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Lexical Errors Produced During Category Generation Tasks by Bilingual Adults and Bilingual Typically Developing and Language-Impaired Seven to Nine-Year-Old Children

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Lexical Errors Produced During Category Generation Tasks by Bilingual Adults and Bilingual Typically Developing and Language-Impaired Seven to Nine-Year-Old Children

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Dedication

To my parents and grandparents, without whom this would not have been possible,

and to David and his family.

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Abstract

Lexical Errors Produced During Category Generation Tasks by Bilingual Adults and Bilingual Typically Developing and Language-Impaired Seven to Nine-Year-Old Children

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The development of category knowledge is in part a function of one's experiences with the world. The types of errors produced during category generation tasks may reveal the boundaries of these experiences and the ways in which they are organized into lexical networks. Examining the errors made by bilingual children with and without language impairment (LI) and bilingual adults may help to distinguish the effects of ability versus experience on the development and organization of lexical-semantic categories. The purpose of this study was to examine the types of errors made by bilingual (Spanish-English) children with (n=37) and without (n=35) LI and bilingual adults (n=26) on category generation tasks in both their languages and at two category levels: taxonomic and slot-filler. Results revealed a main effect for level (taxonomic vs. slot-filler) and error type (semantic vs. other) and suggest that bilingual seven to nine-year-old children's and adults' proportions and types of errors produced on category generation tasks differ significantly based on ability (i.e., TD or LI) but not on experience (i.e., TD or Adults).

Table of Contents

List of Tables

List of Figures

Introduction and Review of the Literature

The development of categories in children is thought to be in part a function of their knowledge of and experiences with the outside world; category generation tasks may reveal the methods by which they store and organize this knowledge. As children develop cognitively and gain more experiences with age, such methods likewise become increasingly adult-like in sophistication. The types of errors produced by typical populations during category generation tasks reveal the processes by which they organize lexical information as well as the boundaries of category composition. The patterns of errors made by children with language impairment may differ from those of typical populations and may afford a view into parallel differences in the composition and organization of their lexical systems.

Category generation tasks have been used to examine vocabulary composition and organization in typically developing monolingual (Lucariello, Kyratzis, & Nelson, 1992; Nelson & Nelson, 1990) and bilingual children (Peña, Bedore, & Zlatic-Giunta, 2002), as well as typical monolingual and bilingual adults (Gollan, Montoya, & Werner, 2002; Portocarrero, Burright, & Donovick, 2007; Roberts & Le Dorze, 1997; Rosselli, Ardila, Araujo, Weekes, Caracciolo, Padilla, & Ostrosky-Solís, 2000). Information on the performance of bilingual children with language impairment on such tasks, however, is lacking. As category knowledge is in part based on experience, both with the world and with one's language(s), bilingual children may produce errors as a result of limited

experience with each of their languages. Comparison of errors of bilingual children with and without LI may reveal differences between the role of experience and the role of language ability in the development of categories. Typical bilingual adults provide an appropriate control for both of these factors because they, while bilingual, have more experience with language in general than do children.

One way to examine the lexical storage system is through the analysis of error types. Word-retrieval errors indirectly reveal the nature of lexical storage and organization (McGregor, 1997). Examining the types of errors produced by the aforementioned groups during a category generation task may be a useful means of exploring differences in lexical organization with potentially valuable application to clinical practice with bilingual populations. The purpose of the current study was to explore patterns of lexical error types in bilingual (Spanish-English) children with language impairment and bilingual (Spanish-English) children and adults with typical development.

Category Development in Children

Young children (under about seven years of age) categorize objects based on both perceptual and functional similarities (Nelson, 1973; Nelson, 1988; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), but do not yet classify at the superordinate level of a taxonomic conceptual hierarchy. Theories emphasizing the role of cognition on children's development of category knowledge propose that this lack of superordinate

classification is due to an inability to understand class inclusion and exclusion before about seven years of age (Inhelder and Piaget, 1964; cited in Nelson & Nelson, 1990).

In contrast, Nelson (1988) proposed that young children categorize objects according to the schemas involved in events occurring in their daily environments. These events, such as eating breakfast or putting on clothes in the morning, involve a sequence of goal-oriented actions in which certain objects can fulfill an "object-of-action" slot in each particular event. These objects represent alternative possibilities for different incidences of an event and are called "slot fillers" because they can fill the slot for a particular event in any given occurrence. The child's collective representation of those items is therefore termed a "slot-filler category" (Nelson & Nelson, 1990).

Slot-filler categories are restricted to the context to which they correspond, but also can be grouped and labeled by superordinate terms (Nelson, 1988). Nelson (1988) proposed that children experience a shift around seven to eight years of age in their ability to categorize objects at the superordinate level. These taxonomic categories are also based on knowledge about the function of objects, but differ from slot-filler categories in that they are not constrained to any particular event (Lucariello *et al.*, 1992).

Typically Developing Monolingual and Bilingual Children's Performance on Category Generation Tasks

To test this proposed developmental shift in category knowledge, Nelson and Nelson (1990) developed a series of category generation tasks in which children were

asked to name items within slot-filler and taxonomic types of categories. For the slot-filler type, children were asked to name as many items as they could that related to a specific event, such as animals found at the farm or foods eaten for breakfast. For the taxonomic condition, children were asked to name items from a general category such as animals, foods, or clothing. Based on the proposal that children's early category development is based on experientially-derived knowledge, Nelson and Nelson (1990) compared performance on these tasks of two groups of kindergartners, one with preschool experience and one without, as well as that of a group of older, second grade children.

Results revealed significant interactions between groups, conditions, and categories. The second grade children produced a greater number of overall items and more items in the taxonomic condition than in the slot-filler condition. In contrast, the kindergarten children generated more items in the slot-filler condition than in the taxonomic condition. The kindergartners with preschool experience produced more items in both conditions than those without preschool experience. Nelson and Nelson (1990) concluded that monolingual children's category knowledge is experienced-based and organized by slot-filler categories until about five to eight years of age. At that time, a developmental shift from slot-filler to taxonomic category organization occurs (Nelson & Nelson, 1990).

The emphasis on the role of experience in the development of monolingual children's categorization abilities proposed by Nelson and Nelson (1990) suggests that

differences might be expected in the performance of bilingual children on such a task due to varying amounts of exposure to their home and/or school languages (Peña *et al.*, 2002). To investigate this hypothesis, Peña and colleagues (2002) analyzed the performance of typically developing bilingual (Spanish-English) children aged four to seven years on a category generation task. Following Nelson and Nelson's (1990) protocol children were asked to generate items from slot-filler and taxonomic categories in both Spanish and English. Peña *et al.* (2002) concluded from their findings that bilingual children also demonstrate a developmental shift from slot-filler to taxonomic category organization, but appear to exhibit taxonomic knowledge at an earlier age than monolingual children.

Several studies have investigated types of errors made during naming and word association tasks by monolingual children with typical development (McGregor, Friedman, Reilly, & Newman, 2002; Wiegel-Crump & Dennis, 1986) and with language impairment (McGregor, 1997; McGregor & Waxman, 1998; McGregor, Newman, Reilly, & Capone, 2002). But, with the exception of Lucariello *et al.* (1992), the types of lexical errors produced by monolingual or bilingual children during category generation tasks have not been examined.

Lexical Error Typology in Typically Developing Monolingual Children

Errors in lexical retrieval may be categorized by type according to the relationship between the error and the target response. Such a relationship may be characterized by its

position within current models of lexical storage and access. Assuming that errors are a direct reflection of the point of breakdown in the process of lexical access (Butterworth, 1989), semantic and phonologic errors would be expected given breakdowns at the lemma and lexeme levels, respectively, of Levelt's model of lexical access (Levelt, 1991).

The most common naming errors in both children and adults with normal as well as impaired language are those that have a semantic relationship to the target response (Caramazza & Hillis, 1990; Dapretto & Bjork, 2000; Fried-Oken, 1984; Fromkin, 1987; German, 1982; Goodglass, Klein, Carey, & Jones, 1966; Lahey & Edwards, 1999; McGregor, 1997; McGregor, Newman *et al.*, 2002; Tager-Flusberg, 1986; Wiegel-Crump & Dennis, 1986; Wijnen, 1992). Such errors may involve the storage rather than the access or retrieval of lexical entries and, thus, be a function of the robustness or quality of semantic representations stored in the lexicon (McGregor, Newman *et al.*, 2002). In monolingual children both with and without language impairment, these errors may reflect incomplete or less elaborate representations of lexical entries (Kail & Leonard, 1986; McGregor, 1997). Examining such errors in bilingual children with and without language impairment will help to distinguish between the role of experience and the role of ability in the development of category knowledge.

