.

In order to determine if the cognition of semantic differences varies according to type of bilingual and level of cognitive development, series of statistical analyses were performed. Using the row variability scores (see Appendix F), the F ratios were computed and examined (see Table 2). The differences in variability, that is, differences in preference for a given response, between coordinate and compound bilinguals in the pre-operational level of cognitive development are not significantly different ($F = 1.01$, $df = 1$, $p < 0.05$). Similarly, the differences in variability between coordinate and compound bilinguals in the transitional level of cognitive development are not significantly different ($F = 0.97$, $df = 1$, $p < 0.05$). In the same manner, the difference in variability between coordinate and compound bilinguals in the operational level of cognitive development are not significantly different ($F = 1.24$, $df = 1$, $p < 0.05$).

In summary, using the total row variability scores, the differences in variability by type of bilingual at each level of cognitive development were not significantly different. In other words, subjects did not respond differently to the target word according to type of bilingual.

TABLE 2

F ratios of the Row Variability Scores

Level of Cognitive Development	Pre-operational Level	Transitional Level	Operational Level
F ratios	1.01	0.97	1.24
df	1	1	1

Using the word's variability score (see Appendix F) a 2 X 3 analysis of variance (see Table 2) of the children's responses by type of bilingual and level of cognitive development yielded a non-significant interaction between semantic differences, type of bilingual and cognitive development of subject ($F = 1.23$, $df = 2$, $p < 0.05$). The effect of type of bilingual ($F = 4.55$, $df = 1$, $p < 0.05$) and the effect of cognitive development are not significant ($F = 5.87$, $df = 2$, $p < 0.05$).

Although the analysis of variance test showed no differences between types of bilinguals and levels of cognitive development, nor within types of bilinguals; the row variability scores suggest, tentatively, that coordinate bilinguals vary more in their selection of the English corresponding meaning and that the children exhibit a more differentiated pattern of response (more variability) as they progress toward higher levels of cognitive development (see Table 3). The variability scores for the coordinate bilinguals is smaller for the operational and pre-operational levels of cognitive development than the variability scores for the compound bilinguals. There is a reverse tendency for the children in the transitional level of cognitive development. Moreover, the row variability scores increase for both types of bilinguals as the level of cognitive development in-

TABLE 3

Row Variability Scores

Level of Cognitive Development	Type of Bilingual	
	Coordinate	Compound
Pre-operational Level	95.46	97.43
Transitional Level	101.59	98.97
Operational Level	104.83	129.45

creases. Nevertheless, these differences were not significant.

A series of chi square analyses (and Fisher's Exact Test when necessary) were also carried out to find out whether or not coordinate bilinguals respond differently than compound bilinguals to each target word. The different variables controlled were type of bilingual, level of cognitive development, age, and sex; for each word. Furthermore, level of cognitive development by type of bilingual, and age by level of cognitive development were controlled too. Several of these chi square analyses were significant for some of the words. However, it was impossible to detect any systematic pattern in those analyses. In summary, given that not a single hypothesis can account for those tests that were significant, these are not reported.

In summary, there is an overall relationship between age and score in the Piagetian Conservation Test. The results of the separate correlations indicate that there is a relationship between age and score in the Piagetian Conservation Test among the coordinate bilinguals and for the compound bilinguals. Differences in cognition of semantic differences by type of bilingual are not significant as shown by the F ratio analysis and the analysis of variance. The chi square analysis showed that for some target words subjects responded significantly differently. Nevertheless, no systematic pattern

was detected among these target words.

