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Language and the Developing Organization of Bilingual Memory in Children

by

Calliope Haritos

**A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment
of the requirements for the degree of Doctor of Psychology, The City University of
New York.**

1996

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Abstract

Language and the Developing Organization of Bilingual Memory in Children

by

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The issue of bilingual memory organization is examined with respect to general issues of storage, event representations, encoding, organization of storage, and retrieval issues. The developing role of language and the language-thought relationship with respect to organization of bilingual memory is also explored. Bilingual English-Greek children in the first, third, and fifth grade, heard two stories over the course of two days. On the third day they were asked to recall all foods from the two stories. Each story consisted of two events, a breakfast and a party. Each event was presented in a different language (English or Greek). Monolinguals were presented with the same stories as well. Recall was measured in terms of mean number of total foods remembered, story one foods, story two foods, party foods, and breakfast foods. A second recall measure was the Adjusted Ratio of Clustering(ARC). Recall was analyzed for story, event, and LP (language of presentation) clustering. A 3(Grade) X 2(Event) X 2(Language of Presentation) ANOVA with repeated measures on the last two factors produced a Main effect for Grade, a Main effect for Event, a Main effect for Language of Presentation, and a three-way Interaction. There were significant gains in memory, with age. Memory preferences were reported for

party foods and foods presented in Greek. Cluster analyses revealed the importance of event clustering, the decline of story clustering with age and the failure for LP to emerge as a significant recall organizer. Bilingual memory organization is discussed with respect to the changing role of language for bilinguals, which afforded them the cognitive opportunity to maximize their recall performance. They remembered significantly more foods, overall, than monolinguals of the present study, suggesting that complexity in organization can be beneficial, with respect to bilingual recall performance.

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Chapter 1. Introduction

The dynamics of the developing relationship between language and thought suggest an interdependence that becomes even more apparent if one considers the fact that the origins of such a relationship are rooted in the socio-historic environment in which one initially acquires, uses, and develops her or his language and thought capacities, that is, in the culture in which one speaks and thinks. The ability of bilingual individuals to speak and/or think in either one or both of their languages and the fact that such an ability may be strengthened or weakened depending upon bilinguals' language socialization history, namely, familial and societal patterns of language use at a given time, illustrates the fact that the language(s)-thought relationship is not static and may develop in a variety of ways over the course of a bilingual individual's life. It follows that any given path of development may result in a somewhat different organization of knowledge, for the bilingual in question, depending upon his or her societal activities and/or practices.

One way to examine the dynamics of the relationship between language(s) and thought, including how these cognitive domains interact with one another, is through memory. Cognitive models of memory, focused on its components or contents are limited in that they fail to delineate the possible origins of their constituents as well as the various processes by which they may be assembled and subsequently reorganized as one's language and thinking abilities develop as one interacts in her or his world. The development of memory is even more complex

for bilingual individuals who engage in a variety of activities and may organize knowledge from such activities in either one or both of their languages.

Researchers attempting to explain bilingual memory have based their descriptions on studies using memory tasks involving word lists; in contrast the present study uses story recall tasks. Most bilingual children are exposed to a variety of stories from a very young age and are quite adept in listening to and retelling such stories in both their languages as well as translating material from one of their languages to the other (Haritos & Nelson, 1993).

The goal of the present study is to examine how bilingual children organize knowledge presented to them in the context of real world activities for the purpose of subsequent recall. From a strong Whorfian (Whorf, 1956a) standpoint, it is logical to assume that bilinguals will remember things in language specific ways. This, in fact, has been the major debate in the literature, that is, do bilinguals have language specific semantic memory stores (dual storage systems) or a common semantic memory store that draws upon both languages? Vygotsky (1962) has suggested that it is the interdependent relationship of one's language(s) with one's thought processes within one's culture, that influences the way individuals organize knowledge from the world. It is possible that individuals, including bilingual individuals, have multiple codes of thinking and remembering which undergo diverse organization and reorganization depending upon one's own personal predispositions and one's context of socialization, such as the school or home setting. This has been termed "cognitive pluralism" (John-Steiner, 1984).

It is important to note that “thought”, a key factor in the process of comprehension, is observed in the present study through a subject’s memory, whereas “language” refers to the language in which the subjects hear the stories and the language in which subjects are asked to retell information from each of the stories. Thus, as always, any conclusions that will or can be made regarding linguistic influences on thought will and should be limited by researchers’ definitions of terms.

Linguistic Influence of Thought: Clarification of Terms

Historical Perspectives

The study of linguistic relativity dates back to Von Humboldt (1836/1988:60) who claimed that every language is characterized by a particular world view. It was further developed by Weisberger and Trier, in the German speaking countries, and then constituted, independently of these scholars by Boas (1858-1942), Sapir (1884-1939), and Whorf (1897-1941) in the United States.

“Language” for Boas (1911) reflected elementary psychological functioning, its universal character, as well as specific historical experience, that is, its variability. He claimed that language categories reflect or express conceptual ideas, which he termed “thought”, and further, that every language represents a classification of experience which is so automatic that it lies outside the sphere of

conscious awareness. His later writings suggested language specific influences on thought as is evident from the following passage:

“The categories of grammar compel us to see the world arranged in certain definite conceptual groups which, on account of our lack of knowledge of linguistic processes, are taken as objective categories and which therefore impose themselves upon the form of our thoughts” (Boas, 1920/1966c, p289).

Sapir (1921/1949e) defined “language” as a particular “how” of thought. He claimed that it is only through language that one is led to “fully conceptual thought,” as illustrated in the following passage:

“It is indeed in the highest degree likely that language is an instrument originally put to uses lower than the conceptual plane and that thought arises as a refined interpretation of its content” (Sapir, 1921/1949e pp. 14-15).

Sapir also argued that the linguistic forms or language categories of any given language, as well as the individual experiences they represent, cohere into a formally complete yet incommensurate system. Further, such linguistic forms have a tyrannical hold upon one’s orientation to the world.

“Human beings don’t live in the objective world alone, nor alone in the world of social activity as ordinarily understood but are very much at the mercy of the particular language which has become the medium of expression for their society. No two languages are ever sufficiently similar to be considered as representing the same social reality. The worlds in which different societies live are distinct worlds, not merely the same worlds with different labels attached”
(Sapir, 1929/1949b p162).

“It would be possible to go on indefinitely with such examples of incommensurable analyses of experiences in different languages. The upshot of it all would be to make very real to us a kind of relativity that is generally hidden from us by our naive acceptance of fixed habits of speech as guides to an objective understanding of the nature of experience. This is the reality of concepts or as it might be called, the relativity of the form of thought”
(Sapir 1924/1949c p15).

Although Boas and Sapir laid the groundwork for the thesis of linguistic relativity, it is the work of Benjamin Lee Whorf, a student of Sapir, which has been most readily associated with the notion of language as a “shaper” of thought. In fact the following passage is almost always cited by scholars when referring to linguistic influences on thought.

“What I have called the "linguistic relativity principle" means in informal terms that users of markedly different grammars are pointed by their grammars toward different types of observations and hence are not equivalent as observers but must arrive at somewhat different views of the world” (Whorf, 1956a p221).

Although Whorf has been identified by researchers as a strong linguistic determinist, deeper analysis of his writings indicates that when Whorf (1956a) discussed linguistic influences on thought he had rather specific definitions of the terms “grammar, language, and thought”, each of which were a bit different from our everyday uses of such terms. In some instances, Whorf questions the existence of “language” as we know it.

“My own studies suggest to me that language for all its kingly role is in some sense a superficial embroidery upon deeper processes of consciousness, which are necessary before any communication, signaling, or symbolism whatsoever can occur, and which also can at a pinch effect communication (though not true agreement) without language’s and without symbolism’s aid... It may even be in the cards that there is no such thing as "Language" (with a capital L) at all” (Whorf, 1956a p158).

On the matter of “thought” Whorf stated:

“The statement that thinking is a matter of language is an incorrect generalization of the more nearly correct idea that thinking is a matter of tongues. The different tongues are the real phenomena and may generalize down not to any such universal as “language” but to something better called sublinguistic or superlinguistic and not altogether unlike, even if much unlike what we now call mental” (Whorf, 1956a p239).

For Whorf the conceptual differences between languages:

“do not depend so much upon any one system (tense or nouns) within grammar as upon ways of analyzing and reporting experience which have become fixed in the language as integrated “fashions of speaking” and which cut across typical grammatical classifications so that such a fashion may include lexical, morphological, syntactic, and otherwise systematically diverse means coordinated in a certain frame of consistency” (Whorf, 1956a p158).

It appears that the statement “language or grammar influences thought” does not grasp the essence of what Whorf was trying to explain. Lucy (1987) has pointed out that what Whorf stressed was the importance of large scale linguistic

patterns in particular languages and their relation to thought as well as the inadequacy of analyzing a single linguistic element such as a lexeme in isolation from its associated patterns. A more succinct statement of Whorf's thesis would be that the "fashions of speaking" of a language influence the habitual thought worlds of the speakers of that language. Whorf (1956a) defines the former as linguistic representations of reality and the latter as the microcosm each man carries about within himself by which he measures and understands what he can of the macrocosm. This influence or interaction which Whorf described is unconscious to the speaker/thinker in question.

The Developing Relationship of Language and Thought:

Whether or not one supports a strong determinist position, namely that language determines thought, or even a weaker version, that is, that language influences or guides thought, this subject is bound to continue to produce controversial debates depending upon the way one defines "language" and/or "thought". It is evident from the examples above that there exists a variety of usage of such terms and that many of them may not be applicable to bilingual individuals. A more worthwhile endeavor, perhaps would be to attempt to explain the relationship between language and thought.

The importance of cultural considerations when discussing the relationship of language to thought was acknowledged by Whorf (1956a p 156), who asked and

answered: “Which was first; the language patterns or the cultural norms; in the main they have grown up together, constantly influencing each other”. The necessity of understanding the dynamics of the relationship between culture, language, and thought is evident from the fact that we do not “talk, think, or live” in a world of isolation but are products of specific language socialization histories, which are not only crucial to the understanding of the varied nature of bilingual development, but also contribute to the “microcosm” presumably carried within ourselves, which will in turn affect our perceptions of the world, namely our “world view”. The importance of socialization has also been noted by Vygotsky (1962) who stated that if it were not for “socialization” the mental capacities of “language” and “thought” would remain unrelated.

It appears that certain questions pertaining to the relationship of language to thought need to be addressed so as to better comprehend the development of such a relation. First, how is it that language enters into cognition? Second how is the reorganization of cognitive structures affected by the use of language for various functions? And third how do what Vygotsky terms “higher mental processes” emerge from language experience? Nelson (1993) has noted that such questions have been neglected in discussions pertaining to language. Such matters become even more complex in bilinguals who have two languages in their repertoire.