Errors in category naming are thought to reflect problems with category boundaries and attention to perceptual features rather than a reliance on noncategorical response bases (Lucariello *et al*., 1992). One study analyzed types of errors produced by

monolinguals during a category generation task. Lucariello *et al.* (1992) presented English-speaking, typically developing four and seven-year-old children and adults with superordinate category labels (i.e., clothes, animals, food, furniture, and tools) and asked them to produce category members. Errors were coded as one of two types: (1) *noncategorical* errors included thematic responses naming a complement or characteristic spatiotemporal context (e.g., "wood" for tools) and function responses naming a characteristic function (e.g., "put on" for clothes); and (2) *other* errors included associated responses naming instances from related categories (e.g., "appliances" for furniture), featural responses naming perceptual attributes of members (e.g., "fur" for animal), and unrelated responses (e.g., "horse" for furniture). Results revealed few errors for all groups for the animals, clothes, and food categories, and many errors for the furniture and tools categories, especially for the preschoolers. Errors predominantly consisted of associated and featural responses for all groups.

Similarly, Wiegel-Crump and Dennis (1986) investigated typically developing children's naming accuracy in response to semantic description, rhyming, and visual drawing conditions. In all conditions and for all age groups, most of the errors produced were semantic errors involving a response to the semantic category of the target and some of its features. Errors unrelated to the target were rare, and errors bearing a phonetic rather than a meaning-based relationship to the target did not occur at any age (Wiegel-Crump & Dennis, 1986).

Because semantic errors are the most common error type produced by children during naming tasks (Dapretto & Bjork, 2000; McGregor, 1997; Wiegel-Crump & Dennis, 1986; Wijnen, 1992), McGregor, Friedman, Reilly, and Newman (2002) focused on the specific types of semantic errors produced by five to seven-year-old English-speaking children during a naming task. They proposed that semantic taxonomic errors such as "chair" for "saddle" would suggest taxonomic organization of the lexicon, while semantic thematic type errors, such as "horse" for "saddle," would suggest thematic organization. Descriptive responses (e.g., "you sit on it") would suggest that some functional properties of the target word were part of the child's lexical representation. The investigators found that semantic errors were more frequent than indeterminate (i.e., "don't know" or nonspecific responses), phonological, and other (i.e., unintelligible responses or visual misperceptions) type errors. Within the body of semantic errors, taxonomic type errors (i.e., coordinate or superordinate substitutions) were more frequent than thematic and descriptive errors. The majority of taxonomic errors involved coordinate substitutions (e.g., "mouse" for kangaroo; McGregor *et al*., 2002a). These results replicated those reported in other studies of typically developing children (Dapretto & Bjork, 2000; Wiegel-Crump & Dennis, 1986; Wijnen, 1992).

Lexical Error Typology in Language-Impaired Monolingual Children

Children with developmental language problems are slower and less accurate during naming tasks than their typical peers (Lahey & Edwards, 1996; Leonard, Nippold,

Kail, & Hale, 1983; McGregor, 1997). Such difficulties may be related to linguistic processing problems involving the storage or retrieval of lexical items (Kail, Hale, Leonard, & Nippold, 1984). A few studies (McGregor, 1997; McGregor & Waxman, 1998; McGregor, Newman *et al*., 2002) have compared types of errors on naming tasks produced by monolingual children with language impairment (LI) to their typical peers.

McGregor and Waxman (1998) presented pictures of objects to children with and without LI and asked contrastive questions across a taxonomic hierarchy (e.g., "Is this an animal?", "Is this a tree?", "Is this a dandelion?" for the stimulus of *rose*). They found that indeterminate errors, including "I don't know" responses and acceptances of the contrasting stimulus, were the most common type of error produced by children with LI, while semantic coordinate substitution errors were the most common type produced by the typical children. During traditional confrontation naming tasks, McGregor (1997), in contrast, found that semantic errors were the most common type of error produced by both children with and without LI, but that, similar to McGregor and Waxman (1998), children with LI produced a higher proportion of indeterminate errors than did typical children. Like McGregor (1997), McGregor, Newman, Reilly, and Capone (2002) found that semantic errors were the most frequent type of error produced by both children with and without LI during a naming task.

These findings indicate that, in general, semantic error types were the most common naming error type among children with and without LI. However, in comparison to their typical peers, children with LI also produced a greater proportion of errors in

which the relationship to the target was unknown or could not be determined based on the child's response. McGregor, Newman *et al.* (2002) concluded from the results of tasks in which children's drawings of items were compared to their naming responses that storage level deficits were responsible for LI children's errors. Such deficits, in which children do not have enough information stored for some semantic concepts to identify even the lexical neighborhood, may underlie both semantic and indeterminate type errors produced by children with LI.

Lexical-Semantic Systems of Language-Impaired Bilingual Children

Studies of typically developing monolingual and bilingual children's performance on category generation tasks indicate that children's organization of vocabulary undergoes a developmental shift from a reliance on experience-based slot-filler categories to broader, linguistic-based taxonomic categories (Nelson, 1988; Nelson & Nelson, 1990; Lucariello *et al*., 1992; Peña *et al*., 2002). In monolingual, English-speaking children, this shift occurs around seven to eight years of age, while in Spanish-English bilingual children, use of taxonomic organization strategies may occur at even earlier ages (Peña *et al*., 2002). Bilingual children are an informative research population in the study of categorization and the lexical-semantic system. Compared to monolinguals, they may develop more event schemas due to their exposure to two languages and cultures, and their use of two language systems may necessitate a more efficient filing system for the number of words to which they are exposed in each of their languages (Peña *et al*., 2002).

Consequently, the lexical-semantic system of a bilingual child can be significantly affected by the presence of language impairment. The performance of bilingual children with LI on category generation tasks has yet to be thoroughly evaluated. Difficulties at the level of storage and/or retrieval of lexical items may result in distinct patterns of error responses for these children, and such patterns may differ with respect to language and the type of categorization strategy employed.

Research Questions

The purpose of the current study is to investigate the patterns of error types produced by seven to nine-year-old bilingual children with and without language impairment and bilingual adults on category generation tasks. The primary research questions addressed by this study are: (1) Do bilingual children with language impairment (LI) ages seven to nine make different kinds of errors on category generation tasks in comparison to their typically developing (TD) age-matched peers and to normal bilingual adults? (2) Do seven to nine-year-old bilingual children with and without LI and bilingual adults demonstrate different patterns of performance based on task condition (taxonomic versus slot-filler)? (3) Is there an effect of task language (Spanish, English) on the number or types of errors made by bilingual children and adults on category generation tasks?

It is expected that semantic errors will be the most common type of error produced by all participant groups, based on previous findings of monolingual adults and

children with and without LI (Caramazza & Hillis, 1990; Dapretto & Bjork, 2000; Fried-Oken, 1984; Fromkin, 1987; German, 1982; Goodglass *et al*., 1966; Lahey & Edwards, 1999; McGregor, 1997; McGregor, Newman *et al*., 2002; Tager-Flusberg, 1986; Wiegel-Crump & Dennis, 1986; Wijnen, 1992). It is also expected that seven to nine-year-old bilingual children with LI will produce a different pattern of error types than their TD peers and normal adults given that monolingual children with LI produce a slightly different pattern of errors than their typical peers on naming tasks (McGregor, 1997; McGregor & Waxman, 1998; McGregor, Newman *et al*., 2002). Specifically, compared to the typical groups, children with LI are expected to produce a greater proportion of errors for which the relationship to target responses cannot be determined. Second, it is expected that all groups overall will make more errors at the slot-filler category level than at the taxonomic level, as the former requires more specific and context-dependent responses. Finally, the language in which a task is performed, Spanish or English, is not expected to impact the different types of errors produced by bilingual children and adults. However, because each of the groups is slightly dominant in one language over the other, it is predicted that task language will affect the number of errors produced, particularly for the two groups of children. Specifically, it is expected that the TD and LI children will produce a greater average number of errors during tasks in English than during those in Spanish.

Methods

Participants

A total of 72 children (48 males, 24 females) between the ages of seven (84 months) and nine years (119 months) and 26 adults (9 males, 17 females) between the ages of 18 and 59 years participated in this study. All participants were bilingual Spanish-English speakers. The children's use of Spanish and English fell along a continuum ranging from English-dominant to Spanish-dominant, though they all were exposed to both Spanish and English at least 20% of the time. The children were part of a larger, ongoing study of bilingual (English-Spanish) semantic development that included category generation, functions, characteristic properties, associations, definitions, similarities and differences, and verbal analogy tasks. The adults were drawn from a comparative ongoing study of language performance in bilingual adults for the development of testing tools for this population.

The children were recruited from first, second, third, and fourth grade classrooms in three school districts in central Texas, and one school district in northwestern Colorado enrolling large numbers of bilingual children. Socioeconomic status was determined by the children's lunch program. The majority of children in the study, 67 (93%), received free or reduced lunch through the school, as revealed by parent report. The remaining five (7%) children were not receiving assistance. As reported by their primary caregivers in a

telephone interview, all children (100%) were identified as being of Hispanic descent, defined as having at least one parent of Hispanic origin.