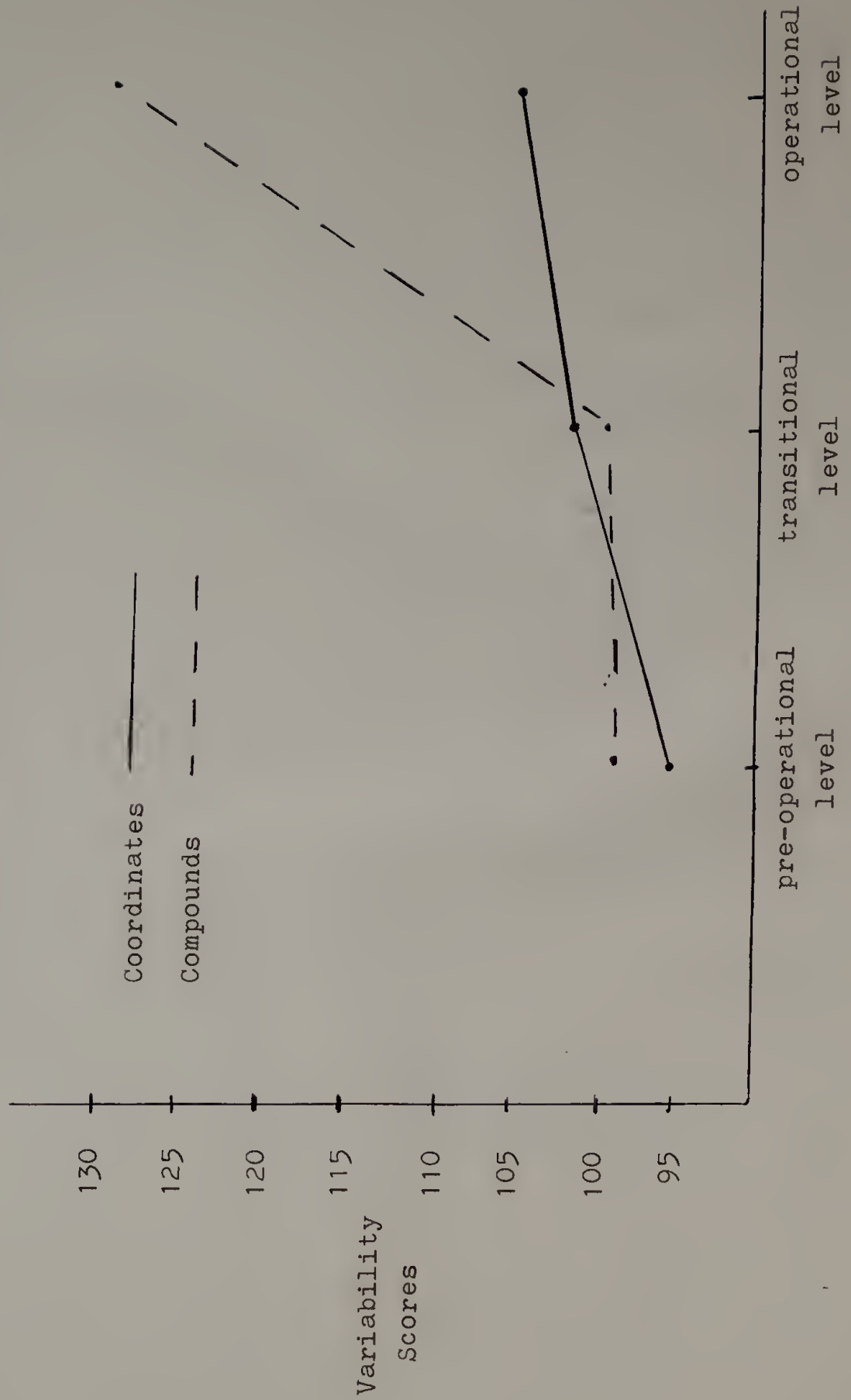
Discussion

The prediction that the Piagetian Conservation Test was an appropriate tool for this population was confirmed. The results indicated, that as for monolinguals, this test's score correlates with the subjects' ages.

The most conspicuous results to emerge from this study was that there are no significant differences in the cognition of semantic differences according to type of bilingual. In the pre-operational and transitional levels of cognitive development no differences were shown between compound and coordinate bilinguals (see Figure 1). However, the results obtained do approach significance as predicted but only in the operational level of cognitive development. These results suggest that at the operational level, coordinate bilinguals are more aware of semantic differences than compound bilinguals. Why is this difference not present at the pre-operational and transitional level? Why, even at the operational level, is this difference not significant?

It should be recalled that the studies that show differences in cognition of semantic differences involved a different task. In other words, with different tasks the results might not be the same. The instrument used in this study

Figure 1
Variability Scores as a Function of Cognitive Development



might be somewhat sensitive to semantic differences but not as sensitive as the others used before. To determine if the instrument used in this study is sensitive enough, it should be used in another study with adult subjects. If the results of this follow-up study are like those of the previous experiment using adults, we can assume that this instrument is sensitive enough to indicate the subjects' awareness of semantic differences. This conclusion would seem reasonable if it produces results similar to those obtained in previous research. In other words, replication of data indicating that adult coordinate and compound bilinguals in fact process semantic differences differently would confirm that this instrument is an appropriate tool to study cognition of semantic differences.

Another consideration involves the size of the sample used, eight subjects per cell of the experimental design and forty-eight in total, which might not be large enough to engender significant results. To clarify the role of the sample size in the obtained results, an identical experiment with a larger sample (for example 20 subjects per cell) would have to be conducted.

If after performing this series of experiments, subjects at the pre-operational and transitional levels of cognitive development do not respond differently, as the subjects in the operational level seem to; then we would have to ask, why are

there are no differences according to type of bilingual at the earlier levels of cognitive development? Moreover, why do coordinate and compound bilinguals in the operational level process semantic differences differently?

Based on the research of Padilla and Liebman (1975) on the process of language acquisition it was hypothesized that at the first two levels of cognitive development the magnitude of the differences in the cognition of semantic differences was going to be weaker. The reasoning behind this prediction was that at the earlier stages children's structures are not very stable. As they grow and the linguistic skills are more firm, consistent, and sophisticated, their cognitive processes become more fixed. In other words, young coordinates and compounds might have the two linguistic codes not as well differentiated as the coordinate and compound bilinguals at the operational level of cognitive development. Perhaps, this flexibility in the organization of the linguistic codes is so pronounced that it accounts for the similarity in the cognition of semantic differences between these two types of bilinguals at the earlier stages of cognitive development. In other words, bilinguals' cognitive system at the earlier stages of cognitive development are such that there are no differences in the way they process semantic differences. But, what is the cognitive structure that is not well developed at the earlier stages of cog-

nitive development but which is functioning at the operational level?

The structure to which we have been referring to is a construct which attempts to explain why coordinates and compound bilinguals differ in the cognition of semantic differences. For the compound bilinguals the different meanings for one word in one of the linguistic codes (e.g. Spanish) coincide with the corresponding meanings of the same word in the other code (e.g. English). In other words, compounds have one set of meanings for two linguistic codes. When a given word is presented to a compound in the first linguistic code, the different meanings are elicited. If after presenting the word in the first linguistic code, the subject is requested to respond in the second code; due to the previous experiences one of the corresponding meanings emerges. That corresponding meaning concurs with one of the meanings elicited by the word presented originally. The elicitation of that particular meaning related to the second language adds strength to the meaning with which it coincides. Consequently, the answer in the second language will be the word that concurs with the meaning related to the first language. Thus as the data suggests compound bilinguals show less variation in their responses to the target words.