Concrete versus Abstract thinking

The answers to the above questions are addressed, albeit indirectly, in Luria's (1976) discussion of the cultural and social foundations of cognitive development. Language and thought are not depicted as isolated units which develop separately, but as interdependent entities, with common sociohistoric roots, which continuously interact with one another and co-develop via culture. Luria (1976) pointed out the complexity of the cognitive processes involved in one's perceptual ordering of the world as well as the vehicle through which the encoding and analysis of life's experiences is made possible, namely, language. Children assimilate language, which is a ready made product of their social history, and use it to develop relationships with the many objects or "things" from which their world is comprised. They name these things with historically established phrases or expressions and assign them to certain categories depending upon the dominant type of activity in their culture or society. For Luria (1976), activity also determines the structure of the individual's thought or cognitive processes. Practical or Situational thinking in which "things" are categorized by way of their incorporation into graphic, functional situations drawn from life and reproduced from memory, predominates in societies characterized by the practical manipulation of objects, whereas Abstract/Theoretical or Categorical thinking, in

which objects are sorted into logical, general type categories, predominates in societies that consist of more “abstract” forms of “theoretical” activity.

Language, then, according to Luria (1976) enters into cognition as a mediator of perception resulting in the encoding of impressions into words, which not only carry meaning but represent “units of consciousness” reflecting the external world. The relationship between language and perception is not a static one in that it is constantly under the influence of societal human practices, which are subject to change. These practices can alter the system of codes we use to process incoming information and also influence our decisions pertaining to the categorization of objects, making this entire cognitive process extremely complex.

While Luria marks the entrance of language into cognition as that of mediator, Vygotsky (1962) assigns language a more powerful role, that as a reorganizer of cognitive structures or processes. Although transitions in different types of thinking are often characterized by cognitive reorganization, the question that needs to be addressed in the present discussion is one mentioned earlier, namely, how the use of language for various functions affects this reorganization. The role of language in this regard is best understood by considering that language consists of words, which for Vygotsky (1962) signify different things at different stages of development. Not only do the meanings of words develop and change but the psychological processes that govern their use also change, depending upon the pertinent socioeconomic and sociocultural factors of the time (Vygotsky, 1962).

For example, in “concrete” thinking, where comparisons among objects are based on such graphic perceptions as size or color, words are not used as independent means of classification but rather to establish practical interrelationships between objects. The psychological elements that govern this type of thinking are based on one’s daily, visual, sensory, and practical experiences and memories. In “abstract” or “taxonomic/conceptual” thinking, where objects are grouped according to distinct attributes and categorized via their relation to some abstract concept, words become and are used as tools for formulating abstractions and generalizations. The psychological elements that govern this latter type of thinking are thus based on societal experience conveyed through the linguistic system (Luria, 1976).

The transition from visual or concrete thinking to more abstract, theoretical, conceptual forms of thinking is in effect facilitated by the changing role of language via word use and the development of word meaning resulting in a reorganization of cognitive structures. Vygotsky (1962) stated that while concrete ideas or emotional impressions color the meaning of words in the early stages of development and thinking, their meaning will be subsequently governed by a historically developed semantic system, that is, language, where words produce abstractions and generalizations. If we accept Luria’s and Vygotsky’s characterizations of concrete, situational thinking as simple, graphic, and memory based, related to societal activity rooted in practical operations, as opposed to abstract, conceptual thinking that is more logical, complex and mature, associated

with theoretical operations that children learn to perform in school, and we also accept the role of language as facilitator in the transition from simple, concrete thinking to mature, abstract thinking, then we can make some headway in addressing the third question posed earlier in this discussion: How the “higher mental processes” emerge from the language experience.

Development of Spontaneous and Scientific Concepts:

Unsystematic versus Systematic Construction

Luria (1976) whose aim was to analyze sociohistoric shaping of mental processes, claimed that abstract thinking would arise in technical societies that engaged in more abstract forms of theoretical activity. Vygotsky (1962) has pointed out that children learn to perform such theoretical types of operations or cognitive activity in the school environment, once they have acquired and developed what he called “scientific” concepts. These concepts are to be contrasted with the “spontaneous” concepts that children formulate on their own, from everyday activity, prior to the time they begin school. For Vygotsky, concepts develop as word meanings do. Spontaneous and scientific concepts develop in opposite paths in that the former grow up to find abstract, semantic form while the latter grow down to find concrete content. Unlike spontaneous concepts, in which development proceeds from the thing to the concept, scientific

concepts are acquired ready made, via the verbal definition and its use, and proceed to develop from concept to thing.

Differences aside, the mutual interdependence that exists between these two concepts is evident from the fact that once they meet neither one can subsequently develop without the other. Spontaneous concepts provide the concrete materials with which to enter into and comprehend more abstract discourse of schooling and scientific concepts encountered in school context provide the framework for organizing and bringing existing spontaneous concepts under conscious and voluntary control. The shift from spontaneous to scientific concepts, can also be seen as an interaction, really, of two different types of concepts producing a cognitive reorganization facilitated by language, whereby a child begins to engage in reflexive activity and ends up gaining conscious control over his or her own concepts and thinking. This reorganization entails placing one's own spontaneous concepts into a systematic, hierarchical relationship with one's other concepts.

Development of Spontaneous and Scientific Concepts:

Reintegration and Reorganization of Conceptual Knowledge

Although Vygotsky and Luria each have explained how abstract thinking and the development of scientific concepts arise in a school setting, where language becomes a tool that individuals use to formulate generalizations and abstractions, they don't adequately address the consequences of such a development on the individual's prior spontaneous concepts and ways of thinking. Nelson (1995) has

pointed out the importance of understanding the nature of both spontaneous and scientific conceptual systems before attempting to discuss cognitive and/or conceptual changes within the individual. She cautions against labeling the children's knowledge as "theoretical" at some point and then discussing any change as simple movement from one theory to another.

Nelson's (1995) discussion of the development of spontaneous versus scientific concepts is essential in that it questions the misleading dichotomy which Vygotsky (1962) has created between spontaneous concepts, denoted as general, unsystematic, individually constructed knowledge systems, and scientific concepts, which are formal, systematic, and culturally constituted through a society's linguistic system. She makes the important acknowledgment that culture has an impact on the child from the point in which he or she enters and attempts to communicate in the "cultural world". Children initially categorize items in the world to learn their language. They naturally form concepts and categories on the basis of their experience with items in real world activities. It follows that items are conceptualized through their salient function within a child's activities, a process that, according to Nelson, forms a sufficient basis by which a child may acquire words to name all items conceptualized within his or her world. These concepts are therefore not "unsystematic" as Vygotsky termed them, but rather a part of a "natural" prelinguistic representational system based on a child's understanding events in which social activities and asocial objects take part.

From Nelson's perspective, it is rather simplistic and misleading to view development of spontaneous versus scientific concepts as a shift from an individual, unsystematic, conceptual system to a cultural, systematic one in that it suggests developmental discontinuity and a replacement of one type of conceptual system by another. It is more logical to view the process, as Nelson (1995) does, as an integration or coordination of spontaneously developed conceptual knowledge, which is initially organized in a prelinguistic, experience based system and is implicitly constructed by incorporating partial, imperfect, adult-mediated, representations of cultural knowledge systems, with more formal, scientific, cultural systems, explicitly organized and mediated through the conventional language of society. Within this integration concepts are redefined and successively organized in the following order of progression: prelinguistic, linguistic, informal, formal.

Nelson identifies three levels of knowledge organization among children. They first construct their knowledge by their individual, direct experience in the cultural world without the mediation of language. Once they begin to use language, for instance learning the word "food" they attach an event- restricted meaning to the term, interpreting it in a presemantic as opposed to a conventional, cultural system sense. Parents and/or adult caretakers provide the linking mechanism that enables the child to make connections between her or his own organization of world objects and events and those culturally incorporated into a

semantic system of language. Abstractions from activities provide the child with a generalized organization of related knowledge. This knowledge is used as a tool for viewing activities within a larger context of relationships. For instance, returning to our previous example, “food”, at this level, doesn’t just represent “what you eat at lunch” but “anything edible”. Culturally organized knowledge of this kind exists in an informal system partially conveyed to the child through informal home or school instruction. At the third level, theoretical knowledge exists in a formally organized cultural system. Knowledge at this level is not informally accessible to the child through simple exposure to discourse but mastered as an abstract system (Nelson, 1995).

Representation:

Event Schemas

According to Nelson (1982, 1985) our initial level of conceptual representation occurs through event schemas. Semantic structures such as taxonomies, which define relations between referents, are derived from cognitive analyses of this conceptual level. Event representations (ER’s) include sets of possible alternative actors, objects, and actions that play the same role or fill the same function at different occasions. For example there exists a “lunch ER” that contains many food slots. The spatial temporal organization of structure within event schemas is said to underlie knowledge of thematic relations between objects

and functional relations in which different objects enter. Thematic relations consist of objects from distinct taxonomic categories having a complementary, functional relation, for example, “table-stove”. Relations between referents are further defined through the abstraction of paradigmatic relations among the various components of one’s ER’s. An early form of paradigmatic relation to be abstracted, for instance, is the relation existing among different objects that alternatively occupy the same slot in action in an event structure across different occurrences of the same event. Such abstraction is the basis for establishing what is said to be one’s first categorical structures in semantic memory, namely “slot filler categories” (Nelson, 1982, 1985). These higher order categories of objects not only occupy the same function or slot in an event schema across different occurrences of an event, such as “foods that can be eaten for breakfast”, but also are contextually restricted subsets of superordinate categories. The latter refer to categories of objects with the same function in different event schemas, for example, “food” or “clothing”.

Evidence that children possess event based slot filler categories include studies that elicited category production, list recall, forced picture choice, and word association tasks. Subjects produced items from single events, remembered items presented in lists for single events, and chose items from single events in preference to those occurring in different events. Word association studies elicited functional, as opposed to categorical-superordinate responses from preschoolers. For instance, the word “dog” elicited the response “barks” and not “cat” or

“poodle”. Lucariello & Nelson (1985) have suggested that slot filler categories are a closer match to preschoolers’ semantic memory structures as opposed to superordinate categories based on their findings of higher rates of clustering and recall on slot filler category lists versus superordinate category lists. To use superordinate relations as memory organizers children must tag items categorically, link items sharing that label into clusters, and then use those category labels at retrieval time.

The combination of individuals’ slot filler categories, which for children are said to represent discrete cognitive wholes, into higher order units requires the deployment of combinatorial operations through the use of hierarchical “is a” relations. Young children’s (under age eight) representations of these relations are said to be rather weak and fragmented. Once children have mastered such hierarchical “is a” relations, they will be able to establish context free superordinate categories in memory. At this point children subsume all slot filler subsets for which particular category item is a general term into a single unit with the general term applied to the entire composite unit. Nelson attributes this transition towards categorizing superordinately to children’s increased attention or sensitivity to relations defined in language and decreased reliance on relations defined in the real world. For example, while a three year old may know you wear a coat and you wear pajamas, that is, he can identify the clothes you wear, he still doesn’t include both items in “the clothes category” since “clothes” in his

conceptual system, which is not organized yet along superordinate lines, represents “things you put on in the morning”.