Language Status

For the child participants, fluency in both languages was determined through a language-use survey interview with the child's primary caregiver indicating 20% or greater English/Spanish input in the home. Primary caregivers were interviewed over the phone for approximately 10 to 15 minutes by bilingual graduate students in the field of speech-language pathology using the language-use survey. Eighty-five percent of caregivers completing the survey were mothers, followed by fathers (13%), one mother and father (1%), and one child's older sibling (1%). The children's teachers were interviewed in person during their weekly planning time by bilingual graduate and doctoral students using the language-use survey. The information obtained from the parent and teacher interviews was used to calculate the percentage of English- and Spanish-language input. An English input score of 40% and a Spanish input score of 60%, for example, would indicate that a child is bilingual (i.e., greater than 20% English/Spanish input) and slightly more dominant in Spanish.

Language-Impaired and Typically Developing Children Groups

The children were divided into a language impaired (LI) group (37 children; 28 males, 9 females) and a typically developing (TD) group (35 children; 20 males, 15

females). The average age of the LI group was eight years, four months (100 months; Range = 84 to 119 months). Average percentages of language input for the LI group were 44% for English and 56% for Spanish, indicating that, as a group, the children with LI were slightly more dominant in Spanish. LI was determined on the basis of at least three of the following four criteria: (a) currently receiving speech and language services through the school or independent service provider, (b) the presence of ungrammatical utterances and low productivity on a story generation task from either the Test of Narrative Language (TNL; Gillam & Pearson, 2004) or Spanish adaptation of the TNL, (c) primary caregiver's report of concern regarding their child's speech and/or language skills on the language-use survey, (d) classroom teacher's report of concern regarding the child's speech and/or language skills on the language-use survey (Restrepo, 1998).

The mean age of the TD group was eight years, three months (99 months; Range = 84 to 119 months). Average language input scores of the TD group were 43% for English, and 57% for Spanish, indicating that, similar to the LI group, the children with TD were slightly more dominant in Spanish. According to information obtained from the primary caregiver and teacher interviews, the children in the TD group exhibited age-appropriate speech and language skills and were not receiving speech and language services at the time of the study. Few primary caregivers expressed concerns about their child's speech and/or language skills on the language-use survey. When concerns were present, they were generally mild and included comments such as "English is hard," "can't explain things well," "having trouble learning English."

Adult Group

The adult participants were administered a language-use survey in which they answered questions about their exposure to and daily use of each of their two languages. Fifty percent (13 of 26) used and were exposed to both English and Spanish about the same number of hours per week, while the other fifty percent (13 of 26) were more dominant in English. Seventy-seven percent of participants (20 of 26) reported hearing and/or using both languages for a period of 75% or more of their lives. The ages at which the adult participants were first exposed to their second language (English or Spanish) ranged from birth to 24 years, with the majority, 9 (35%), exposed between ages three and six years. Six participants (23%) were exposed to their second language from birth to three years of age, followed by five (19%) from 6 to 9 years, three (11%) 18 to 21 years, two (8%) 12 to 15 years, and one (4%) 21 to 24 years of age.

Procedures

Information regarding the purpose of the study as well as a written consent to participate was provided to each child's family prior to the initiation of testing. Once consent was received, the child's primary caregiver was interviewed using the language-use survey. English and Spanish language use scores were then calculated to confirm each child's eligibility to participate (i.e., 20% or greater English/Spanish input). Each child was assigned an identification number for tracking and anonymity purposes. The children were tested individually in a quiet room at their elementary school. Typically,

each child was seen at least once a week during a time interval agreed upon by the classroom teacher. All testing was completed by bilingual, ASHA certified speech language pathologists and graduate students from the University of Texas at Austin's Communication Sciences and Disorders program trained in the area of diagnostics and test administration. Children were tested in both English and Spanish. Testing in each language occurred on different days, and attempts were made to maintain use of the target language throughout the testing session. The children's responses were audio recorded using digital voice recorders and transcribed verbatim for reliability and scoring purposes.

Description of the Task

The category generation task used in this study was part of the *Bilingual English-Spanish Assessment* (BESA) Semantics Test, designed to evaluate and quantify bilingual children's semantic skills (Peña, Gutierrez-Clellen, Iglesias, Goldstein, & Bedore, in development). At present, no standardized language assessment measure for the purpose of evaluating bilingual children's language has yet been published (Bedore & Peña, 2008). The BESA for Middle Elementary Experimental Semantics Test (BESA-ME) consists of two versions, one in Spanish and one in English, and differed only with regards to language and item order. The category generation task consisted of fifteen expressive items and took approximately 20 minutes to administer. For each item, the child was required to generate as many words as he or she could that pertained to each

stimulus category in one minute. The one minute condition was added to this most recent version of the BESA-ME Semantics Test to challenge the older seven to nine year old subjects. Examiners were permitted to use the prompts "*what else?/¿qué más?*," "*tell me more/dime más*," and "*is that all?/¿es todo?*," as well as back-channeling cues (e.g., "*mhm*" and "*uh huh*") to encourage the children's responses.

Of the fifteen expressive category generation items (fifteen English, fifteen Spanish), six were selected for analysis in this study (six English, six Spanish). Three of the items represented taxonomic categories (i.e., animals, food, and clothing) while the remaining items represented more specific, slot-filler categories (i.e., farm animals, lunch foods, and clothing worn when it's cold outside). The stimulus items included in this study are provided in Table 1.

Table 1: Stimulus items according to BESA Semantics Test version, category, and level.

	BESA Semantics Test, English		*BESA Semantics Test, Spanish*	
Category	**Taxonomic**	**Slot-filler**	**Taxonomic**	**Slot-filler**
Animals	Tell me all the animals you can think of. You have one minute. Ready?	Tell me all the farm animals you can think of. You have one minute. Ready?	Dime todos los animales que conoces. Tienes un minuto. Empieza ya.	Dime todos los animales de zoológico que conoces. Tienes un minuto. Empieza ya.
Food	Tell me all the foods you can think of. You have one minute. Ready?	Tell me all the foods you can eat for lunch. You have one minute. Ready?	Dime todas las comidas que conoces. Tienes un minuto. Empieza ya.	Dime toda la comida que se puede comer para el lonche (almuerzo). Tienes un minuto. Empieza ya.
Clothes	Tell me all the clothes you can think of. You have one minute. Ready?	Tell me what clothes are used when it is cold. You have one minute. Ready?	Dime toda la ropa que puedes usar. Tienes un minuto. Empieza ya.	Dime la ropa que se usa cuando hace frío. Tienes un minuto. Empieza ya.

The reliability of the coding scheme was determined using an inter-rater reliability procedure in which the primary investigator trained an undergraduate student with experience in Spanish-English language transcription in the coding procedure. Fifteen percent of the transcripts from each participant group were then randomly selected (5 transcripts each from the TD and the LI groups, 4 transcripts from the Adult group). The student was asked to agree or disagree with each error code applied to the data for these participants and to provide an explanation for each choice. Percentage agreement ranged from 67% to 100% for each individual transcript and was 91% for the 14 total transcripts.

Scoring

The children's and adults' responses were entered into a spreadsheet and judged as either correct or incorrect members of the taxonomic or slot-filler category. A database was created prior to the start of the study that contained items considered correct and incorrect, in both English and Spanish, for each of the six categories. The children's responses were compared to this database during the scoring process and unique items were evaluated on a case-by-case basis. Additionally, responses were coded using the following conventions: [w] for incorrect or category-inappropriate responses, [c] for code-switched responses, and [r] for repetitions. Despite the language used to administer the test, participants did not receive explicit instructions nor were they required to respond in the target language. Thus, code-switched ([c]) items were included in the overall score.

Error Analysis Coding Scheme

Incorrect responses ([w]) were further coded for type of error according to a coding scheme based on that used by McGregor and colleagues for coding errors during naming tasks (McGregor, Friedman, Reilly, & Newman, 2002; McGregor, Newman, Reilly, & Capone, 2002). Error types were classified as one of four types: semantic, phonologic, indeterminate, or other.

Semantic errors were further subdivided into five groups: taxonomic coordinate, taxonomic superordinate, thematic, descriptive, and unassociated. Taxonomic coordinate

error codes were assigned to items that belonged to the same hierarchical category as target items, but that were determined to be an error for that prompted category. For example, the response “giraffe” under the *farm animals* slot-filler category would be a taxonomic coordinate error because “giraffe” is an *animal*, but it is not considered a *farm animal*. Taxonomic superordinate errors were within-category but were less specific than responses that such a stimulus category would typically elicit. Responses of “pet” for the *all animals* category and “Chinese food” for the *all foods* category would constitute taxonomic superordinate errors, for example.