On the other hand, coordinate bilinguals have one set of meanings for each linguistic code and those two sets function

somewhat independently. When a stimulus is presented in one language and the response is requested in the other language a process of coordination from one set of meanings to the other set of meanings occurs. Because the meanings do not coincide, sometimes the first meaning elicited in the second set is not the corresponding meaning to the one more strongly elicited in the first set. This discrepancy provokes the consideration of alternatives not available to the compound bilingual. As a result of greater awareness of possible alternatives, coordinate bilinguals vary more in their responses. In other words, they are more sensitive to semantic differences than the compound bilinguals, and their responses to the target words show more variation.

Nevertheless, there is still a lot of research to be done in order to verify this construct. Maybe some day we will be able to explain how bilinguals process their linguistic codes.

Appendix A

List of Words

- | | | | |
|---------------|----------------|----------------|---------------|
| 1. bomba---- | hydrant | 9. nada----- | swim |
| | bomb | | nothing |
| | balloon | 10. abanico-- | fan |
| 2. palo----- | stick | | extractor |
| | drink | 11. parada--- | stop |
| | tree | | procession |
| 3. vela----- | candle | 12. abrigo--- | sweater |
| | sail | | coat |
| | watch out for | 13. china---- | orange |
| 4. baño----- | large pan | | Chinese woman |
| | bathroom | 14. banco---- | bench |
| | to take a bath | | bank |
| 5. pluma----- | pen | 15. bota---i-- | throw away |
| | faucet | | boot |
| | feather | 16. pata----- | leg |
| 6. tira----- | throw | | female duck |
| | strip of cloth | 17. sirena--- | mermaid |
| | to pull | | siren |
| 7. pipa----- | pipe | 18. carro---- | car |
| | belly | | cart |
| | cask | 19. carta---- | card |
| 8. media----- | sock | | letter |
| | half | 20. largo---- | long |
| | | | large |

Appendix B

Answering Sheet

Name_____

Type of Bilingual_____

Age_____

Date_____

1. bomba_____hydrant

bomb

balloon

2. palo_____stick

drink

tree

3. vela_____candle

sail

watch out for

4. baño_____large pan

bathroom

to take a bath

5. pluma_____pen

faucet

feather

6. tira_____throw

strip of cloth

to pull

7. pipa_____pipe

belly

cask

8. media_____sock

half

9. nada_____swim

nothing

10. abanico_____fan

extractor

11. parada_____stop

procession

12. abrigo_____sweater

coat

13. china_____orange

Chinese woman

14. banco_____bench

bank

15. bota_____throw away

boot

16. pata_____leg

female duck

17. sirena_____mermaid

siren

18. carro_____car

cart

19. carta_____card

letter

20. largo_____long

large

Nombre
Fecha

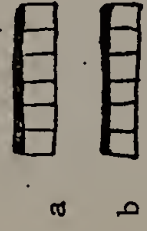
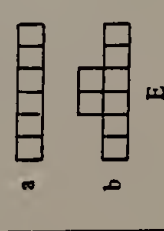
Fecha de Nacimiento
Sexo

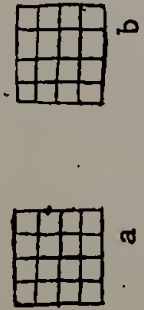
Grado
Examinador

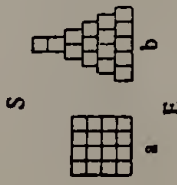
Appendix C

Form A - Piagetian Conservation Test

(A) ESPACIO BIDIMENCIONAL

ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
<div>I. 2 líneas iguales</div> <div> <div>S</div>  </div>	<div> Construya dos líneas cada una de seis bloques de madera diciendo: </div> <div> Cuando termine pregunte: </div> <div> Si el sujeto dice que ambas son iguales, diga: y continúe (II) </div> <div> Si el sujeto dice que no son iguales, diga: </div> <div> Demuestre al sujeto, señalando, que ambas son iguales, y cuando el sujeto este de acuerdo, continúe (II) </div>	<div>Mira lo que estoy haciendo.</div> <div>¿Hay tanta madera <u>aquí</u>, como <u>acá</u> o una tiene más?</div> <div>Sí, son iguales.</div> <div>Mira. <u>Esta</u> es tan grande como <u>esa</u>. <u>Ves</u>, ambas son iguales.</div>	
<div>II. 2 unequal lines</div> <div> <div>S</div>  </div>	<div>Take 2 additional blocks, saying: Then, say:</div> <div>Record. Then ask:</div> <div>Record, and say:</div>	<div>Look. I am putting these blocks here. Now tell me. Is there as much wood <u>here</u> as <u>there</u>, or does one have more? Why?</div> <div>O.K. Let's do something else.</div>	<div> <div>Same</div> <div>a has more</div> <div>b has more</div> </div>