Nelson points out that categorical relations are defined in language since there is no functional real world relation between an object and its superordinate. Once children do develop the ability to categorize superordinately, which is said to occur around the age of eight or so, a new independent system of word meaning evolves where words become related to other words through abstract relations of similarity and contrast. This system becomes differentiated from conceptual knowledge acquired during preschool years and once established allows one’s words to access perceptual images and conceptual contents and to exist as free elements that can operate autonomously of conceptual content and can recombine to produce novel conceptualizations. This independent semantic system then, according to Nelson (1982,1985), presents a new and powerful tool of thinking in a decontexted mode that can establish its own contexts independent of children’s real world experiences and is not embedded in conceptual structures like event schemas, which imply additional contingencies and thus constrain meaning. It is a relational system consisting of labels and relations such as “is a type of”, “is opposite of”, and “belongs to”, which allows for greater manipulation of elements resulting in new constructions in addition to reorganization as well.

Memory:

Origins and Organization of Structures

Ehrlich (1979) has identified two origins of the semantic structures of memory, namely, perceptions and actions, each of which help comprise one's experiences in the world. One perceives events, objects and properties of objects. The actions one performs on objects, such as eating a piece of cake, helps one acquire knowledge about the action, the object to which the action is being performed, the agent who performs it, and the instrument of action, which in the present example might be a fork. The next question that needs to be addressed pertains to organization. That is, once one is capable of identifying objects, actions, events, and their properties, what happens to all this information one has acquired? Is it simply stored in memory, in a manner comparable to the way one stacks up clothes on a closet shelf or is there some type of assembly or organization so as to maximize one's memory potential?

The theories discussed thus far lead to the latter alternative. From a Whorfian standpoint, it would appear that the information obtained from the observations of the world in which the child lives, as well as her subsequent categorization or ordering of that world would largely depend upon the language(s) within her repertoire. Vygotsky, Luria, and Nelson, on the other hand, have advocated that it is not only language itself, but rather, its interdependent relationship with one's

thought processes within the culture in which one lives and engages in various types of activity which contributes to the manner in which knowledge is organized from the world. They are each quite specific in their descriptions of how individuals begin to categorize the world in a very concrete manner and subsequently develop a more abstract, formal system.

Bloom (1981) has stated that the cognitive building blocks of representations of the world, what he refers to as schemas, which include the categories we develop that aid our memory of those representations, develop with and without the assistance of language and in some instances specifically because of language, that is in language specific ways. For example, children may divide the world into such categories as hungry versus thirsty or color versus shape without having mastered the “linguistic labels” associated with these cognitive domains. By the same token, children may also develop schemas that represent the world to think about it, react to it, and store information about it in terms of specific linguistic categories, such as “bachelor” or “society” and in terms of structures to which they have been led by their own previously acquired linguistic labels. This, in turn, leads to subsequent cognitive integration and reintegration of memory structures. For instance, once a child understands the word “bachelor” it integrates notions of “man, unmarried, and never married” and thus reduces the cognitive effort of keeping these four dimensions simultaneously in mind when “bachelor” is heard. Once one understands one’s labeled schemas of “society” one can access those notions directly, without having to retrace one’s cognitive steps by which

one formed this schema and make use of them as building blocks of more complex schemas as readily as one might make use of simpler notions as “blue”, “table”, or “sad”.

These two examples illustrate how language may facilitate the organization of the memory system, in that it has served to minimize the burden placed on one’s informational capacities and thus, in effect, maximized one’s memory potential through efficient assembly. Bloom (1981) has also pointed out that while linguistic labels may lead one to develop many of these schemas in which one thinks, the labels themselves need not be consciously present in one’s mind when one makes use of the schemas one owes to them. For example, learning the word “perspective” may cause one to look at paintings in a different way without the word itself actually popping into one’s mind. This also suggests cognitive efficiency in that a single word may lead one to reorganize one’s thoughts and or memories and can trigger the development of new schemas in future life experiences.

Bilingual Implications:

Cognitive Consequences of having two languages

A matter which many of the above theorists fail to discuss is the cognitive consequences of possessing two languages, that is, of being bilingual. The 1950's idea that bilingualism is a language handicap has long since been replaced with the view that having two languages in one's repertoire, compared to one, results in cognitive advantages in concept formation, semantic development, and metalinguistic awareness (Hakuta & Diaz, 1985). These conclusions have been based on researchers' findings of bilinguals' outstanding performance and flexibility on a variety of cognitive tasks. For example, in semantic-phonetic tests, where subjects must decide which two out of three words are more alike, bilinguals were found to outrank monolinguals in choosing words along the semantic dimension, considered to be more developmentally advanced in comparison to the phonetic (Ianco-Worall, 1972). Bilinguals have also exhibited a greater ability to learn nonsense names for objects and switch and relabel objects, such as calling a "cup" a "plate" when asked, when compared to monolinguals (Feldman & Shen, 1971). Further, bilinguals have also done better than monolinguals in symbol substitution tests where subjects must ignore the semantics of a word, which has been substituted for another, and carry out some cognitive task. For example, a subject may be asked: If the way we say "I" is to say "macaroni", how do you say "I am warm"?, where the correct answer is "Macaroni am warm". Note that to answer correctly the subject must resist mutual

interference or conflict of the substituted item and the sentence frame and not say “Macaroni is warm”.

Concrete versus Abstract Thinking

It was Leopold (1961) who first suggested that bilingualism, whereby a given referent is denoted by two different language codes (words), would promote the early separation of word sound from word meaning, that is separating the word from its referent, resulting in an early awareness of the arbitrariness of language and the conventionality of words, which, in turn, could promote more abstract levels of thinking. The point has already been made that the transition from concrete to abstract thinking is characterized by cognitive reorganization and facilitated by language via word use and meaning. It follows from our discussion that such a transition must, in fact, be accelerated for bilinguals who have two language codes and thus realize that there are different ways to say the same thing, which causes a decline in their viewing of “names” as a part of the “things” which they name.

Feldman & Shen (1971) have suggested that having two language codes does facilitate the shift from the notion of meaning as word reference to a notion of meaning as a function of use. They argue that although bilingual children may first perceive names as attributes of things they name once they learn that names refer to things that they name because someone so uses them they achieve a state

of conscious or metalinguistic awareness. They look at language as an objective set of rules or tools for communication as opposed to looking through it to intended meaning causing them to engage in more abstract, theoretical types of thinking.

Vygotsky (1935/1975) has stated that bilingualism- having more than one language- frees the mind from the prison of concrete language phenomena. He also claimed that because bilinguals express the same thought in different languages they see language as one particular system among many and thus view its phenomena under more general categories.

Development of Spontaneous and Scientific Concepts:

Reintegration and Reorganization of Conceptual Knowledge

It is evident from Nelson's (1995) discussion of knowledge organization that bilingual children have quite a task to accomplish, cognitively speaking. They too must categorize items in their world in order to learn both their languages. Their degree of overlap from language to language, in terms of having one or two words for each object/referent, would depend upon how they are learning each of their respective languages, namely simultaneously from birth or at a time apart (separately). Given Nelson's proposal that children's initial conceptual systems are constructed from their direct contact and experience with the cultural world and are organized via event representation, it follows, that children will

subsequently engage in an integration process whereby their concepts will be redefined and reorganized as they learn and use the language of their community, with adults serving as mediators, and as they participate in formal school instruction. From such a standpoint, it would be of great interest and importance to examine the effects of having two languages and/or even two conceptual systems on such a process. Would the process be, in fact, facilitated, or as was alluded to earlier, delayed, or perhaps markedly more complex?

The majority of bilinguals from the Haritos & Nelson study (1993) indicated that although their parents understood both Greek and English, the main language spoken in the home was Greek. It is then reasonable to assume that before entering school, engaging in formal instruction, and thus acquiring and developing scientific concepts, in both English and Greek, these bilinguals initially constructed implicit knowledge systems and developed everyday or spontaneous concepts in "Greek" alone. It will be of great interest to examine the effect that such a construction may have on bilinguals' subsequent acquisition and development of scientific concepts.

Representation:

Event Schemas

The notion of event schemas and event representations is quite intriguing from the standpoint of bilingualism, in that it poses the possibility of language specific event schemas or representations. This phenomenon may manifest itself in a number of different ways depending upon the way the bilingual has acquired his or her two languages. For example, if the two languages are used interchangeably then his or her “lunch ER” may be comprised of actors, actions, and or objects which the bilingual may refer to in either language or there may be a mix of the two- some foods may only be referred to in L1 while other foods might be referred to only in L2. In this case it would be of interest to see whether or not bilinguals have an easier or more difficult time abstracting among the various referents of this ER that occupy the same function or slot across different occurrences of the same event so as to be able to establish slot filler categories (the first categorical structures in semantic memory). The former possibility suggests accelerated development of superordinate categorization ability while the latter alternative implies delayed development.

If, on the other hand, bilinguals have acquired each of their two languages at different times or even if they associate L1 with one parent or adult and L2 with another they may very well develop language specific event schemas with interesting consequences. For example, the child may have an “English breakfast ER”, since he or she may often have breakfast with Mom, who communicates

with him or her in English, and a “Greek lunch ER”, since he or she may have lunch with grandma with whom the child communicates in Greek only. In this example while the child may not have any more difficulty abstracting among various objects within the same ER, that is, forming slot filler categories, than any monolingual would, it would be of interest to see whether he or she will have a difficult time forming superordinate categories. The latter task involves abstracting relations among objects that share the same function in different event schemas, schemas which in this example are in two different languages.

The ability of bilinguals to successfully transfer ideas, thoughts, and concepts from each of their languages (Haritos & Nelson, 1993), suggests yet another set of alternatives regarding bilinguals’ event representations. If a bilingual has an English ER which she or he associates with Dad, who speaks to her or him only in English when the two of them eat together, and if the bilingual is adept at translating, she or he will have duplicate ER’s. This may either cause a memory burden, in terms of informational capacity in that it may be harder to coordinate two ER’s as opposed to one, or it may facilitate abstraction of relations due to the increased number of named objects (one in L1 and one in L2) which will occupy the same function or slot in these duplicate ER’s. By contrast, if a bilingual has an “English breakfast ER” and a “Greek lunch ER”, as previously suggested, the ability to transfer ideas and concepts from one ER to the other would suggest no

apparent difficulty in the formation of superordinate categories, which again entail abstraction of relations among objects sharing the same function in different event schemas.

Bilingual Memory:

Development and Organization of Structures

It follows from the discussion thus far that the organization of a bilingual individual's memory is under a number of influences. From a strong Whorfian standpoint, it would be reasonable to assume that bilinguals should remember things in language specific ways. This conclusion was supported by the Haritos & Nelson (1993) study that reported both quantitative and qualitative differences in story recall depending upon the language in which the story was initially heard and subsequently retold. Another important finding from that same study, however, was that bilinguals who heard the story in English and subsequently retold it in Greek, had the best recall, remembering significantly more phrases than any other language group.