Other semantic errors included thematic, descriptive, and unassociated errors. Thematic errors were out-of-category semantic associations of the target responses. Responses such as “Golden Corral” under *foods*, “farmer” under *farm animals*, and “earrings” under *clothes* were examples of thematic errors. Descriptive errors included circumlocutions, such as “those things that you put on your neck” under *cold clothes*, and novel derivatives, such as “ground-hopper” under *all animals.* Semantic unassociated errors included real items that were neither in the same hierarchical category as nor associated with target items for a given category. An example of an unassociated item would be “boat” under *farm animals*.

Phonologic errors included approximations of the word form, such as “galla” for *gallina* (chicken) under *farm animals*. Indeterminate errors included nonspecific single- and multi-word responses, such as “your ears cannot be cold” or “go with the car and go buy” under *cold clothes*. Other errors included unintelligible responses or misperceptions

of the prompt, such as when, for example, one child responded "footprints" and "the mysterious man" under *all clothes* because he had misperceived the category prompt as "clues." Repetitions ([r]) included exact and slightly varied replications of items previously produced within a given category. Types of errors and their codes are listed in Table 2.

Table 2: Coding conventions and examples of types of errors produced.

Type		***Code***	***Example***
Semantic	Taxonomic Coordinate	[sem:tax:c]	"giraffe" in *farm animals*
	Taxonomic Superordinate	[sem:tax:s]	"pet" in *all animals*
	Thematic	[sem:the]	"earrings" in *all clothes*
	Descriptive	[sem:d]	"those things that you put on your neck" in *cold clothes*
	Unassociated	[sem:un]	"boat" in *farm animals*
Phonologic		[p]	"galla"/gallina (chicken) in *farm animals*
Indeterminate		[i]	"go with the car and go buy" in *cold clothes*
Other		[o]	"footprints" in *all clothes*, child heard "clues"
Repetition		[r]	"apple…apple"
			"chicken…little chicken"
			"frijoles (beans)…más frijoles (more beans)"

Analysis

Quantitative analyses were then used to determine patterns of error production for the three participant groups. Total numbers of items generated in each of the categories were analyzed to determine between-group differences that may affect interpretation of error type results. A repeated-measures ANOVA comparing total number of words was conducted with language (English, Spanish) and category level (taxonomic, slot-filler) as within-subjects factors and group (LI, TD, Adults) as the between-subjects factor. Means of occurrence of two error types (*semantic*, including taxonomic coordinate, taxonomic superordinate, thematic, descriptive, and unassociated; and *other*, including phonologic, indeterminate, and "other" type errors and repetitions), expressed as percentages of total words generated, were entered into a repeated-measures ANOVA with group (LI, TD, Adults) as the between-subjects factor and language (English, Spanish) and level (taxonomic, slot-filler) as the within-subjects factors. In a subsequent analysis, repetitions, which occurred frequently for all groups, were excluded from the *other* error type composite in order to more closely investigate a *semantic* versus *other* error type distinction.

Results

The primary purpose of this study was to determine if seven to nine-year-old bilingual TD and LI children and bilingual typical adults differ on types of errors produced during category generation tasks. Two main analyses were conducted; one explored the number of items generated by each of the three groups. The next set of analyses explored the types and proportions of errors made by the three groups.

Total Number of Items Generated

The total number of items generated for all category tasks by each group was analyzed to determine possible between-group differences that may impact interpretation of the results for types of errors. A repeated-measures ANOVA comparing total number of words was conducted. Within-subjects factors included language (English, Spanish) and level (taxonomic, slot-filler). Group (Adults, TD, LI) was the between-subjects factor. Of particular interest in this analysis was the effect for group because group differences in the number of words generated may affect interpretation of error type rates.

Results revealed a significant main effect for group, $F(2,95) = 103.489$, $p < .001$, $n_p^2 = 0.685$. Adults generated more items (M=50.33) than TD children (M=23.46) or children with LI (M=22.84). Due to these group differences, rates of error types expressed as a percentage of total number of items generated by each participant were used in subsequent analyses.

Proportions and Types of Errors Produced

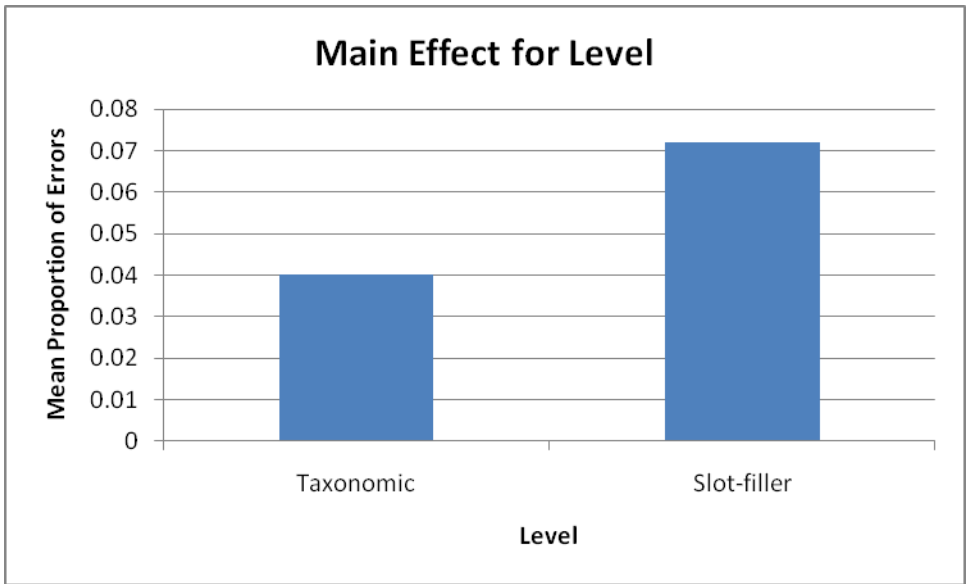
In the second analysis, mean numbers of error types expressed as percentages of total words generated were entered into a repeated-measures ANOVA with language (English, Spanish), level (taxonomic, slot-filler), and error type (semantic, other) as the within-subjects factors. Group (Adults, TD, LI) was the between-subjects factor. Main effects and interactions have been summarized in Table 3.

Table 3: Significant results of a repeated-measures ANOVA.

Main Effects	
Main Effect for Level (Taxonomic, Slot-filler)	$F(1,95) = 52.577$, $p < .001$
Main Effect for Error Type (Semantic, Other)	$F(1,95) = 6.246$, $p < .014$
Interactions	
Group x Language Interaction	$F(2,95) = 4.963$, $p < .009$
Group x Level Interaction	$F(2,95) = 5.999$, $p < .004$
Level x Error Type Interaction	$F(1,95) = 24.37$, $p < .001$
Group x Level x Error Type Interaction	$F(2,95) = 7.345$, $p < .001$

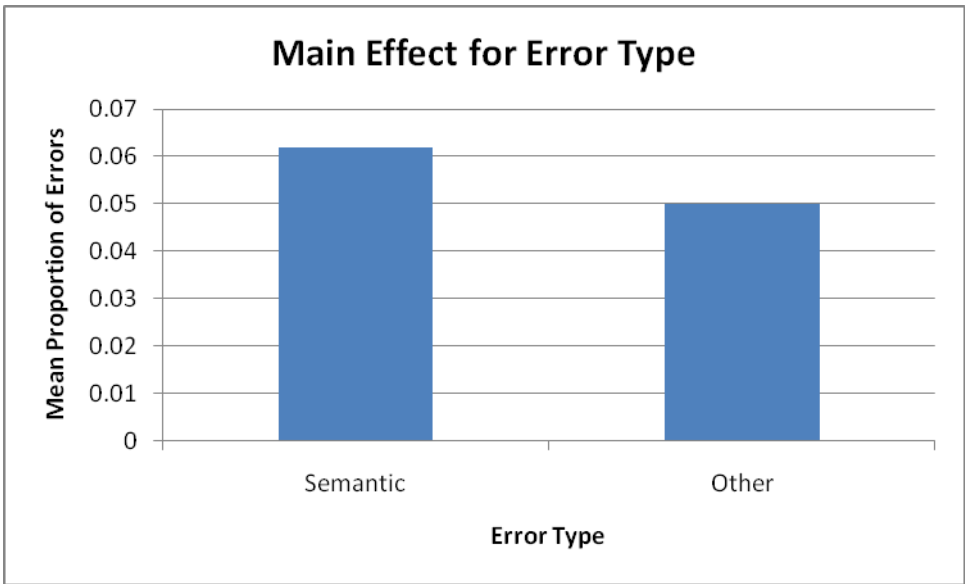
A main effect was found for level, revealing a statistically significant difference between the mean proportion of errors generated at the taxonomic and slot-filler levels, $F(1,95) = 52.577$, $p < .001$, $n_p^2 = 0.356$ (Figure 1). Significantly more errors were produced at the slot-filler level (M=7.2%) than at the taxonomic level (M=4.0%).

Figure 1: Mean proportion of errors produced according to level.