III. 2 cuadrados iguales	 S E	Construya dos cuadrados con 16 pedazos de madera cada uno, diciendo: Cuando termine, pregunte: Si el sujeto dice que son iguales, continúe (IV) Si el sujeto dice que no son iguales, diga: Demuestre al sujeto, señalando, que son iguales, luego, prosiga a (IV)	Mira lo que estoy haciendo. ¿Hay tanta madera <u>aquí</u> como <u>acá</u> , o uno tiene más que el otro? Mira. Este es tan grande como <u>ese</u> . Ves, los dos son iguales.
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IV. square vs. pyramid	 S E	Then, take the blocks from the right square and build a pyramid with a base of 5 blocks and successive levels of 4, 3, 2, 1 and 1 blocks, saying: When finished, ask: Record, then ask: Record.	Watch what I do. Now, is there as much wood in this one as in <u>that</u> one, or does one have more? Why? Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more <input type="checkbox"/>
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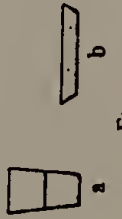
(B) NUMBER	ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
1.	parallel red and white chips S a ●●●●●● b ○○○○○○ E	Place 6 red chips in a straight line about 4 inches apart. Parallel to and below the red chips, place 6 white chips in corresponding position, also in a straight line, saying: When finished, say: If subject says there are as many red as white chips go on to (II) If he says one line has more than the other, say: Demonstrate to subject by pointing that they are the same, then, when he agrees, go on to (II)	Watch what I do. Are there as many <u>red</u> chips as <u>white</u> chips or are there more <u>red</u> chips than <u>white</u> chips? No, look. There is one red chip for every white chip. Do you see now that there are as many red chips as white chips?		

II. red vs white chips S a ●●●●●●●● b ○○○○○○○○ E	Leave the two lines of chips in a horizontal position, one line below the other, but spread out the white chips (6 inches apart), and move the red chips closer together (2 inches apart), saying: When finished, ask: Record, and ask: Record.	Watch what I do. Now, are there as many <u>red</u> chips as <u>white</u> chips, or is there more of one kind? Why?	<input type="checkbox"/> Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more
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(C) SUBSTANCIA

ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
I. 2 bolas iguales S a   b  E	Haga dos bolas iguales de plastilina (cada una de 3 onz.), diciendo: Si el sujeto dice que son iguales, continúe (II) Si el sujeto dice que una es más grande, diga: Continúe ajustando las bolas hasta que el sujeto diga que son iguales.	Aquí hay dos bolas de plastilina. Hay la misma cantidad de plastilina en cada bola. Las dos son parecidas. ¿Hay tanta plastilina en <u>esta</u> bola como en <u>esa</u> , o una tiene más? Vamos a hacerlas iguales. Voy a coger un poco de esta y se lo voy a añadir a esa. Ahora, ¿hay tanta plastilina en <u>esta</u> como en <u>esa</u> ?	

II. ball vs. hotdog S a   b  E	Roll one ball into a hotdog (6 inches long - use ruler), saying: When finished, ask: Record, and ask: Record.	Now watch what I do. See, I am making this ball into a hotdog. Now, is there as much play doh in <u>this</u> one, as in <u>that</u> one, or does one have more? Why?	<input type="checkbox"/> Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more
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ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
I. 2 vasos grandes iguales <div style="display: flex; justify-content: space-around; align-items: center;">  </div>	<p>Coloque los dos vasos grandes llenos con la misma cantidad de agua (150 ml.) frente al niño, y diga:</p> <p>Luego, pregunte:</p> <p>Si el sujeto dice que tienen la misma cantidad continúe (II)</p> <p>Si el sujeto dice que uno tiene más, ajuste el nivel del agua, diciendo:</p> <p>Luego, pregunte:</p> <p>Continúe ajustando el agua dentro de los vasos hasta que él diga que ambos tienen la misma cantidad.</p>	<p>Ves, aquí hay dos vasos de agua llenos con la misma cantidad de agua.</p> <p>¿Hay tanta agua en este vaso como en <u>ese</u>, o uno tiene <u>más</u>?</p> <p>Vamos a ponerles iguales. ¿Ves?</p> <p>Estoy echando un poco de agua de este vaso en ese.</p> <p>Ahora, ¿hay tanta agua en <u>este</u> como en <u>ese</u>, o uno tiene <u>más</u>?</p>	
II. 2 unequal glasses <div style="display: flex; justify-content: space-around; align-items: center;">  </div>	<p>Pour 25 ml of water from an extra glass into the large glass at right, remove the extra glass, but leave it on the table, saying:</p> <p>Then ask:</p> <p>Record, and ask:</p> <p>Record.</p>	<p>Watch what I do. See, I am pouring a little water from this glass into that one.</p> <p>Now, is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?</p> <p>Why?</p> <p style="text-align: right;"> <input type="checkbox"/> Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more </p>	
III. large glass vs. dish <div style="display: flex; justify-content: space-around; align-items: center;">  </div>	<p>Pour water from right glass (which has more water) into the flat dish, saying:</p> <p>When finished, ask:</p> <p>Record, and ask:</p> <p>Record.</p>	<p>Watch what I do.</p> <p>Now, does <u>this</u> one have as much water as <u>that</u> one, or does one have more?</p> <p>Why?</p> <p style="text-align: right;"> <input type="checkbox"/> Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more </p>	

S



E

Coloque los dos vasos grandes llenos con la misma cantidad de agua (150 ml.), frente al niño, y diga:

Luego, pregunte:

Si el sujeto dice que los dos tienen la misma cantidad de agua, continúe (V)

Si el sujeto dice que uno tiene más, ajuste el nivel del agua diciendo:

Luego, pregunte:

Continúe ajustando el agua en los dos vasos hasta que él diga que ambos tienen la misma cantidad de agua.

Mira, aquí hay dos vasos y los dos están llenos con la misma cantidad de agua.

¿Hay tanta agua en este vaso como en ese, o uno tiene más que el otro?

Vamos a ponerlos iguales. Ves, yo estoy echando un poco de este vaso en ese.

Ahora, ¿hay tanta agua en este vaso como en ese, o uno tiene más?

V. large glass vs. dish

S



E

Pour the water from right glass into the dish, saying:

Remove empty glass, but leave it on the table, and ask:

Record, and ask:





Record.