Such a result is not surprising, from the standpoint of Vygotsky, Luria, and Nelson, who argue that it is the interdependent relationship of one's language(s) with one's thought processes within the culture in which one lives and engages in various forms of activity, be it practical or theoretical, which influences the way an individual organizes knowledge from the world. Bilinguals of this study were quite adept at speaking English in school and subsequently translating their daily

experiences into Greek, at home. Further, organizing knowledge from English into Greek in the story recall task, as was required by subjects in group EG of the study, was a matter of routine which allowed bilinguals to maximize their memory potential in this regard .

The transition from concrete thinking to abstract thinking, may be facilitated if bilinguals have an early awareness of the arbitrary nature of language and the conventionality of words, or delayed if bilinguals have less of an opportunity to hear particular words frequently (words are divided between their two languages). It follows that either one of these alternatives will depend upon subjects' familial and societal patterns of language use.

The language(s) a bilingual may predominately use at home and/or in school will no doubt affect his or her acquisition and development of spontaneous concepts, associated with concrete thinking, which will, in turn, affect the bilingual's acquisition and development of scientific concepts, which coincide with more abstract forms of thinking. For example, if one's spontaneous concepts are acquired and subsequently develop in one language (L1) whereas one's scientific concepts subsequently develop in yet another, (L2) or both (L1 &L2), the strength of the influence of the former on the latter becomes a matter of degree depending upon the relationship between each of the bilingual's respective languages. That is, L1 & L2 may be used interchangeably in school and at home or L1 may be used predominately in school while L2 may be used predominately at home. The variety of relationships that may exist between each of a bilingual's

respective languages will, again, depend upon her or his language socialization history.

The organization and reorganization of knowledge that occurs within a bilingual individual, as she or he learns and uses her or his language(s) and as each engages in initially concrete and subsequently more abstract forms of thinking, is perhaps best understood in terms of its being rooted in a conceptual system which, according to Nelson (1992), is initially constructed from her or his experience with the cultural world and thus organized via event representations. The importance of event representations is evident in that it is the temporal organization of structure within them that forms the basis from which one acquires knowledge of thematic relations between objects, that is, functional relations into which different objects enter. It is also logical to assume that an individual's initial introduction to or interaction with objects and the various functional relations they have with one another is most likely to occur within the context of an event, such as a breakfast or lunch meal, a party, or even a bathing or "getting ready for bed" routine. This event may be one in which an individual may be actually participating or has seen somewhere or has read about in a story.

As a bilingual acquires and organizes knowledge via the construction of various event schemas, through either different occurrences of the same event or simply different events, it is questionable as to what effect this may have on his or her memory capacity. While memory may be initially organized through event representations, possessing a variety of such schemas in L1, L2, and/or both L1 &

L2 may pose a cognitive burden, in terms of information capacity, which according to Ehrlich (1979) is limited in the early stages of memory development. Language specific event representations may serve as a cognitive aid to bilinguals, in this regard, in that "language" may be used to distinguish one event schema from another and that such event schemas, which include a variety of information pertaining to objects and object relations, may be cognitively stored in the bilingual's memory via language.

With further development of memory structures and further development of language, bilinguals will be able to generalize across different occurrences of the same event representation, regardless of what language each is constructed in, and subsequently construct slot filler categories in either L1 or L2. Once bilinguals master hierarchical "is a" relations, their memory structures will develop into a system of free, autonomous, and connectable elements. It is at this point, which for monolinguals is around the age of eight, that bilinguals will be able to abstract relations existing among objects that occupy the same or similar functions in different event schemas and thus establish context free superordinate categories in memory. This process may, again, be influenced by the fact that bilinguals have two languages to process material in. For instance, the ease with which bilinguals may be able to abstract information from one event to another to form superordinate categories, if one event is in L1 and the other is in L2, will depend upon the degree to which the bilingual can transfer material from one language to the other.

Goals of the Present Study

The goal of the present study is to examine the organization and reorganization of bilingual's semantic memory structures through the organization and reintegration of lexical items presented via event representations that differ in both type and language specific content. The enormous variety of event representations which may be constructed by bilinguals through their everyday life experiences, in either one or both of their languages, poses a problem in terms of systematically attempting to explain their organization of knowledge within such schemas. In order to provide some type of control, in terms of type of event schema as well as its language specific content, children in the present study are presented with stories, each of which contains two types of events, namely a breakfast event and a birthday party event. Events also vary, in that within each story, one event is presented to subjects in English while the other is presented to subjects in Greek.

The present study is directed to the following questions:

- 1) How do bilinguals organize material for the purpose of subsequent recall and what is the role of having two languages in this regard? Are there two separate language specific stores in bilinguals' memory system or one general common store of knowledge which draws upon both languages?
- 2) If memory is initially organized through event representations what effect does the construction of a variety of such schemas, in L1, L2, or both, have on the

bilingual's memory capacity? What is the role of having two languages, in this regard?

a) Does language help bilinguals keep events cognitively separate in memory?

If so, does language also serve as an efficient retrieval cue? Is language specific information best retained if retrieved in the same language as it was processed in?

b) Are events simply processed in the language they are initially presented in and then subsequently stored in a common semantic store, in which case the language that material was processed and retrieved in would have no effect on memory performance, via amount and kind of material retained?

3) Is a bilingual's ability to generalize across different occurrences of the same event (i.e. two different breakfast events) to form slot filler categories, such as "breakfast foods" facilitated, delayed, or simply made more complex by the fact that she or he has two languages to cognitively contend with? It is important to note that different occurrences of the same event, for a bilingual, may be in L1 or L2 or a combination of both languages with each event occurrence.

4) Once bilinguals do construct slot filler categories, from event representations in either language, and achieve mastery of hierarchical "is a" relations through increased experience with language and acquisition and development of scientific concepts in school, what effect, if any, will having two languages have on their ability to abstract information from one type of event representation to another,

for example, from a breakfast event to a party event, in order to construct superordinate, context free, categories?

The answer to many of these questions will depend upon subjects' familial and societal patterns of language use, which contribute to the construction of particular event representations as well as to the degree to which bilinguals can successfully transfer information from one language to another.

Developmental Issues

If semantic memory development is a progression from global to differentiated semantic memory structures, the question arises as to whether or not bilingual semantic memory development will follow such a clearly defined path. Bilinguals may begin to organize their memory of information somewhat globally, through event representations, without being consciously aware of the fact that they are cognitively contending with two different languages. This is similar to what Bloom (1981) described, when he stated that children may initially divide the world into linguistic categories without having mastered the linguistic labels. Young bilinguals, who have, for example, constructed an "English breakfast ER", which they associate with mom, and a "Greek breakfast ER", which they associate with dad, may simply think of each event as "breakfast with mom" or "breakfast with dad", not paying conscious attention to the language used in each schema. With further development of language skills and memory structures, increased schooling, and acquisition and development of scientific concepts, memory may begin to become more differentiated. For example, bilinguals may

consciously realize they have two languages, two different ways of representing and storing information. They may use this to their advantage by differentiating and storing abundant amounts of information, from different occurrences of events and different types of events, in language specific ways. This may ease the burden placed on their information capacity.

However, as bilinguals continue to practice and develop their language skills, and further develop their scientific concepts in school, both in English and Greek, the degree to which they will be able to transfer material from one language to another is bound to increase. They may disregard language and begin to organize material in a rather global fashion again, generalizing across different occurrences of a particular event, which may occur in either language, in order to construct slot filler categories. Once they have constructed such categories in L1 & or L2 and mastered “is a” relations through further language development and further formal school instruction, their ability to abstract information from different types of events, such as a breakfast and a party, to form superordinate categories may be facilitated by the fact that they have two languages. For example, it may be initially easier, cognitively speaking, to realize that “the food” one ate for breakfast is the same as the “food” one ate at a birthday party, abstracting information from one event to another to construct the superordinate category of “food”, if both events are in L1 or if both events are in L2. This is an example of how bilingual memory may again become differentiated for the purpose of facilitating bilinguals’ superordinate category ability. It follows that at a later

point in development, once bilinguals fully master their two languages, bilinguals' memory will function in a more integrated manner as they abstract information from one type of event to another, regardless of the language the event is constructed in, to form superordinate categories in either L1, L2, or both. These possible developmental progressions will be examined in the study as well.

Chapter 2. Method

The present study consisted of three groups of subjects. Two groups of subjects, a group of bilinguals and a group of monolinguals, heard two stories over the course of two days while a third group of bilingual subjects- a control group- heard two lists of words (taken from the stories). On the third day all subjects were given a recall task.

Subjects

The present study consisted of three groups of subjects. The first group consisted of forty-eight bilingual children, sixteen first graders (six-seven year olds), sixteen third graders (eight-nine year olds), and sixteen fifth graders (ten-eleven year olds) selected from a Greek-American parochial school, located in a predominately Greek American, middle class New York community, where both “English” and “Greek” were spoken. There were twenty-eight girls and twenty boys.

The second group of subjects were thirty-six monolingual children, twelve first graders (six-seven year olds), twelve third graders (eight-nine year olds), and twelve fifth graders (ten-eleven year olds), of various ethnic backgrounds, selected from a Catholic school, located in the same community as the first group of subjects but not the same neighborhood. The only language spoken and

understood by monolingual subjects was English. There were twenty girls and sixteen boys.

A third group of subjects, a bilingual control group, were comprised of twenty-four children, eight first graders (six-seven year olds), eight third graders (eight-nine year olds), and eight fifth graders (ten-eleven year olds) selected from the same Greek-American parochial school as the first group of bilingual subjects. There were twelve girls and twelve boys.

Materials

Two stories, each containing two different events, a breakfast event and a birthday party event, were used. Within each story, one event was presented in English while the other was presented in Greek. The characters of each story were the same as was the structure or type of event, with the only difference being that the breakfast and birthday party event from story two had different slots in terms of objects and actions, as opposed to those in the breakfast event and birthday party event from story one [See Appendix A for these stories]. Different occurrences of the same event, as illustrated in these two stories, are common in everyday life in that individuals usually participate in more than one breakfast event and as a result have constructed different versions of such an event schema. Each story had a total of twelve different food items, six per event. The stories were constructed such that for every food in a given event in story one there was a

comparable food, in terms of food type, in the analogous event in story two [See Appendix A for a list of these foods]. Further, the four events in the two stories were comparable in length (measured by number of propositions in each).

Monolinguals heard the same stories as bilinguals with the exception that both stories were presented in English.

Two word lists, each consisting of the twelve food items contained within each of the two stories presented to bilinguals and monolinguals, were presented to the bilingual control group of subjects. Lists were constructed such that the ordering of foods within each list was in accordance with the order of appearance of these foods within each event, namely, the breakfast event and the birthday party event respectively, of each story.