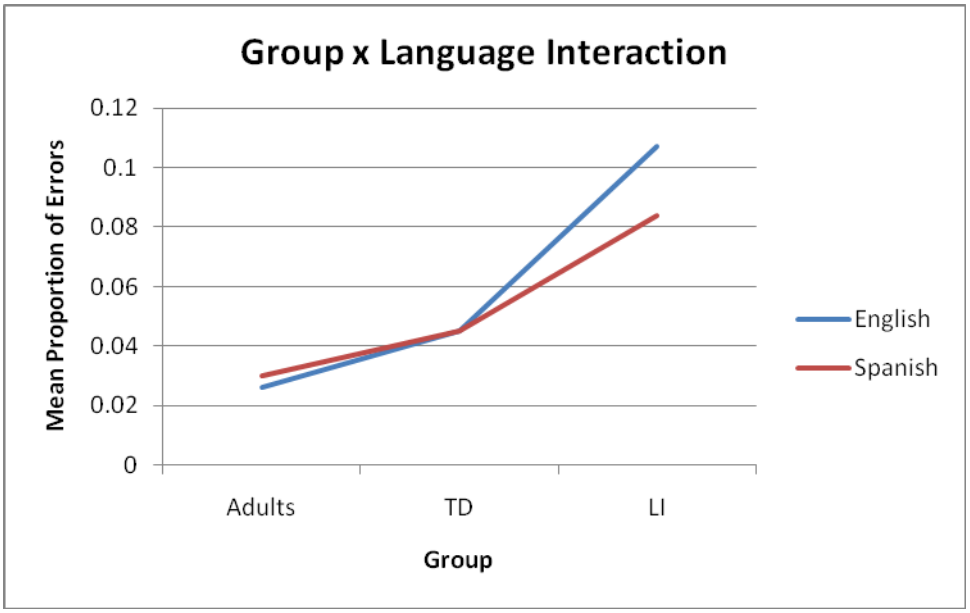
A main effect was found for error type, with a significant difference between the proportions of semantic type errors and the proportion of other type errors produced, $F(1,95) = 6.246$, $p < .014$, $n_p^2 = 0.062$ (Figure 2). For all groups overall, more semantic type errors (M=6.2%) than errors of all other types including repetitions (M=5.0%) were produced.

Figure 2: Mean proportion of errors produced according to type.



Statistical analyses also revealed several significant interactions (refer to Table 3). First, a two-way interaction between group and language was found, $F(2,95) = 4.963$, $p < .009$, $n_p^2 = 0.095$, indicating a significant difference in the mean proportion of errors produced by each participant group according to task language. As seen in Figure 3, the adults and TD children produced similar proportions of errors in both English (M=2.6% and M=4.5%, respectively) and Spanish (M=3.0% and M=4.5%, respectively). In contrast, the LI children produced significantly more errors in English (M=10.7%) than in Spanish (M=8.4%). This finding suggested that although both the TD and the LI children were, as a group, slightly more dominant in Spanish, the children with LI were more vulnerable to the effects of differences in language proficiency than were the children with typical development.

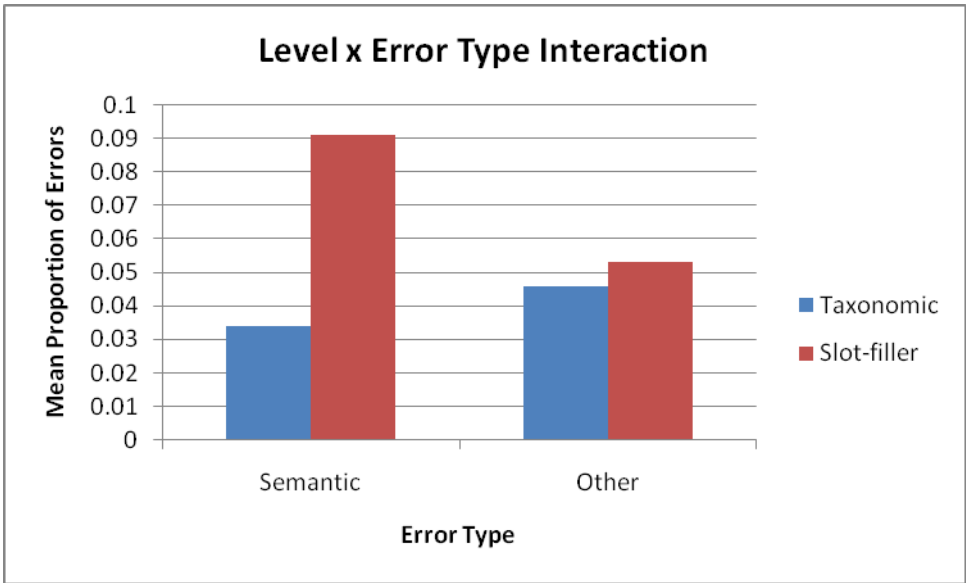
Figure 3: Mean proportion of errors produced by the Adult, TD, and LI groups according to language.



A significant group by level interaction was also found, $F(2,95) = 5.999$, $p < .004$, $n_p^2 = 0.112$. In general, there were more errors made in the slot-filler condition compared to the taxonomic condition (as indicated by the main effect for level). However, the difference between the two levels was considerably greater for the LI children (M=6.9% for taxonomic and M=12.2% for slot-filler) than for the adults or the TD children.

A significant two-way interaction between level and error type was also found, $F(1,95) = 24.37$, $p < .001$, $n_p^2 = 0.204$. As shown in Figure 4, significantly more semantic type errors were produced at the slot-filler level (M=9.1%) than at the taxonomic level (M=3.4%), while slightly more other type errors were produced at the slot-filler level (M=5.3%) compared to the taxonomic level (M=4.6%).

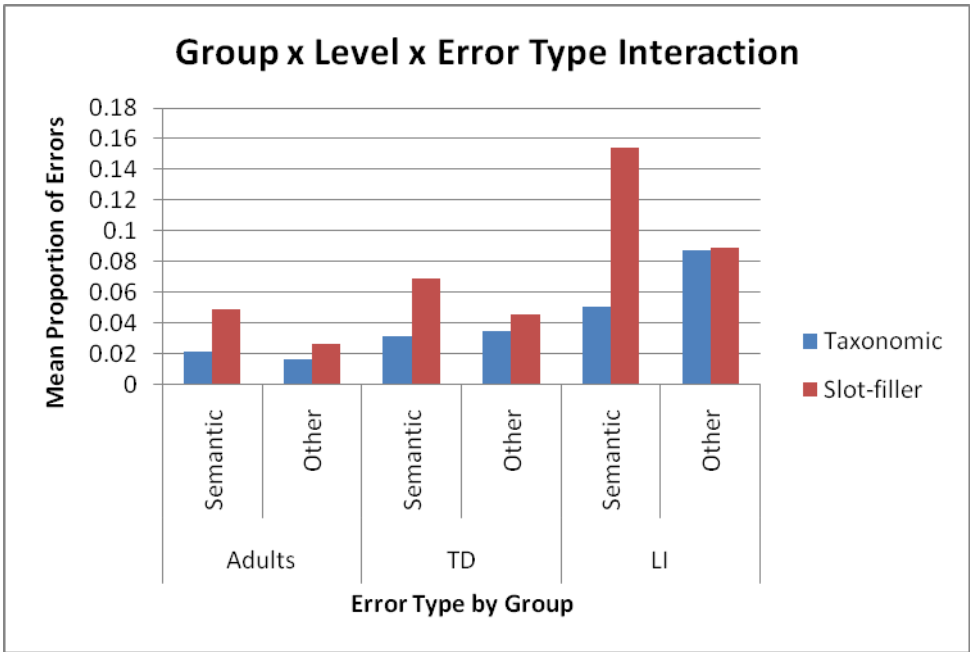
Figure 4: Mean proportion of semantic and other error types produced at each level.



Finally, a three-way interaction between group, level, and error type was found, $F(2,95) = 7.345$, $p < .001$, $n_p^2 = 0.134$. For slot-filler categories and for all groups, semantic errors (adults, M=4.9%; TD, M=6.9%; LI, M=15.4%) were more common than other types of errors (adults, M=2.6%; TD, M=4.6%; LI, M=8.9%; Figure 5). This pattern was not observed for taxonomic categories. While adults and TD children made similar proportions of semantic (M=2.1% and M=3.1%, respectively) and other type errors (M=1.6% and M=3.5%, respectively), children with LI produced significantly more other type errors (M=8.7%) than semantic errors (M=5.1%) in taxonomic categories. For both taxonomic and slot-filler levels, children with LI produced significantly more other type errors than did the adults or TD children. Children with LI also produced significantly more semantic errors in slot-filler categories than did the adults or TD children. These

results suggested that the children with LI had particular difficulty generating appropriate items within the more narrow boundaries of slot-filler categories. They also suggested that the relationship of LI children's errors to the target responses were more often indeterminate than were the errors produced by the adults and TD children groups.