Watch what I do.


Is there as much water in this one as in that one, or does one have more?

Why?

Same ☐
a has more ☐
b has more ☐

ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
<p>I. 2 bolas iguales</p> <p>S</p> <p>a  b </p> <p>E</p>	<p>Haga dos bolas iguales de plasticina, diciendo:</p> <p>Dele las bolas al niño, y diga:</p> <p>(Cerciorece que el sujeto coga los bolas y las pese en sus manos)</p> <p>Si el niño dice que pesan lo mismo, continúe (II).</p> <p>Si el sujeto dice que una pesa más, diga:</p> <p>De las bolas nuevamente al sujeto y pregunte:</p> <p>Continúe ajustando las dos bolas hasta que diga que pesan lo mismo.</p>	<p>Aquí hay dos bolas de plasticina. Una bola es tan pesada como la otra bola.</p> <p>¿Es una bola tan pesada como la otra, o es una más pesada que la otra?</p> <p>Vamos a hacerlas iguales. Voy a coger un poquito de esta y se lo voy a añadir a esa.</p> <p>Ahora, ¿son iguales? ¿Es una bola tan pesada como la otra?</p>	
<p>II. ball vs. pancake</p> <p>S</p> <p>a  b </p> <p>E</p>	<p>Make the right ball into a pancake. Flatten the ball until the diameter is 4 inches (use ruler), saying:</p> <p>When finished, ask:</p> <p>(Do not allow the subject to pick up the ball or pancake)</p> <p>Record, and ask:</p> <p>Record.</p>	<p>Watch what I am doing. See, I am making one of the balls into a pancake.</p> <p>Now, is the <u>ball</u> as heavy as the <u>pancake</u>, or is one heavier?</p> <p>Why?</p> <p>Same <input type="checkbox"/></p> <p>a has more <input type="checkbox"/></p> <p>b has more <input type="checkbox"/></p>	

ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
I. 2 vasos grandes <div></div> S E	<p>Coloque los dos vasos, llenos con la misma cantidad de maíz (150 ml.), frente al niño, diciendo:</p> <p>Si el sujeto dice que tienen igual cantidad, continúe (II).</p> <p>Si el sujeto dice que uno tiene más, diga:</p> <p>Continúe ajustando el nivel del maíz, hasta que el diga que ambos tienen la misma cantidad.</p>	<p>Mira, aquí hay dos vasos llenos con la misma cantidad de maíz. ¿Hay tanto maíz en <u>este</u> vaso como en <u>ese</u>, o uno <u>tiene</u> más?</p> <p>Vamos a ponerlos iguales. Mira, yo voy a echar un poco de maíz de este vaso a ese. Ahora, ¿hay tanto maíz en <u>este</u> como en <u>ese</u>, o uno <u>tiene</u> más que el otro?</p>	

II. large glass vs. 5 small glasses <div></div> S E	<p>Pour the corn from the large glass into the small glasses (arranged in a circle, close together) in equal amounts, saying:</p> <p>When finished, ask:</p> <p>Record, then ask:</p> <p>Record.</p>	<p>Watch what I do. See, I am pouring the corn from this glass into all of these glasses.</p> <p>Now, is there as much corn in this one as in all of <u>these</u> together, or does one side have more?</p> <p>Why?</p>	<div><input type="checkbox"/> Same <input type="checkbox"/> a has more <input type="checkbox"/> b has more</div>
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RECORDING FORM
FORM A

NAME _____ DATE _____

DATE OF BIRTH _____ AGE _____ SEX _____



SCHOOL _____ GRADE _____



EXAMINER _____



COMMENTS _____

Task	Behavior	Explanation	Total
A			
B			
C			
D			
E			
F			
Total			

(A) TWO-DIMENSIONAL SPACE

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 equal lines S a  b  E	Build 2 lines, each with 6 blocks of wood, saying: When finished ask: If the subject says they are both the same, say: And go on to (II) If he says they are not the same, say: Demonstrate to subject by pointing that they are the same, then, when S agrees, go on to (II)	Watch what I do. Is there as much wood <u>here</u> * as <u>there</u> or does one have more? Yes, they are both the same. Look. This one is just as big as <u>that</u> one. See, they are both the same.		



II. 2 líneas desiguales S a  b  E	Tome dos bloques adicionales diciendo: Luego, diga: Anote. Luego, pregunte: Anote, y diga:	Mira. Voy a poner estos bloques aquí. Ahora dime. ¿Hay tanta madera <u>aquí</u> , como <u>acá</u> , o una tiene más que la otra? ¿Por qué? OK. Vamos a hacer otra cosa.	Igual <input type="checkbox"/> a tiene más <input type="checkbox"/> b tiene más <input type="checkbox"/>
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III. 2 equal squares S a  b  E	Build 2 squares with 16 pieces of wood each, saying: When finished, ask: If the subject says they are the same, continue with (IV). If the subject says they are not the same, say: Demonstrate to subject by pointing that they are the same, then, go on to (IV)	Watch what I do. Is there as much wood <u>here</u> as <u>there</u> , or does one have more? Look. This one is just as big as <u>that</u> one. See, they are both the same.	
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<div> <div>pirámide</div> <div> <div> <div>a</div> <div>b</div> </div> <div> <div>S</div> <div>E</div> </div> </div> </div>	<div> <div>cuadrado de la derecha y construya una pirámide con una base de 5 bloques y los niveles sucesivos de 4, 3, 2, 1 y 1 bloques, diciendo:</div> <div> <div>Cuando termine, pregunte:</div> <div>Anote, luego pregunte:</div> <div>Anote.</div> </div> </div>	<div> <div>Mira lo que estoy haciendo.</div> <div>Ahora, ¿hay tanta madera en este como en ese, o uno tiene más?</div> <div>¿Por qué?</div> </div>	<div> <div> <input type="checkbox"/> Igual <input type="checkbox"/> a tiene más <input type="checkbox"/> b tiene más </div> </div>
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(B) NUMERO



ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
<div> <div>I. fichas rojas y blancas paralelas</div> <div> <div>S</div> <div> <div>a</div> <div>b</div> </div> <div>E</div> </div> </div>	<div> <div>Coloque 6 fichas rojas en línea recta dejando un espacio de alrededor de 4" entre cada ficha. Debajo y paralelo a las fichas rojas, coloque 6 fichas blancas, en la posición correspondiente, también en línea recta, diciendo:</div> <div>Cuando termine, diga:</div> <div>Si el sujeto dice que hay igual cantidad de fichas rojas como de blancas, continúe (II)</div> <div>Si él dice que una línea tiene más que la otra, diga:</div> <div>Demuestre al sujeto, señalando, que son iguales, luego, cuando esté de acuerdo, continúe (II)</div> </div>	<div> <div>Mira lo que estoy haciendo.</div> <div>¿Hay tantas fichas rojas como blancas o hay más rojas que blancas?</div> <div>No, mira. Hay una ficha roja por cada ficha blanca. ¿Ves ahora que hay igual número de fichas rojas y blancas?</div> </div>	<div> <div>48</div> </div>


<p>vs. fichas blancas</p> <p>S</p> <p>a </p> <p>b </p> <p>E</p>	<p>posición horizontal, una línea de- bajo de la otra, pero esparza las fichas blancas (6 pulgadas entre cada una) y las rojas (2 pulgadas entre cada una), diciendo:</p> <p>Cuando termine, pregunte:</p> <p>Anote y pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo.</p> <p>Ahora, ¿hay tantas fichas rojas como blancas, o hay más de una de los dos?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>
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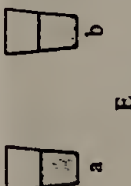

(C) SUBSTANCE

<p>I. 2 equal balls</p> <p>S</p> <p>a </p> <p>b </p> <p>E</p>	<p>Make two equal balls of play doh (each 3 oz.), saying:</p> <p>If the subject says they are both the same, go on to (II)</p> <p>If the subject says one ball is larger, say:</p> <p>Continue to adjust the two balls until the subject says they are the same.</p>	<p>Here are two balls of play doh. There is the same amount of play doh in each ball. They are both alike. Is there as much play doh in this ball as in <u>that</u> one, or does one have more?</p> <p>Let's make them the same. I am taking a little bit away from this one and adding it to <u>that</u> one.</p> <p>Now, is there as much play doh in <u>this</u> one as in <u>that</u> one?</p>	
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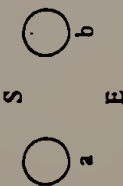
<p>II. bola vs. perro caliente ("hotdog")</p> <p>S</p> <p>a </p> <p>b </p> <p>E</p>	<p>Convierta una de las bolas en un perro caliente ("hotdog") de 6" de largo, diciendo:</p> <p>Cuando termine, pregunte:</p> <p>Anote, y pregunte:</p> <p>Anote.</p>	<p>Ahora, mira lo que hago. ¿Ves? Estoy convirtiendo esta bola en una perro caliente ("hotdog").</p> <p>Ahora, ¿hay tanta plastilina en <u>este</u> como en <u>esa</u>, o uno de los dos tiene más?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>
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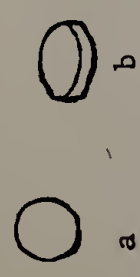
<p>I. 2 equal large glasses</p> <p>S</p>  <p>E</p>	<p>Place the two large glasses filled with an equal amount of water (150 ml) before the child, and say:</p> <p>Then, ask:</p> <p>If the subject says they both have the same amount, go on to (II)</p> <p>If the subject says one has more, adjust the water level, saying:</p> <p>Then, ask:</p> <p>Continue to adjust the water in the two glasses until he says that they both have the same.</p>	<p>See, here are two glasses both filled with the same amount of water.</p> <p>Is there as much water in <u>this</u> glass as in <u>that</u> one, or does one have more?</p> <p>Let's make them the same. See, I am pouring a little from this glass into that one.</p> <p>Now, is there as much water in <u>this</u> one as in <u>that</u> one or does one have more?</p>		
<p>II. 2 vasos desiguales</p> <p>S</p>  <p>E</p>	<p>Eche 25 ml. de agua de un vaso extra en el vaso de la derecha, aleje el vaso extra, pero déjelo en la mesa, diciendo:</p> <p>Luego,, pregunte:</p> <p>Anote, y pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo. ¿Ves?</p> <p>Estoy echando un poquito de agua en ese vaso.</p> <p>Ahora, ¿hay tanta agua en <u>este</u> vaso como en <u>ese</u>, o uno <u>tiene</u> más que el otro?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>	

ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA	
<p>III. vaso grande vs. plato</p> <p>S</p>  <p>E</p>	<p>Eche el agua del vaso derecho (el que tiene más agua) en un plato llano, diciendo:</p> <p>Cuando termine, pregunte:</p> <p>Anote y pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo.</p> <p>Ahora, ¿hay tanta agua en <u>este</u> como en <u>ese</u>, o uno <u>tiene</u> más?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>	50