Design and Procedure

Upon receiving written consent from the parochial schools, letters were sent to parents also seeking consent for their child to be a participant in a study examining the development of bilingual memory. Parents were informed that experimenter-child interactions would be audio-taped but parents were not told of the hypotheses of the study.

Every effort was made to assure that bilingual subjects of the present study were balanced. English and Greek teachers were questioned with respect to the adeptness of each potential subject in both his or her languages. Subjects that had a language difficulty in either English or Greek, in terms of verbal or written

proficiency, were not included in the present study. Bilinguals were also given an oral language questionnaire in order to examine their familial and everyday patterns of language use (See Appendix A).

Teachers of monolingual subjects were also questioned about potential subjects' language abilities. Subjects that spoke or understood more than one language were not included in the present study.

Bilingual and monolingual subjects of the present study were told, in English, that they would hear two audio-taped stories over the next two days and to try to remember as much of each story as they possibly could because they would be questioned about them on the third day.

Bilingual subjects were randomly assigned to one of eight possible experimental orders. There were two possible story orders; hearing story one on Day one and story two on Day two or hearing story two on Day one and story one on Day two. There were two possible language orders, with respect to the specific events in each story. These were EGGE (where the first event in the first story was presented in English and the second event was presented in Greek and the first event of the second story was presented in Greek and the second event of the second story was presented in English) or GEEG. Language of instruction also varied with respect to the language in which recall instructions were initially stated. Half of the subjects were initially asked in English and half of the subjects were initially asked in Greek. Thus, the design of the present study was a 2(story order) X 2(language of event) X 2(language at recall) between subjects design.

This procedure and design was identical with respect to bilinguals in the control group with the exception that these subjects were informed that they would hear two lists of words over the next two days and to try to remember them because they would be asked to recall them on the third day.

Monolinguals of the present study were randomly assigned to one of two possible story orders orders, story one on Day one and story two on Day two or story two on Day one and story one on Day two.

On the third day bilinguals were asked, in either English or Greek, to tell the experimenter all the foods they remember from the stories. Once this task was completed, the experimenter restated the same question but in the opposing language. The purpose behind asking the same question in English and Greek was to examine whether or not the “language” that the request for retained material was made would trigger any language specific memory stores that may exist within the bilinguals’ memory. For monolinguals, recall instructions were only stated in English. Responses were recorded and analyzed in terms of the number of items recalled from each event, from each language, and from each story. There was also an analysis of responses in terms of clustering by event, language, and story. The recall measure used in this regard was The Adjusted Ratio of Clustering (ARC), (Roenker, et al 1971). The formula for this measure is listed in Appendix A. Monolinguals’ responses were analyzed in the same manner with the exception of the language variable.

Predictions

It is predicted that responses from the youngest subjects of the present study, first graders, who had limited formal schooling, would recall slot clusters from any one of the four events heard within the two stories, for example, the breakfast event from story one or the birthday party event from story two. This prediction is made in accordance with the notion that children's initial memories are organized via event representations and previous evidence that children remember items presented from lists for single as opposed to different events. The event that these young subjects may choose to focus on may vary depending upon a number of factors, including general preference, language preference (for example, a child may be more proficient in Greek and may tend to construct ER's in Greek and as a result may tend to identify with and remember events presented to her or him in Greek) or even recency effects, that is, remembering information from the most recent event heard (Day two, story two, event two).

Older subjects, such as third graders who have had more language experience and more formal school training may be at a point in memory development where they can generalize across different occurrences of the same event, regardless of language, (e.g. the English breakfast event in story one and the Greek breakfast event in story two) and construct a slot filler category such as "foods for breakfast". The degree to which they are able to master this task successfully, of

course, will depend upon their ability to transfer material from each of their respective languages, which may depend upon their language socialization history.

The oldest subjects of the present study, namely fifth graders, whose language skills are perhaps the most developed and who have had the most formal instruction may exhibit slot clustering in a variety of forms. They may generalize across the two types of events successively and produce, for example, lists of “breakfast foods” and then lists of “party foods”. It is also possible that they produce lists of foods in the order in which they occurred in each story. For example they may produce the foods from the breakfast event in story one, then foods from the birthday party from story one, then foods from the breakfast from story two, and finally the foods from the birthday party from story two. If subjects are at a point in development, in terms of language ability as well as memory structures, where it is still difficult to abstract from one event to another to form the superordinate category “food”, regardless of language, they may simply abstract information from the event in story one that was in English and the event from story two that was in English. The alternative of course is for subjects to abstract information from the Greek event in story one and two. All of the above alternatives will, again, depend upon the ability of the bilingual to transfer material from one language to another, that is the relationship the bilingual has between each of her or his respective languages.

It is also possible that subjects will produce individual event slot filler clusters that are taxonomically classified, for example, list all the drinks from

event one, story one, or general event slots that are taxonomically classified, for example, all the drinks from both breakfast events. Slot filler clusters may also be produced that are classified by language, listing the foods not only by the event in which they were presented but also in the language in which they were presented. It is predicted that such clusters will be produced by subjects with the most language and school experience.

Chapter 3. Results

There were two measures of recall for all subjects, bilinguals and monolinguals who heard stories and bilinguals who heard lists of words. The first recall measure was number of total foods remembered. Additional measures, for subjects who heard stories, included mean number of food items from story one, story two, first story heard, second story heard, breakfast events, B1 (breakfast event from story one), B2, first B (breakfast event) heard, second B heard, Party events, P1 (party event from story one), P2, first P (party event) heard, and second P heard. For bilingual subjects, recall was also calculated in terms of number of remembered food items recalled in E (English), recalled in G (Greek), presented in E, presented in G, P&R in E (presented and recalled in English), P&R in G, and P in G & R in E.

The second recall measure for all subjects, was the Adjusted Ratio of Clustering (ARC), (Roenker, et al, 1971). Recall was analyzed for story clustering, two event clustering, (by Breakfast and/or by Party), and four event clustering (B1,P1,B2,P2). For bilingual subjects, recall was also analyzed for LP (language of presentation) clustering.

Recall from stories

Bilinguals

The data were initially subjected to analyses of variance testing the effect of story order (Day 1-story 1, Day 2-story 2 or Day 1-story 2-Day 2-story 1), language order (of the two events within each story- English, Greek on Day 1 and Greek, English on Day

2 (EGGE) or (GEEG)- Greek, English on Day 1 and English, Greek on Day 2), and language initially used by the experimenter at recall (English or Greek). None of these factors were significant (all p 's $>.10$). [See Table B-1 in Appendix B]

An ANOVA on mean number of total items recalled by Grade produced a Main effect for Grade, $F(2,45) = 48.88$, $p < .01$. Subsequent ANOVAS compared means of first, third, and fifth graders on total number of recalled items. Bilingual fifth graders remembered significantly more food items than bilingual third graders, $F(1,30) = 19.28$, who, in turn, recalled significantly more foods than bilingual first graders, $F(1,30) = 16.70$, both p 's $< .01$ (See Table 1).

A Grade by Story ANOVA with repeated measures on the latter factor produced a Main effect for Story, $F(1,46) = 21.6$ and a Main effect for Grade, $F(2,45) = 14.45$, both p 's $< .01$ (See Figure 1). Subsequent ANOVAS, comparing mean number of items recalled from story one versus story two, revealed that recall for story one foods was significantly higher than recall for story two foods for first graders, $F(1,14) = 4.80$, $p < .05$, and fifth graders, $F(1,14) = 14.65$, $p < .01$. Means and standard deviations are reported in Table 1.

A 3(Grade) X 2(Event) X 2(Language of Presentation) ANOVA with repeated measures on the last factors produced a Main effect for Grade, $F(2,45) = 42.20$, $p < .01$, a Main effect for Event, $F(1,46) = 29.36$, $p < .01$, and a Main effect for Language of Presentation, $F(1,46) = 4.20$, $p < .05$ and an Interaction of Grade by Event by Language of Presentation, $F(2,45) = 3.32$, $p < .05$. These effects are depicted in Figure 2 and Table 2 (Standard deviations for Table 2 are in Table B-2 in Appendix B).

Table 1.**Mean number of items recalled by Grade and Story**

	GRADE		
	FIRST	THIRD	FIFTH
Story One (B1,P1)	3.31 (1.30)	4.25 (1.61)	6.06 (1.81)
Story Two (B2,P2)	2.25 (1.44)	3.25 (1.44)	3.69 (1.70)
Total	5.56 (.89)	7.50 (1.67)	9.75 (1.18)