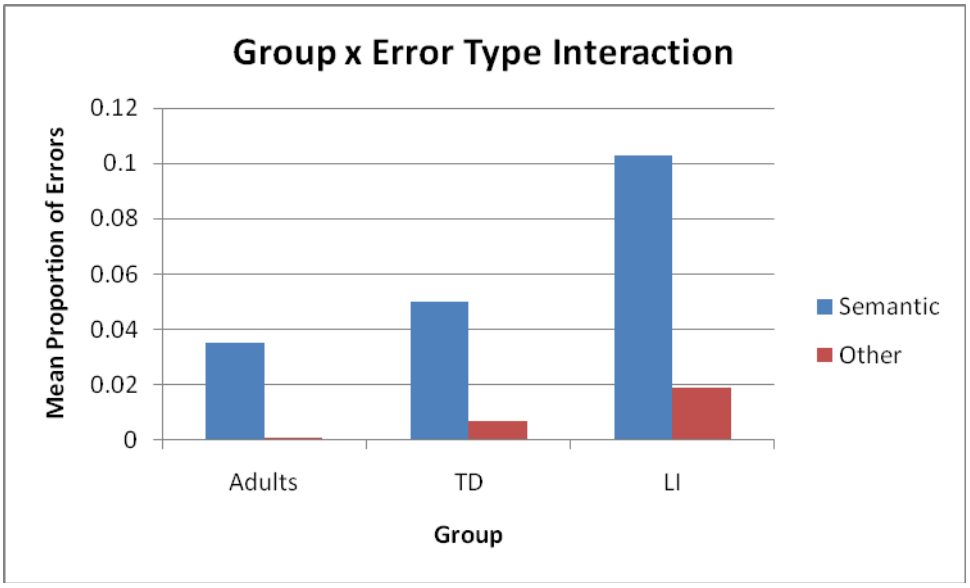
Figure 5: Mean proportion of semantic and other type errors produced by the Adult, TD, and LI groups at each level.



In this first set of analyses, *other* type errors included phonological, indeterminate, and "other" type errors as well as repetitions. During category generation tasks, repetitions occurred relatively frequently for all groups. They also do not reflect the nature of the relationship between the error response and the target response in the way

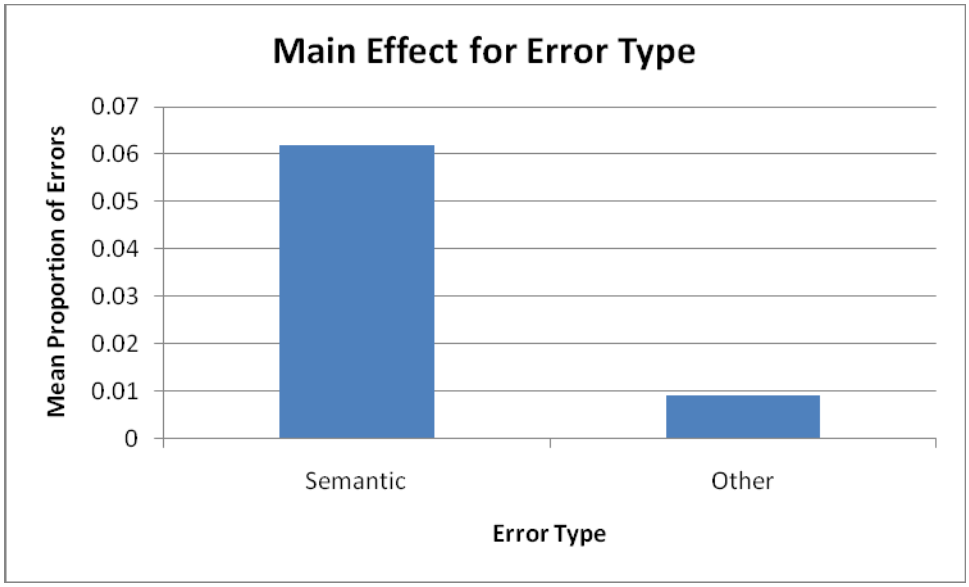
that phonological, indeterminate, and "other" classifications do. For these reasons, a second analysis was conducted in which repetitions were excluded from the *other* type composite and only phonological, indeterminate, and "other" type errors were included. Mean proportions of errors were again entered into a repeated-measures ANOVA. Results revealed the same pattern of main effects and interactions as for the first analysis, with two important exceptions. First, a significant group by error type interaction was found, $F(2,95) = 12.649$, $p < .001$, $n_p^2 = 0.21$, indicating that when repetitions were excluded from analysis, types of errors produced during category generation tasks differed significantly according to ability (Figure 6). Children with LI produced significantly more semantic type errors (M=10.3%) than did the adults (M=3.5%) or the TD children (M=5.0%). Though errors of other types (phonological, indeterminate, and "other") were very infrequent for all groups, the children with LI produced significantly more other type errors (M=1.9%) than did the adults (M=0.1%) or the TD children (M=0.7%).

Figure 6: Mean proportion of semantic and other error types produced by Adults, TD, and LI groups.



Second, the effect size for the main effect of error type, $F(1,95) = 147.449$, $p < .001$, $n_p^2 = 0.608$, was considerably larger with repetitions removed from analysis (Figure 7). Semantic errors were by far the most frequent type of error produced during category generation tasks.

Figure 7: Mean proportion of errors produced by type.



Discussion

The purpose of this study was to investigate the types of errors produced by seven to nine-year-old bilingual children with and without LI and typical bilingual adults during category generation tasks similar to those developed by Nelson (1986, 1988). It was predicted that all groups would produce semantic error types more frequently than other types of errors. It was also predicted that bilingual children with LI would demonstrate lexical error patterns similar to those observed in monolingual children with LI. That is, when compared to their typically developing peers, they would produce a greater proportion of errors characterized by an indeterminate or idiosyncratic relationship to the target response. Furthermore, it was predicted that task language would not have a significant effect on types of errors produced, but that both groups of children, who were slightly more dominant in Spanish, may have greater proportions of errors during English tasks. It was also expected that, overall, all participant groups would produce more errors for context-dependent slot-filler categories than for their less restrictive taxonomic counterparts.

Types of Errors Produced Across Groups

Consistent with previous findings (Caramazza & Hillis, 1990; Dapretto & Bjork, 2000; Fried-Oken, 1984; Fromkin, 1987; German, 1982; Goodglass *et al.*, 1966; Lahey & Edwards, 1999; McGregor, 1997; McGregor, Newman *et al.*, 2002; Tager-Flusberg,

1986; Wiegel-Crump & Dennis, 1986; Wijnen, 1992), semantic errors were the most common type of error produced by all participant groups in the present study. Semantic substitution errors bear a logical relationship to the target response but suggest an incomplete representation of the target item in the lexical storage system (Kail *et al*., 1984; McGregor, 1997; McGregor, Newman *et al.*, 2002). In the present study, bilingual children with LI produced a significantly higher proportion of semantic type errors compared to the typical groups. Typical children produced a slightly higher proportion of semantic errors compared to the adults. As both groups of children had, on average, similar levels of experience with each of their languages, this difference reflects the impact of the role of language ability on the development of robust semantic representations and networks. Though the role of experience had an effect, as demonstrated by the difference between the performance of typical children and typical adults, the effect was much smaller by comparison. Ability was the most significant predictor of category knowledge development based on the quality of semantic representations in the lexical storage system.

The kinds of semantic errors produced provide further insight into the nature and quality of bilingual children's and adults' semantic representations. Children with LI produced more unrelated semantic substitutions, in particular, compared with the typical groups. Errors such as "door knob" in the *lunch foods* slot-filler category and "bubble gum" in the *all clothing* taxonomic category demonstrate the kinds of unrelated substitutions produced by the children with LI. Such substitutions, like other kinds of

errors in which the relationship to the target response was less clear, suggest a lack of stored information for semantic concepts that contributes to deficient semantic network connections. Having exhausted a limited system of stored concepts for a particular category, children may reach for responses haphazardly if they feel the need to produce longer lists.

With respect to the second prediction, the results of the present study revealed a significant effect for error type based on group when semantic types of errors were compared to a composite of phonological, indeterminate, and "other" types of errors. When compared to their typical peers as well as to typical adults, bilingual children with LI produced, on average, significantly more errors within this *other* type composite. The majority of these errors were indeterminate and "other" type errors, for which the relationship to the target response was idiosyncratic or could not be determined. These results are consistent with findings of previous studies of monolingual children. McGregor (1997) and McGregor and Waxman (1998) found that monolingual preschoolers with LI produced a significantly higher proportion of indeterminate errors than did their TD peers during naming tasks. McGregor, Newman *et al*. (2002) also found that school-aged children with LI produced a greater number of indeterminate errors than did their TD peers during a naming task.