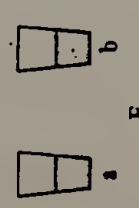
	<p>Then, ask: If the subject says they both have the same amount, go on to (V).</p> <p>If the subject says one has more, adjust the water level, saying:</p> <p>Then, ask:</p> <p>Continue to adjust the water in the two glasses until he says they both have the same.</p>	<p>Is there as much water in this glass as in that one, or does one have more?</p> <p>Let's make them the same. See, I am pouring a little from this glass into that one.</p> <p>Now, is there as much water in this glass as in that one, or does one have more?</p>	
ITEM	DIRECCIONES	INSTRUCCIONES VERBALES	RESPUESTA
<p>V. vaso grande vs. plato</p> <p>S</p>  <p>E</p>	<p>Eche el agua del vaso derecho en el plato, diciendo:</p> <p>Aleje el vaso vacío, pero déjelo en la mesa, y pregunte:</p> <p>Anote, y pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo.</p> <p>¿Hay tanta agua en <u>este</u> como en <u>ese</u>, o uno tiene más?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p> <p>_____</p>


(E) WEIGHT

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
<p>I. 2 equal balls</p> <p>S</p>  <p>E</p>	<p>Make two equal balls of play doh (each 3 oz.), saying:</p> <p>Give the balls to the child, and say:</p> <p>(Be sure that the subject picks up the balls and weighs them in his hands.)</p> <p>If the child says they weigh the same, go on to (II).</p> <p>If the subject says one weighs more, say:</p> <p>Give balls back to subject and ask:</p> <p>Continue to adjust the two balls until he says they weigh the same.</p>	<p>Here are two balls of play doh. One ball is as heavy as the other ball.</p> <p>Is one ball as heavy as the other, or is one ball heavier than the other?</p> <p>Let's make them the same. I am taking a little bit away from this one and adding it to that one.</p> <p>Now are they the same? Is one ball as heavy as the other?</p>		

<p>("pancake")</p>  <p>S</p> <p>E</p>	<p>la bola hasta que tenga un diametro de 4", diciendo:</p> <p>Cuando termine, pregunte:</p> <p>(No permita que el sujeto coja la bola y/o la torta ("pancake"))</p> <p>Anote, y pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo. Mira estoy haciendo una torta ("pancake") con una de las bolas.</p> <p>Ahora, ¿es la bola tan pesada como la torta ("pancake"), o es uno más pesado?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>
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(F) DISCONTINUOUS QUANTITY

<p>I. 2 large glasses</p>  <p>S</p> <p>E</p>	<p>Place the two glasses, filled with an equal amount of corn (150 ml), in front of the child, saying:</p> <p>(Level the surface in both glasses.)</p> <p>If the subject says they both have the same, go on to (II).</p> <p>If the subject says one has more, say:</p> <p>Continue to adjust the corn in the two glasses, until he says they both have the same amount.</p>	<p>See, here are two glasses both filled with the same amount of corn. Is there as much corn in <u>this</u> glass as in <u>that</u> one, or does one have more?</p> <p>Let's make them the same. See, I am pouring some corn from this glass into that one. Now, is there as much corn in <u>this</u> one as in <u>that</u> one, or does one have more?</p>	
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<p>II. vaso grande vs. vasos pequeños</p>  <p>S</p> <p>a</p> <p>b</p>	<p>Eche el maíz del vaso de la derecha en los cinco vasos pequeños (colocados en círculo unos cerca de los otros) en igual cantidad, diciendo:</p> <p>Cuando termine, pregunte:</p> <p>Anote, luego pregunte:</p> <p>Anote.</p>	<p>Mira lo que estoy haciendo. ¿Ves? Yo estoy echando el maíz de este vaso en todos estos vasos.</p> <p>Ahora, ¿hay tanto maíz en <u>este</u> vaso como en todos <u>estos</u> juntos, o uno tiene más que el otro?</p> <p>¿Por qué?</p>	<p>Igual <input type="checkbox"/></p> <p>a tiene más <input type="checkbox"/></p> <p>b tiene más <input type="checkbox"/></p>
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Appendix D

Experimenter's Instructions
for the
Semantic Differences Task

Por favor siéntate aquí. Yo me voy a sentar al otro lado de la mesa. Aquí tenemos un juego con láminas y palabras. Voy a colocar unos dibujos frente a tí que tienen debajo una palabra escrita en inglés. Luego voy a decir una palabra en español. Yo quiero que tú me señales el dibujo que mejor representa lo que yo dije.

¿Entiendes lo que vamos a hacer? ¿Quieres saber algo más? Bien. Vamos a comenzar.

(Please sit down here. I am going to sit on the other side of the table. Here we have some words and a set of drawings. I am going to put some of the drawings in front of you. There is an English word under each drawing. Then, I am going to say a word in Spanish. I want you to show me the drawing which best represents what I said.

Do you understand what we are going to do? Would you like to know anything else? Good. Let us begin.)

Appendix E

Experimenter's Instructions
for the
Piagetian Conservation Test

Aquí tenemos otro juego. Este tiene agua de colores, plasticina, bloques de madera y otras cosas. Voy a hacerte algunas preguntas y me gustaría que me contestes lo mejor que puedas. ¿Entiendes lo que vamos a hacer? Bien, vamos a empezar.

(Here we have another game. This one has color water, play dough, wooden blocks, and some other things. I am going to ask you some questions and I would like you to answer in the best way you can. Do you understand what we are going to do? Fine! Let's begin.)