Figure 1. Grade by Story Analysis

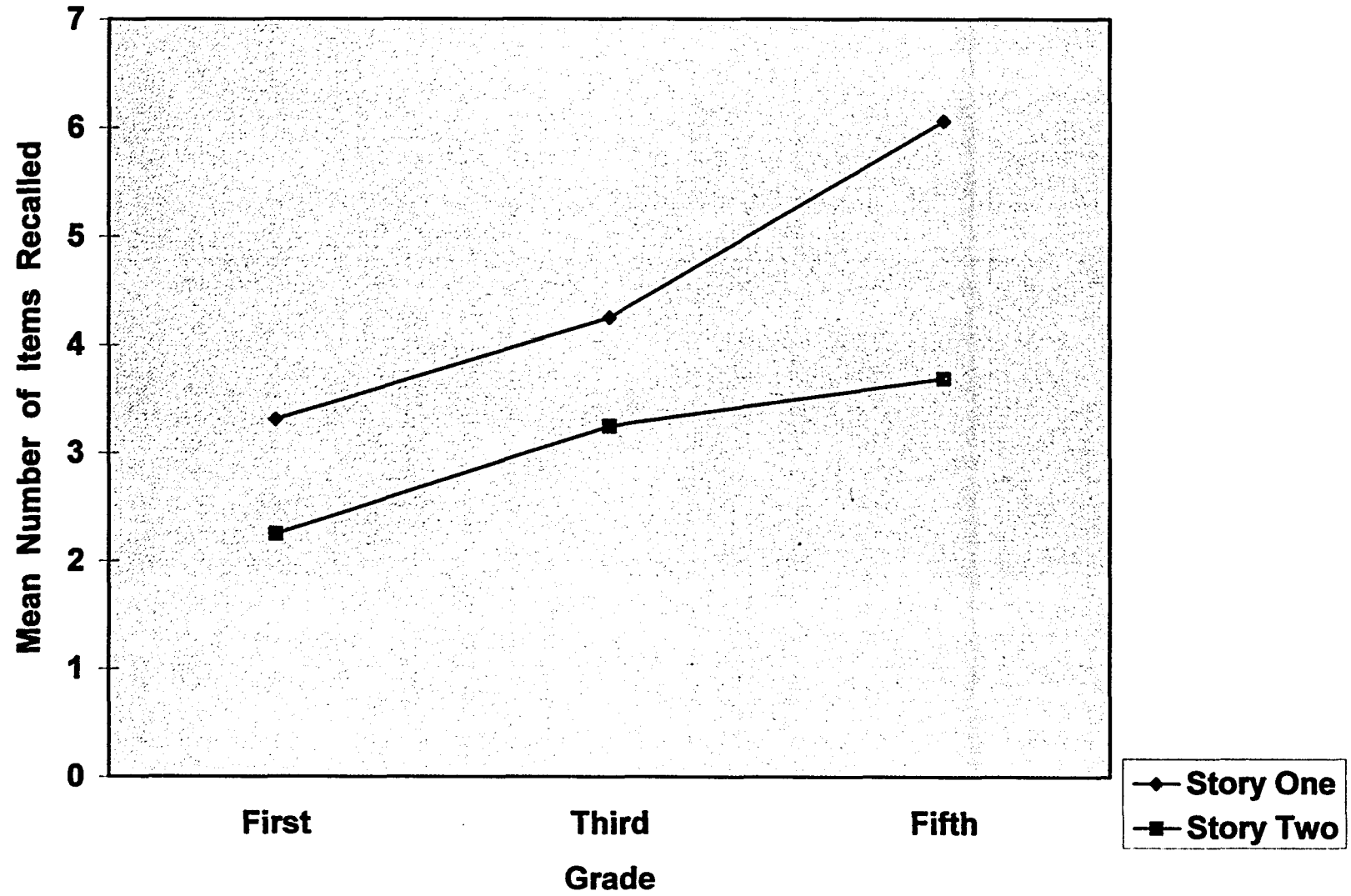


Figure 2. Grade by Event by LP Interaction

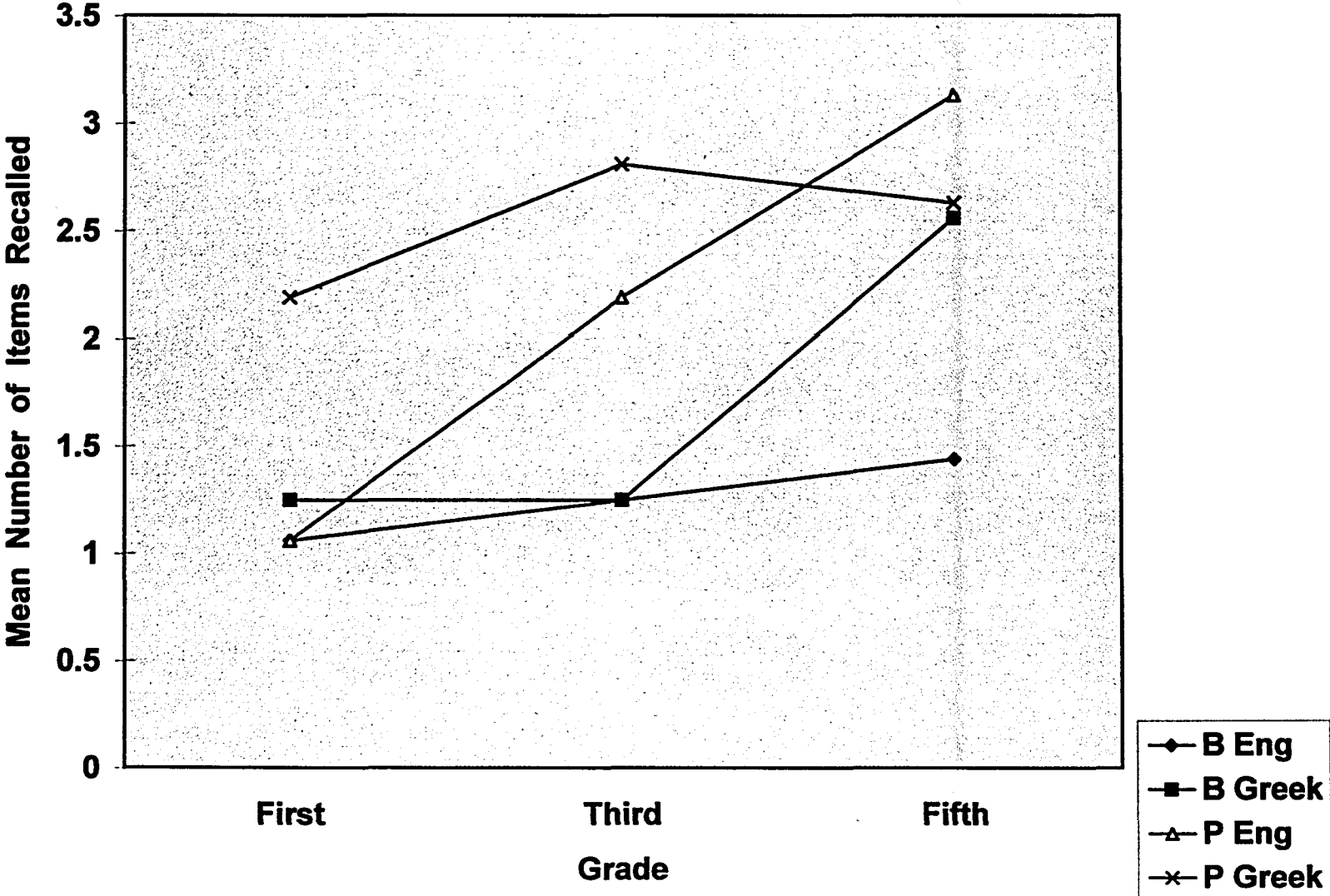


Table 2.

Recall by grade, event, and language of presentation

	GRADE			
	FIRST	THIRD	FIFTH	
Breakfast				<i>Total</i>
Greek	1.25	1.25	2.56	
English	1.06	1.25	1.44	
Total	2.31	2.50	4.00	8.81
Party				
Greek	2.19	2.81	2.63	
English	1.06	2.19	3.13	
Total	3.25	5.00	5.76	14.01
Total Greek	3.44	4.06	5.19	12.69
Total English	2.13	3.44	4.56	10.13
TOTALS	5.57	7.50	9.75	

The Event effect, as shown in Table 2 and Figure 2, reflected greater recall for party foods overall and at each grade and in each language (with the exception of first graders in English and fifth graders in Greek). The language effect revealed that overall children recalled more of the foods that were presented in Greek than those presented in English.

The three-way interaction is graphed in Figure 2. There it appears that the interaction reflects primarily differences in the tendency to recall English party foods and Greek breakfast foods at the different grade levels. Both were elevated for the fifth graders in comparison to the third graders. These effects were tested with individual comparisons, which showed that first graders remembered significantly more party foods when they were presented in Greek than in English, $F(1,14) = 7.25, p = .01$. First graders also recalled more party foods than breakfast foods when presented in Greek, $F(1,14) = 5.35, p < .05$ (See Figure 2 and Table 2).

Among third graders, recall for party foods was significantly higher than recall for breakfast foods when presented in English, $F(1,14) = 4.45, p < .05$, as well as Greek, $F(1,14) = 11.39, p < .01$. Fifth graders remembered significantly more breakfast foods presented in Greek than in English, $F(1,14) = 5.91, p < .05$. Recall for party foods was significantly higher than recall for breakfast foods when presented in English, $F(1,14) = 14.33, p < .01$.

A Grade by Language (used by subjects at recall) ANOVA with repeated measures on the latter factor produced a Main effect for Language, $F(1,46) = 361.6$ and a Main effect for Grade, $F(2,45) = 14.20$, both p 's $< .01$. Subsequent ANOVAS, comparing mean

number of remembered items reported in English versus Greek, revealed a significantly higher number of food items reported in English than in Greek. This was true at each grade level- first graders, $F(1,14) = 166.42$, third graders, $F(1,14) = 71.17$, and fifth graders, $F(1,14) = 187.5$, all p 's $< .01$. These means are reported in Table 3 (Means and standard deviations are reported in Table A-3 in Appendix A). No significant differences were found among means, with respect to number of recalled foods presented and reported in English versus number of recalled foods presented in Greek and reported in English, for first, third, and fifth graders, all p 's $> .10$. Thus, although these bilingual children preferred to respond in English as opposed to Greek, at recall, the language in which such food items were initially presented, did not influence this action.

To summarize, recall for bilinguals of the present study indicate significant gains in memory, with age. The Main effect of Grade showed that fifth graders recalled more than third graders who, in turn, recalled more than first graders. Preferences were also reported, in terms of story (story one versus story two), event type (breakfast or party), language of presentation (English or Greek), and language used by subjects at recall (English versus Greek). First graders and third graders remembered significantly more food items from story one versus story two, as evidenced by the reported Main effect of Story. Main effects for Event and Language of presentation indicated greater recall for party foods, overall and at each grade, and overall better memory for foods presented in Greek, not English (See Table 4).

Table 3.

Recall analysis by language of presentation and language used by subjects at recall**[English-(E) or Greek-(G)]**

	GRADE		
	FIRST	THIRD	FIFTH
Presented and Recalled in E	2.13	3.38	4.44
Presented in E & Recalled in G	0	.06	.12
 Total Presented in English	2.13	3.44	4.56
Presented and Recalled in G	.44	.81	.81
Presented in G & Recalled in E	3.00	3.25	4.38
 Total Presented in Greek	3.44	4.06	5.19
Recalled in English	5.13	6.63	8.81
Recalled in Greek	.44	.88	.94
 Total items recalled	5.56	7.50	9.75

Table 4.

Summary of Significant Results for Bilingual Recall

RESULT	INDIVIDUAL COMPARISON	P VALUE
Main effect of Grade	Total recall for 5th graders > 3rd graders	p < .01
	Total recall for 3rd graders > 1st graders	p < .01
Main effect of Story	Greater recall for Story 1 versus Story 2	
	first graders	p < .05
	fifth graders	p < .05
Main effect of Event	Greater recall for Party versus Breakfast foods first, third, and fifth graders	p < .01
Main effect of LP (language of presentation)	Greater recall for foods presented in Greek versus English first graders	p = .01
Main effect of LS (lang. used at recall)	More items recalled (said) in English first, third, and fifth graders	p < .01
Interaction of Grade by Event by LP	Greater recall for Party versus Breakfast foods	
	a) when both events were in Greek	
	first graders	p < .05
	third graders	p < .01
	b) when both events were in English	
	third graders	p < .05
	fifth graders	p < .01
	Greater recall for Party foods: presented in Greek versus English first graders	p = .01
	Greater recall for Breakfast foods: presented in Greek versus English fifth graders	p < .05

The three way Interaction of Grade by Event by Language of Presentation highlighted recall differences with respect to memory of party foods presented in English and breakfast foods presented in Greek, at the different grade levels. For fifth graders, both were elevated in comparison to third graders. Bilinguals preference for party foods over breakfast foods was evident for first graders when such foods were presented in Greek, for fifth graders when foods were presented in English, and for third graders when foods were presented in either language.