Qualitative analysis of these *other* types of errors, including repetitions, produced during category generation tasks in the current study revealed that children with LI were much more likely than the typical participants to repeat items previously generated for a

given category prompt (refer to Table 4 in the Appendix). On average, children with LI repeated items more often than both the TD children and the typical adults for 10 of the 12 category prompts. These repetitions were often slight variations of previously mentioned items, e.g., “muchos/many x,” “dos/two x,” or “más/more x,” and “baby chicken” or “small horse.” The adults and TD children also repeated items with relative frequency compared to most other types of error responses. The adults were especially likely to produce repetitions because of the large quantity of items generated for each prompt; they produced more repetitions on average than the TD children for 8 of the 12 prompts.

In addition to repetitions, bilingual children with LI were more likely than other groups to produce errors that were unintelligible or were auditory misperceptions of the prompt (i.e., “other” responses) and those with an indeterminate relationship to target responses (i.e., “indeterminate” responses). Unintelligible responses and misperceptions of the category prompt were produced more often, on average, by children with LI for 8 of the 12 prompts. Interestingly, children with LI appeared to have misperceived the prompt only for those presented in English. One child, for example, perceived “clothes” as “clues,” another perceived “clothes” as “colors,” and another perceived “foods” as “foots.” Each child in each case responded based on these perceptions of the prompt. Children with LI may experience subtle deficits in their ability to perceive and process acoustic-phonetic and prosodic characteristics of spoken language (Dollaghan, 1998; Ellis Weismer & Hesketh, 1996, 1998; Rice, Buhr, & Oetting, 1992). Such deficits may

impact their ability to later analyze and use words for semantic purposes by overburdening their working memory and decreasing available cognitive resources (Brackenbury & Pye, 2005). Unintelligible responses, though very rare, were also produced almost exclusively by children with LI. These types of errors reflect general language processing difficulties experienced by children with LI that may be intensified by decreased proficiency in one language compared to the other.

Effect of Task Language

The finding of a significant interaction between participant group and task language provides further evidence for the implications of language experience and ability on category generation performance. While the adults and TD children produced similar proportions of errors in both English and Spanish, the LI children produced significantly more errors in English than in Spanish. Although the TD and LI children, in general, were comparable to each other in levels of experience with each of their two languages, this finding suggested that the groups' slight dominance in Spanish had a greater impact on the group with impaired language ability than it did on the group with typical language skills.

According to the phonological loop hypothesis proposed by Baddeley and colleagues (e.g., Baddeley, 1986, 2003; Gathercole & Baddeley, 1990), children with LI experience word-learning deficits because of difficulties storing and rehearsing new auditory stimuli in short-term memory. They consequently lose all or part of the

phonological information required for learning new words and morphemes. Such difficulties with new-word learning may occur more frequently in the language whose phonological structure is less familiar to an unbalanced bilingual child. Not having learned a sufficient number of words to appropriately respond to a category generation task, a child may produce errors, particularly during tasks in the less familiar language.

Effect of Task Condition

Finally, it was found that, as predicted, significantly more errors were produced in slot-filler categories than in taxonomic categories for all groups overall. Errors may have been more commonly produced in slot-filler categories for two reasons. First, these categories require the production of more specific responses than do the broader, less restrictive taxonomic categories. Second, performance on slot-filler category generation tasks is heavily based upon experience with a particular slot-filler event. Without experience with a particular event, such as animals one finds on a farm or clothes one wears in cold weather, one may be less familiar with the schema associated with that event. He or she, therefore, may be more likely to produce items within the same hierarchical category, but not a part of the specific event schema, when at a loss for appropriate responses.

Furthermore, an interaction was found between level and the types of errors produced. Semantic errors, particularly taxonomic coordinate substitutions (e.g., “bear” for “horse”), were more commonly produced in slot-filler categories than in taxonomic

categories by all groups because, by definition, coordinate (basic-level) substitutions cannot occur in taxonomic categories (refer to Table 4 in the Appendix). The only exclusionary criterion when naming taxonomic category exemplars is non-membership at a broad taxonomic hierarchical level (e.g., animals, foods). Slot-filler categories, in contrast, explicitly restrict exemplars to those bound to a particular event. While both "cow" and "monkey" belong to the overarching taxonomic category of *animals*, only "cow" is acceptable in the corresponding slot-filler category of *farm animals*.

The difference between performance on the slot-filler and taxonomic levels was considerably greater for the LI children than it was for the adults or the TD children. Children with LI may have been particularly vulnerable to the narrower boundaries of slot-filler categories. Semantic coordinate substitutions, such as "giraffe" in the slot-filler category *farm animals*, were the most common type of error produced in slot-filler categories. As McGregor, Newman and colleagues (2002) suggested based on their results of monolingual children with LI, the bilingual children with LI in the current study may have an insufficient amount of information represented in semantic memory to allow distinctions between close semantic coordinates.

The LI children's differential performance on slot-filler and taxonomic categories may also be a function of the degree to which they had experience with each slot-filler event. Varying degrees of experience could have significantly impacted their ability to generate event-specific items. In their study on typical monolingual children, Nelson and Nelson (1990) found that kindergartners with preschool experience produced more

appropriate items on category generation tasks than those without preschool experience. They concluded that knowledge of categories is both a function of the child's own organization and of his experiences with his environment (Nelson & Nelson, 1990). The effect of a possible lack of familiarity with any particular event experienced by bilingual children with LI in the current study may have been exacerbated by having to divide experience bases between each of their two languages.

In conclusion, the results of this study augment existing knowledge of bilinguals' lexical-semantic organization and development of category knowledge across the lifespan. Results suggest that seven to nine-year-old bilingual children's and bilingual adults' proportions and types of errors produced on category generation tasks differ significantly based on ability (i.e., TD or LI) but not on experience (i.e., TD or Adults). These findings increase understanding of the degree and kind of deficits that characterize the lexical-semantic systems of bilingual children with language impairment.

Appendix

Table 4: Mean proportions of error subtypes by group and language for each category prompt.

Error Subtype by Group	**Language**	**Category Prompt**					
		Animals	Farm Animals	Clothing	Cold Clothing	Foods	Lunch Foods
TD children							
Semantic Taxonomic Coordinate	English	0.000	0.371	0.000	0.029	0.000	0.257
	Spanish	0.000	0.400	0.000	0.029	0.000	0.114
Semantic Taxonomic Superordinate	English	0.000	0.000	0.114	0.029	0.057	0.000
	Spanish	0.029	0.000	0.086	0.029	0.057	0.000
Semantic Thematic	English	0.057	0.029	0.114	0.114	0.429	0.229
	Spanish	0.114	0.086	0.143	0.143	0.343	0.486
Semantic Descriptive	English	0.029	0.029	0.000	0.114	0.000	0.000
	Spanish	0.000	0.000	0.000	0.200	0.057	0.000
Semantic Unassociated	English	0.000	0.057	0.143	0.029	0.000	0.000
	Spanish	0.029	0.000	0.000	0.029	0.029	0.000
Phonologic	English	0.000	0.000	0.000	0.000	0.000	0.000
	Spanish	0.000	0.000	0.000	0.000	0.000	0.000
Indeterminate	English	0.000	0.000	0.000	0.114	0.000	0.000
	Spanish	0.029	0.000	0.029	0.171	0.000	0.029
Other	English	0.000	0.000	0.057	0.000	0.029	0.000
	Spanish	0.114	0.057	0.000	0.000	0.000	0.000

Repetitions	English	0.571	0.457	0.171	0.314	0.143	0.114
	Spanish	0.457	0.400	0.400	0.143	0.143	0.171
LI children							
Semantic Taxonomic Coordinate	English	0.000	1.270	0.000	0.027	0.000	0.189
	Spanish	0.000	1.000	0.000	0.054	0.000	0.270
Semantic Taxonomic Superordinate	English	0.027	0.000	0.081	0.054	0.000	0.027
	Spanish	0.000	0.027	0.054	0.000	0.027	0.000
Semantic Thematic	English	0.108	0.135	0.189	0.297	0.378	0.919
	Spanish	0.054	0.216	0.135	0.135	0.676	0.784
Semantic Descriptive	English	0.054	0.000	0.000	0.108	0.108	0.027
	Spanish	0.000	0.000	0.027	0.081	0.000	0.000
Semantic Unassociated	English	0.135	0.270	0.108	0.027	0.189	0.027
	Spanish	0.135	0.270	0.081	0.054	0.000	0.054
Phonologic	English	0.027	0.027	0.000	0.000	0.000	0.000
	Spanish	0.027	0.000	0.000	0.000	0.000	0.000
Indeterminate	English	0.027	0.000	0.000	0.270	0.027	0.108
	Spanish	0.000	0.027	0.027	0.135	0.027	0.000
Other	English	0.081	0.027	0.432	0.027	0.000	0.000
	Spanish	0.108	0.054	0.027	0.054	0.054	0.027
Repetitions	English	0.784	0.676	0.703	0.405	0.568	0.405
	Spanish	0.676	0.676	0.838	0.649	0.324	0.297
Adults							
Semantic Taxonomic Coordinate	English	0.000	0.346	0.000	0.000	0.000	0.115
	Spanish	0.000	0.423	0.000	0.038	0.038	0.385