Appendix F a - Collected Data

Words	bomba	palo	vela	baño	pluma	tira	pipa
Choices	1 - 2 - 3	1 - 2 - 3	1 - 2 - 3	1 - 2 - 3	1 - 2 - 3	1 - 2 - 3	1 - 2 - 3
Pre-operational Coordinates							
Responses	0 - 1 - 7	5 - 0 - 3	7 - 1 - 0	0 - 4 - 4	4 - 3 - 1	0 - 7 - 1	3 - 5 - 0
Word Variability Scores	8.66	5.34	8.66	5.34	3.34	8.66	5.34
Pre-operational Compounds							
Responses	0 - 3 - 5	4 - 0 - 4	6 - 2 - 0	0 - 4 - 4	7 - 1 - 0	3 - 4 - 1	6 - 2 - 0
Word Variability Scores	5.34	5.34	6.66	5.34	8.66	3.34	6.66
Transitional Coordinates							
Responses	0 - 2 - 6	4 - 0 - 4	7 - 0 - 1	0 - 5 - 3	6 - 0 - 2	5 - 3 - 0	3 - 5 - 0
Word Variability Scores	6.66	5.34	8.66	5.34	6.66	5.34	5.34
Transitional Compounds							
Responses	0 - 3 - 5	5 - 0 - 3	6 - 1 - 1	0 - 7 - 1	7 - 1 - 0	5 - 2 - 1	3 - 4 - 1
Word Variability Scores	5.34	5.34	6.66	8.66	8.66	4.66	3.34
Operational Coordinates							
Responses	1 - 4 - 3	6 - 1 - 1	8 - 0 - 0	1 - 4 - 3	6 - 2 - 0	5 - 3 - 0	5 - 2 - 1
Word Variability Scores	3.34	6.66	10.66	3.34	6.66	5.34	4.66
Operational Compounds							
Responses	0 - 0 - 8	3 - 0 - 5	7 - 0 - 1	0 - 7 - 1	7 - 1 - 0	8 - 0 - 0	1 - 7 - 0
Word Variability Scores	10.66	5.34	8.66	8.66	8.66	10.66	8.66
Column Variability Scores	40.00	33.66	49.96	38.68	42.62	38.00	34.00

Appendix F b - Collected Data

Words	media	nada	abanico	parada	abrigo	china	banco
Choices	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2
Pre-operational Coordinates							
Responses	7 - 1	3 - 5	2 - 6	1 - 7	8 - 0	4 - 4	1 - 7
Word Variability Scores	6	2	4	6	8	0	6
Pre-operational Compounds							
Responses	7 - 1	4 - 4	0 - 8	1 - 7	5 - 3	6 - 2	1 - 7
Word Variability Scores	6	0	8	6	2	4	6
Transitional Coordinates							
Responses	8 - 0	4 - 4	1 - 7	0 - 8	3 - 5	6 - 2	2 - 6
Word Variability Scores	8	0	6	8	2	4	4
Transitional Compounds							
Responses	7 - 1	5 - 3	1 - 7	0 - 8	3 - 5	4 - 4	2 - 6
Word Variability Scores	6	2	6	8	2	0	4
Operational Coordinates							
Responses	7 - 1	1 - 7	2 - 6	2 - 6	2 - 6	2 - 6	2 - 6
Word Variability Scores	6	6	4	4	4	2	4
Operational Compounds							
Responses	8 - 0	4 - 4	1 - 7	1 - 7	5 - 3	6 - 2	1 - 7
Word Variability Scores	8	0	6	6	2	4	6
Column Variability Scores	40.00	10.00	34.00	38.00	20.00	14.00	30.00

Appendix F c - Collected Data

Words	bata	pata	sirena	carro	carta	largo	Row Variability Score
Choices	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	1 - 2	
Pre-operational Coordinates							
Responses	3 - 5	6 - 2	6 - 2	7 - 1	4 - 4	3 - 5	95.34
Word Variability Scores	2	4	4	6	0	2	
Pre-operational Compounds							
Responses	0 - 8	5 - 3	5 - 3	8 - 0	5 - 3	3 - 5	97.43
Word Variability Scores	8	2	2	8	2	2	
Transitional Coordinates							
Responses	2 - 6	7 - 1	3 - 5	8 - 0	4 - 4	7 - 1	101.59
Word Variability Scores	4	6	2	8	0	6	
Transitional Compounds							
Responses	1 - 7	6 - 2	7 - 1	7 - 1	5 - 3	6 - 2	98.97
Word Variability Scores	6	4	6	6	2	4	
Operational Coordinates							
Responses	2 - 6	8 - 0	3 - 5	8 - 0	0 - 8	8 - 0	104.83
Word Variability Scores	4	8	2	8	8	8	
Operational Compounds							
Responses	0 - 8	7 - 1	3 - 5	8 - 0	2 - 6	8 - 0	129.45
Word Variability Scores	8	6	2	8	4	8	
Column Variability Scores	32.00	30.00	18.00	44.00	16.00	30.00	

Footnotes

1. Language distance is the term used to indicate the difference in language structure between two languages.

2. Hass (1955) constructed a classification of bilinguals which does not take relative skill into account. Bilinguals are classified as receiving vs. sending, oral vs. visual, close vs. distant.

3. The terms pre-operative, transitional, and operational levels of cognitive development are used as Jean Piaget used them.

4. My sincere thanks and appreciation is extended to the Holyoke public system; especially to the staff, teachers and children of the West Street School for their cooperation in this research.

5. My sincere thanks and appreciation is extended to Dr. Arnold Well for his assistance in developing a statistical measure for variation in cognition of semantic differences.

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