Monolinguals

A Grade by Story Analysis of variance with repeated measures on the Story factor produced a Main effect for Grade, $F(2,45) = 5.60$ and a Main effect for Story, $F(1,34) = 37.56$, both p 's $< .01$, but no significant Interaction. Subsequent ANOVAS compared means of first, third, and fifth graders on total number of items recalled. Although third graders remembered significantly more foods than first graders, $F(1,22) = 6.8$, $p = .01$, recall for fifth graders in comparison to third graders did not differ ($p > .10$), in this regard. ANOVAS comparing mean number of items recalled from story one versus story two, revealed that recall for story one foods was significantly higher than recall for story two foods for first graders, $F(1,14) = 30.95$, $p < .01$, third graders, $F(1,14) = 6.75$, $p = .01$, and fifth graders, $F(1,14) = 11.70$, $p < .01$. These data are reported in Table 5.

Table 5.**Mean number of items recalled by Grade and Story for Monolinguals**

	GRADE		
	FIRST	THIRD	FIFTH
STORY ONE	4.00 (1.48)	4.75 (2.53)	4.83 (.83)
STORY TWO	1.25 (.87)	2.67 (1.15)	3.17 (1.47)
TOTAL	5.25 (1.22)	7.42 (2.61)	8.00 (1.21)

Bilinguals versus Monolinguals

The stories presented to monolinguals were identical to stories presented to bilinguals, with respect to semantic content. However, while bilingual subjects heard mixed language stories, monolingual subjects did not. An ANOVA on Total number of items recalled with Language status (bilingual or monolingual) X Grade as factors produced a Main effect for Language status, $F(1,82) = 4.51, p < .05$ and a Main effect for Grade, $F(2,81) = 35.7, p < .01$, but no significant interaction (See Table 6). It is evident from Table 6 that although bilingual subjects had to process stories in two different languages bilingual children, overall, remembered more foods than their monolingual counterparts.

Subsequent ANOVAS, comparing recall by bilinguals and monolinguals, in each grade, found that fifth grade bilingual subjects remembered significantly more items than monolingual subjects, $F(1,36) = 14.76, p < .01$. Among first graders, individual comparisons showed that bilingual subjects recalled a significantly greater number of story two foods, $F(1,26) = 4.54, p < .05$. Among fifth graders, individual comparisons showed that bilinguals remembered a significantly greater number of story one foods, $F(1,26) = 14.76, p < .01$ (Compare Tables 1 & 5).

Table 6.

Mean number of items recalled and standard deviations for Bilinguals (B) versus Monolinguals (M)

	GRADE				
	FIRST	THIRD	FIFTH		OVERALL
TOTAL					
B	5.56 (.89)	7.50 (1.67)	9.75 (1.18)		22.81
M	5.25 (1.21)	7.42 (2.61)	8.00 * (1.20)		20.67 *

* bilingual- monolingual comparison significant at $p < .05$

Although the superior recall of bilingual students was not significant for all sub-analyses, no instances were discovered among first, third, and fifth graders, where recall for monolinguals was significantly higher than that of bilinguals (See Table B-4 in Appendix B for all bilingual versus monolingual recall comparisons).

Dramatic differences in recall were revealed from comparisons between bilingual subjects who heard stories and bilingual subjects who heard word lists. An ANOVA on total number of recalled items with Presentation Type (story or list) X Grade produced a Main effect for Presentation Type, $F(1,70) = 265.6, p < .01$ and a Main effect for Grade, $F(2,69) = 54.6, p < .01$. See Table 7. (Means and Standard deviations are reported in Table B-5 in Appendix B) Bilingual subjects who heard stories remembered significantly more items than those who heard lists of words. Table B-5 in Appendix B presents individual comparisons that show this advantage to be true in all grades and on most item types.

Clustering

Bilinguals

Clustering scores were obtained for subjects using the ARC measure. Recall was analyzed for story clustering, two event clustering (Breakfast and Party), four event clustering (B1,P1,B2,P2), and LP clustering (Language of presentation). Mean cluster scores for bilingual first, third, and fifth graders are reported in Table 8 (Means and standard deviations are reported in Table B-6 in Appendix B).

Table 7.

Mean number of items recalled by Grade and Story between Bilinguals who heard stories(BS) and Bilinguals who heard word lists (BL)

GRADE

	FIRST	THIRD	FIFTH
STORY ONE			
BS(story)	3.31 *	4.25 *	6.06 *
BL(list)	.75	1.00	2.75
STORY TWO			
BS	2.25	3.25 **	3.69 **
BL	1.25	1.00	2.13
TOTAL			
BS	5.56 *	7.50 *	9.75 *
BL	2.00	2.00	4.88

* BS- BL comparison significant at $p < .01$

** BS- BL comparison significant at $p < .05$

Table 8.**Mean Clustering Scores for Bilinguals who heard stories (BS)****GRADE**

	FIRST	THIRD	FIFTH
STORY	.40	.57 *	.19 *
TWO EVENT	.42	.52	.51 *
FOUR EVENT	.49	.65	.39
LP	.29	.35	.22

* Third versus Fifth grade comparison significant at $p < .05$

* Two Event- Story clustering comparison for Fifth graders significant at $p < .05$

It is evident from Table 8 that mean clustering scores were quite comparable among first graders, with four event clustering, two event clustering, and story clustering each somewhat higher than LP clustering. The same was true for third graders but with a wider discrepancy among these types. An ANOVA comparing third and fifth grade scores indicated a significant decrease in clustering by story, $F(1,30) = 5.08, p < .05$. Among fifth graders, two event clustering was significantly higher than story clustering, $F(1,14) = 5.5, p < .05$. These findings suggest that the importance of story as a recall organizer decreased with grade while event type remained important at all ages and language of presentation did not emerge as an important factor at any grade. This analysis is examined further in terms of detailed patterns in a later section.

Monolinguals

Recall for monolinguals was analyzed for story clustering, two event clustering, and four event clustering. Mean scores are reported in Table 9 (Standard deviations are in Table B-7 in Appendix B). An ANOVA comparing mean clustering scores among first graders revealed no significant differences with respect to type of clustering even though four event clustering appears higher than two event and story clustering. Subsequent ANOVAS comparing mean cluster scores among monolingual first, third, and fifth graders revealed no significant increases or decreases in clustering of any type (all p 's $> .10$). However, two event clustering was found to be significantly higher than story clustering for both monolingual third graders, $F(1,10) = 4.6, p < .05$, and monolingual fifth graders, $F(1,10) = 5.64, p < .05$.

Table 9.**Mean Clustering Scores for Monolinguals**

	GRADE		
	FIRST	THIRD	FIFTH
STORY	.22	.02	.04
TWO EVENT	.25	.65 *	.46 *
FOUR EVENT	.65	.19	.27

* Two Event- Story clustering comparison significant at $p < .05$

Bilinguals versus Monolinguals

Comparisons of Bilingual and Monolingual groups on clustering scores, revealed that two event clustering and four event clustering for first, third, and fifth graders did not differ (all p 's $> .10$). An ANOVA on story clustering score X Language Type (Bilingual versus Monolingual) produced a Main effect for Language Type, $F(1,82) = 5.08$, $p < .05$ (Compare Tables 8 & 9). A subsequent ANOVA comparing bilingual and monolingual third graders, in terms of mean story clustering scores, revealed that story clustering for bilingual third graders was significantly higher than for monolingual third graders, $F(1,26) = 4.8$, $p < .05$, who appear to cluster more by two event.

Word List Clustering

Recall for bilinguals who heard lists of words was analyzed for the same types of clustering as their bilingual counterparts who heard stories. This included story, two event, four event, and LP. These data are reported in Table 10 (Means and standard deviations are reported in Table B-8 in Appendix B). It is clear from Table 10 that not only were mean cluster scores, of every type, quite low for first, third, and fifth graders, but in addition, mean cluster scores were quite comparable among first, third, and fifth graders, with respect to different types of clustering.

Table 10.**Mean Clustering Scores for Bilinguals who heard word lists (BL)****GRADE**

	FIRST	THIRD	FIFTH
STORY	0	-.13	.09
TWO EVENT	.13	0	.10
FOUR EVENT	.13	-.13	.03
LP	.13	-.13	.18

Comparisons of recall for bilingual first graders who heard stories (BS) as opposed to lists of words (BL), revealed that LP clustering for first, third, and fifth graders, did not differ (all p 's $> .10$). An ANOVA on story clustering score X Bilingual Type (BS versus BL) produced a Main effect for Bilingual Type, $F(1,70) = 9.85$, $p < .01$ (Compare Tables 8 & 10). A subsequent ANOVA, comparing BS and BL at the third grade level, in terms of mean story clustering scores, revealed that story clustering for BS was significantly higher than for BL, $F(1,22) = 12.64$, $p < .01$.

An ANOVA on two event clustering X Bilingual Type produced a Main effect for Bilingual Type, $F(1,70) = 15.22$, $p < .01$ (See Tables 7 & 9). Subsequent ANOVAS, comparing two event clustering of BS versus BL, revealed significantly higher two event clustering for BS, in the third grade, $F(1,22) = 9.9$, $p < .01$ and in the fifth grade, $F(1,22) = 6.2$, $p < .05$.

An ANOVA on four event clustering by Bilingual Type produced a Main effect for Bilingual Type, $F(1,70) = 13.40$, $p < .01$. A subsequent ANOVA compared four event clustering scores of BS to BL and revealed that for third graders, four event clustering was significantly higher for BS, $F(1,22) = 17.07$, $p < .01$.

Overall clustering analyses revealed that for bilinguals who heard stories, the importance of event type clustering stayed constant at each grade level while story as an organizer of memory declined with age and was ultimately replaced by event. For fifth graders, two event clustering was significantly higher than story clustering.

Language of presentation (LP) clustering failed to emerge as a significant recall organizer, at every grade level.

Among monolinguals, story failed to emerge as a significant organizer of memory, at each grade level. In fact, story clustering among third graders, was significantly higher for bilinguals who heard stories than for monolinguals, as indicated by the reported Main effect of Language Type. The importance of event as a recall organizer was evident for monolinguals, who organized their recall by four event clustering, in the first grade, and two event clustering in both the third grade and the fifth grade.

Unlike their bilingual counterparts, who heard stories, bilinguals who heard word lists failed to organize their recall by story or event as indicated by reported Main effects of Bilingual Type, with respect to each of these clustering types. Among third graders, story, two event, and four event clustering was significantly higher for bilinguals who heard stories, not word lists. The same statement was true with respect to two event clustering among fifth graders. Language of presentation (LP) failed to emerge as an important recall organizer among bilinguals who heard lists of words just as it did for these subjects' bilingual counterparts, who heard stories.

Qualitative analyses

Bilinguals

The main objective for qualitative analyses of recall was to examine the actual organization patterns among bilinguals and to note any differences and/or changes in such patterns among first, third, and fifth graders. Appendix C presents a detailed description of this analyses and there are a few important observations to report here. First, the ability of bilinguals to both generalize across different language versions of the same event, namely breakfast or party, and abstract information from different event types (either between stories, e.g. from a B1 event to a P2 event or within story, e.g. from a B1 event to a P1 event) to produce lists of “breakfast and party foods” was evident among even the youngest of bilingual subjects. This point is illustrated by the closeness of story, two event, and four event clustering scores among bilingual first graders. Comparisons of patterns of organization among bilingual first, third, and fifth graders, however, did reveal some interesting variations in this regard.