Semantic Taxonomic Superordinate	English	0.000	0.000	0.077	0.038	0.346	0.231
	Spanish	0.000	0.000	0.077	0.038	0.000	0.000
Semantic Thematic	English	0.000	0.038	0.346	0.346	0.577	0.462
	Spanish	0.000	0.077	0.423	0.115	0.769	1.077
Semantic Descriptive	English	0.000	0.038	0.038	0.077	0.038	0.000
	Spanish	0.000	0.000	0.000	0.077	0.000	0.000
Semantic Unassociated	English	0.000	0.000	0.000	0.000	0.000	0.000
	Spanish	0.000	0.000	0.000	0.000	0.000	0.000
Phonologic	English	0.000	0.000	0.000	0.038	0.000	0.000
	Spanish	0.000	0.000	0.000	0.000	0.000	0.000
Indeterminate	English	0.000	0.000	0.000	0.000	0.000	0.000
	Spanish	0.000	0.000	0.000	0.000	0.000	0.000
Other	English	0.000	0.000	0.000	0.000	0.077	0.000
	Spanish	0.000	0.000	0.000	0.000	0.038	0.000
Repetitions	English	0.462	0.462	0.423	0.500	0.269	0.231
	Spanish	0.346	0.269	0.269	0.269	0.154	0.385

References

Baddeley, A. (1986). *Working memory*. Oxford, England: Oxford University Press.

Baddeley, A. (2003). Working memory and language: An overview. *Journal of Communication Disorders, 36,* 189-208.

Bedore, L.M., & Peña, E.D. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*(1), 1-29.

Brackenbury, T., & Pye, C. (2005). Semantic deficits in children with language impairments: Issues for clinical assessment. *Language, Speech, and Hearing Services in Schools, 36,* 5-16.

Butterworth, B. (1989). Lexical access in speech production. In W. Marslen-Wilson (Ed.), *Lexical representation and process* (pp. 108-135). Cambridge, MA: MIT Press.

Caramazza, A., & Hillis, A. (1990). Where do semantic errors come from? *Cortex, 26,* 95-122.

Dapretto, M., & Bjork, E.L. (2000). The development of word retrieval abilities in the second year and its relation to early vocabulary growth. *Child Development, 71*(3), 635-648.

Dollaghan, C.A. (1998). Spoken word recognition in children with and without specific language impairment. *Applied Psycholinguistics, 19,* 193-207.

Ellis Weismer, S., & Hesketh, L. (1996). Lexical learning by children with specific language impairment: Effects of linguistic input presented at varying speaking rates. *Journal of Speech, Language, and Hearing Research, 39,* 177-190.

Ellis Weismer, S., & Hesketh, L. (1998). The impact of emphatic stress on novel word learning by children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 41,* 1444-1458.

Fried-Oken, M. (1984). The development of naming skills in normal and language deficient children. Unpublished doctoral dissertation, Boston University, Boston, MA.

Fromkin, V.A. (1987). The lexicon: Evidence from acquired dyslexia. *Language, 63*, 1-22.

Gathercole, S.E., & Baddeley, A.D. (1990). Phonological memory deficits in language disordered children: Is there a causal connection? *Journal of Memory and Language, 29*, 336-360.

German, D.J. (1982). Word-finding substitutions in children with learning disabilities. *Language, Speech, and Hearing Services in Schools, 13*, 223-230.

Gillam, R.B., & Pearson, N.A. (2004). *Test of Narrative Language*. Austin, TX: ProEd.

Gollan, T.H., Montoya, R.I., & Werner, G.A. (2002). Semantic and letter fluency in Spanish-English bilinguals. *Neuropsychology, 16*(4), 562-576.

Goodglass, H., Klein, B., Carey, P., & Jones, K. (1966). Specific semantic word categories in aphasia. *Cortex, 2*, 74-89.

Inhelder, B., & Piaget, J. (1964). *The early growth of logic in the child*. New York: Harper & Row.

Kail, R., Hale, C.A., Leonard, L.B., & Nippold, M.A. (1984). Lexical storage and retrieval in language-impaired children. *Applied Psycholinguistics, 5*, 37-49.

Kail, R., & Leonard, L.B. (1986). *Word-finding abilities in language-impaired children* (ASHA Monographs 25). Rockville, MD: American Speech-Language-Hearing Association.

Lahey, M., & Edwards, J. (1996). Why do children with specific language impairment name pictures more slowly than their peers? *Journal of Speech, Language, and Hearing Research, 39*, 1081-1098.

Lahey, M., & Edwards, J. (1999). Naming errors of children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 42*, 195-205.

Leonard, L., Nippold, M., Kail, R., & Hale, C. (1983). Picture naming in language impaired children. *Journal of Speech and Hearing Research, 26*, 609-615.

Levelt, W.J.M. (1991). Accessing words in speech production: Stages, processes and representations. In W.J.M. Levelt (Ed.), *Lexical access in speech production* (pp. 1-2). Cambridge, MA: Blackwell.

Lucariello, J., Kyratzis, A., & Nelson, K. (1992). Taxonomic knowledge: What kind and when? *Child Development, 63*(4), 978-998.

McGregor, K.K. (1997). The nature of word-finding errors of preschoolers with and without word-finding deficits. *Journal of Speech, Language, and Hearing Research, 40*(6), 1232-1244.

McGregor, K.K., Friedman, R.M., Reilly, R.M., & Newman, R.M. (2002). Semantic representation and naming in young children. *Journal of Speech, Language, and Hearing Research, 45*, 332-346.

McGregor, K.K., Newman, R.M., Reilly, R.M., & Capone, N.C. (2002). Semantic representation and naming in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 45*, 998-1014.

McGregor, K.K., & Waxman, S.R. (1998). Object naming at multiple hierarchical levels: A comparison of preschoolers with and without word-finding deficits. *Journal of Child Language, 25*, 419-430.

Nelson, K. (1973). Some evidence for the cognitive primacy of categorization and its functional basis. *Merrill-Palmer Quarterly Journal of Behavior and Development, 19*, 21-39.

Nelson, K. (1986). *Event knowledge: Structure and function in development*. Hillsdale, NJ: Erlbaum.

Nelson, K. (1988). Where do taxonomic categories come from? *Human Development, 31*, 3-10.

Nelson, K., & Nelson, A.P. (1990). Category production in response to script and category cues by kindergarten and second-grade children. *Journal of Applied Developmental Psychology, 11*, 431-446.

Peña, E.D., Bedore, L.M., & Zlatic-Giunta, R. (2002). Category-generation performance of bilingual children: The influence of condition, category, and language. *Journal of Speech, Language, and Hearing Research, 45*, 938-947.

Peña, E., Gutiérrez-Clellen, V., Iglesias, A., Goldstein, B., & Bedore, L. (in development). *Bilingual English Spanish assessment*. Unpublished assessment tool.

Portocarrero, J.S., Burright, R.G., & Donovick, P.J. (2007). Vocabulary and verbal fluency of bilingual and monolingual college students. *Archives of Clinical Neuropsychology, 22*, 415-422.

Restrepo, M.A. (1998). Identifiers of predominantly Spanish-speaking children with language impairment. *Journal of Speech, Language, and Hearing Research, 41*, 1398-1411.

Rice, M., Buhr, J., & Oetting, J. (1992). Specific-language-impaired children's quick incidental learning of words: The effect of a pause. *Journal of Speech and Hearing Research, 35*, 1040-1048.

Roberts, P.M., & Le Dorze, G. (1997). Semantic organization, strategy use, and productivity in bilingual semantic verbal fluency. *Brain and Language, 59*, 412-449.

Rosch, E., Mervis, C.B., Gray, W.D., Johnson, D.M., & Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology, 8*, 382-439.

Rosselli, M., Ardila, A., Araujo, K., Weekes, V.A., Caracciolo, V., Padilla, M., & Ostrosky-Solís, F. (2000). Verbal fluency and repetition skills in healthy older Spanish-English bilinguals. *Applied Neuropsychology, 7*(1), 17-24.

Tager-Flusberg, H. (1986). Constraints on the representation of word meaning: Evidence from autistic and mentally retarded children. In S.A. Kuczaj & M. Barret (Eds.), *The development of word meaning* (pp. 69-81). New York: Springer-Verlag.

Wiegel-Crump, C.A., & Dennis, M. (1986). Development of word-finding. *Brain and Language, 27*, 1-23.

Wijnen, F. (1992). Incidental word and sound errors in young speakers. *Journal of Memory and Language, 31*(6), 734-755.

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