Recall lists produced by first grade bilinguals, for the most part, consisted of two-three Breakfast foods and two-three Party foods. There were a few cases where foods from only a single type of event (e.g. party) were produced as well as a few cases where three events were represented within lists, namely, party foods, followed by breakfast foods, followed by party foods. In some instances (25% of recall lists) these foods originated from a single Breakfast or Party event (e.g. B1 foods and P2 foods)-(See Table C-2 in Appendix C).

However, even when a group of either Party or Breakfast foods, within a recall list, was mixed, meaning it consisted of foods from B1 & B2 or P1 & P2, it was usually stated in an orderly fashion. A typical example would be the following: B1,B1,B2,P1,P1,P2,P2. This point was reflected in the closeness of two event, four event, and story mean clustering scores among bilinguals in the first grade. These subjects did not appear to be clustering by language (LP), since such mean scores were quite low. Recall lists, for the most part, consisted of foods that were presented in mostly "Greek" with a few "English" foods interspersed throughout a given recall list of items.

Recall patterns of organization for third graders appeared to be a bit more complex, in that in addition to producing lists of Party foods and lists of Breakfast and Party foods, as first graders did, 50% of recall lists consisted of a variety of other kinds of groupings including, P,B,P; P,B,P,B; P,B,P,B,P; and B,P,B lists. On average, each event consisted of at least two or more foods. In most instances, P's and B's in the above lists entailed items from a single P or B event (P1 or P2/ B1 or B2), as evidenced by an increase in story, two event, and four event mean clustering scores for third graders as compared to first graders (See Table C-3 in Appendix C).

It appears, then, that recall lists for third graders manifested more movement from event to event be it B1 to B2 or B1 to P1 or B1 to P2 for example. It is also important to note that although LP mean clustering scores for third graders was only slightly higher than that of first graders (.35 vs .29), the actual number of cases where subjects were clustering their answers by language of presentation (i.e. recall list achieved a perfect LP clustering score of 1) was much higher for third as opposed to first graders- 6/16 vs 1/16-

to be exact, indicating third graders' increased ability to cluster remembered food items by language.

The organization patterns revealed for fifth grade bilinguals were much more distinct than that of third graders or first graders. Recall lists of fifth grade bilinguals represented the following groupings: 63% of lists consisted of either B,P,B,P or P,B,P,B,P respectively. Other groupings included B,P,B,P,B; B&P; P&B; B,P,B; and P,B,P. In some instances, B foods or P foods in any of the above listed groupings, consisted of a single food item but in most cases B foods or P foods were mixed, consisting of B1 & B2 foods or P1 & P2 foods. Most importantly, these mixes were random, for example, B1,B2,B1,P2,P1,P2. This is illustrated by the fact that two event clustering, for fifth graders, was significantly higher than story clustering, and also higher than four event clustering as well as LP clustering, which was quite low (See Table C-4 in Appendix C).

Summary

Bilingual first graders, for the most part, remembered two-three items in any given B or P food grouping. Most recall lists consisted of either one P food grouping or one B food grouping and one P food grouping. Most foods within each respective grouping originated from a single event (B1 or B2/P1 or P2). In the few instances where lists contained foods from both events (B1 & B2 or P1 & P2) foods were listed in order, (B1,B1,B2,B2), that is by specific event.

Third grade bilinguals remembered one or two-three items within any given B or P food grouping, usually from a single event (B1 or B2/P1 or P2). For the most part, foods

within either a B or P grouping were reported in order, even more so than first graders. However, recall lists for third graders consisted of more movement between breakfast and/or party events within a given list. In other words, there were usually more than one B food and/or P food grouping within a given recall list of food items.

Recall lists for bilingual fifth graders incorporated even more successive event groupings (B foods and P foods) than third graders' lists. Each event grouping consisted of one to six items, usually from both language versions of the same event (B1 & B2/P1 & P2), randomly listed.

Chapter 4. Discussion

Organization of Bilingual Memory

The Issue of Storage

The goal of the present study was to examine the organization and reorganization of bilinguals' semantic memory structures. The vehicle by which such examination was made possible was a story processing/recall task, whereby subjects listened to two stories over the course of two consecutive days and on the third day were asked to recall all the foods they could remember from the stories. Each story consisted of two different events, a breakfast and a birthday party, each of which was presented in a different language, namely, English or Greek.

In order to address the issue of organization in bilingual memory, a number of questions were posed. The first question pertained to the issue of storage. How do bilinguals organize material for the purpose of subsequent recall and what is the role of having two languages in this regard? Do bilinguals possess two specific language stores in memory or one common store, which draws upon both languages?

The present study presented several opportunities for bilinguals to manifest evidence of language specific storage. The fact that each story, consisted of two different events, each in a different language, provided bilinguals with the option to remember foods from the "English" event of the story or the "Greek" event, if that was their preference or necessity. The language order of each story presented to bilinguals was manipulated such that half of the subjects in each grade heard

events from each story in one language order (EGGE) while the other half listened to the events in the opposing order (GEEG). One of the reasons this was done was to examine whether or not a given event (breakfast or party) was more memorable to subjects if presented in one language as opposed to the other (English or Greek).

It was also of interest to investigate any possible effects that a particular “language order” of a story may have on bilinguals’ recall. Since the experimenter of the present study was also bilingual, at recall, each subject was addressed twice, once in English and once in Greek. If a subject was initially asked: “state all the foods you can remember from the stories you heard,” once the subject finished her or his response the same question was again posed to her or him but this time in Greek. Likewise, if a bilingual subject was initially asked the question in the Greek language, the same question was subsequently posed in the English language by the experimenter. This procedure made it possible for language specific memory stores to be triggered by the appropriate language, if such stores do in fact exist in bilinguals’ memory.

The results of the present study indicate that the option of language specific memory stores in bilinguals was not apparent. Although a memory preference was revealed among bilinguals for foods presented in Greek as opposed to foods presented in English, as well as a preference for Party foods versus Breakfast foods, bilinguals did not appear to be simply remembering more foods from the Greek events of a given story or the Greek Party event within a given story.

In fact, as indicated in Table B-4 in Appendix B, recall was comparable for B1 and P1 items in story one, and B2 and P2 items in story two, among first, third, and fifth grade bilinguals.

A dynamic relationship was in fact revealed with respect to bilingual recall between language of presentation, event type, and grade. Bilinguals' memory preference for party foods over breakfast foods was manifested when both foods were presented in Greek (first & third graders), and when both food types were presented in English (third graders and fifth graders), as shown in Table 2. There was no evident language preference with respect to memory for breakfast foods, among bilingual first and third graders. The number of breakfast foods recalled when such foods were presented in English was practically identical to the number of remembered breakfast foods presented in Greek. By contrast, with respect to party foods, a language preference for Greek was revealed, as noted above, for first and third graders. This pattern, however, changed, with respect to fifth grade recall. For Breakfast foods, recall was significantly higher when these foods were presented in Greek, not English, while memory for Party foods did not differ significantly by language of presentation.

Although bilinguals remembered overall significantly more foods presented in Greek as opposed to English, the difference by grade was significant only for first graders. Moreover, bilinguals of each grade reported significantly more foods in English as opposed to Greek, as shown in Table 3. This raises a number of important questions. First, how could a bilingual recall a food presented to her or

him in Greek, within the context of an event also presented in Greek, and subsequently state it in English, unless his two languages were conceptually connected? Furthermore, why would a bilingual do this if, in fact, she or he possesses two specific language stores, one for Greek events and Greek items in those events, and one for English events and English items within those events. Wouldn't it be more expedient to simply state the "Greek foods", in the "Greek" language, especially if one was instructed by the experimenter in "Greek"?

Although every bilingual participant heard the experimenter's recall instructions in both languages, no subsequent answers were recorded for any child after the experimenter's second instruction. This poses somewhat of an enigma for theorists who advocate two language specific memory stores for bilinguals, each triggered by its given language. Why didn't a second recall request initiate any further responses? If language specific stores do exist wouldn't an initial memory request, stated in one language, say English, trigger one's memory for foods from a event presented in that language and further, wouldn't a subsequent recall request stated in the other language, Greek, trigger items remembered from events presented in that language?

The notion of language specific storage also appears to be weakened by the fact that no main effects were discovered for Language order, Story order, or Language used by experimenter at recall (See Table B-1 in Appendix B). Bilinguals did not show a memory preference for foods due to the specific language order (EGGE vs GEEG) or story order (Day 1-story 1-Day 2-story 2

versus Day 1-story 2-Day 2-story 1) in which they were presented. All means were reported to be quite comparable in this regard. Also, the language of recall instruction initially used by the experimenter did not apparently trigger any language specific memory stores, as evidenced by low LP clustering scores, an issue which will be further discussed later. Further, language of instruction did not affect the actual number of foods recalled or the language in which bilingual subjects reported food items. Table B-1 in Appendix B reports comparable means, with respect to remembered food items, when instructions were presented in English versus Greek.

Results from cluster analyses of recall, for bilinguals, also support the idea that bilinguals possess one common memory store, not two language specific stores. The nature of each story presented to bilinguals afforded them the opportunity to organize and subsequently recall knowledge, retained from each story, in terms of the story itself, the event(s) within each story, and/or the language in which the event within each story was presented. Bilingual subjects at every grade level opted for the first two choices, as evidenced by low LP (language of presentation) clustering scores and higher story and/or event clustering scores. This suggests that while bilingual subjects may be processing events from stories in the language in which the event was initially presented, the knowledge subjects retained from such events/stories was subsequently stored in common, and was accessible to both the bilinguals' respective languages. Bilinguals of the present study had no difficulty listening to instructions, in either

English or Greek, accessing material presented in Greek and subsequently reporting it in English.

Event Representations

Issues of Encoding, Organization of Storage, and Retrieval

This last point addresses the second question of interest, posed by the present study, with respect to the organization of memory for bilinguals. If memory is initially organized through event representations what effect does the construction of a variety of such schemas, in L1 and L2, have on bilinguals' memory capacity and what is the role of having two languages in this regard? a) Does language help bilinguals keep events cognitively separate in memory, and if so, does language also serve as an efficient retrieval cue? Is language specific information best retained if retrieved in the same language as it was processed? b) Are events processed in the language in which they are heard and subsequently placed in a common semantic store, in which case the language that material was processed and retrieved in would have no effect on memory performance?

The discussion of the results thus far rejects (a) above and supports (b). The notion that memory is initially organized via event representations was evident from the fact that even the youngest bilingual subjects clustered their answers by two event, four event, and story. Language did not appear to help bilinguals keep events cognitively separate, as evidenced by low LP mean clustering scores, for bilinguals of each grade. Bilinguals were, in fact, given an added opportunity to

group their answers by language, if, for example, the language in question matched the language of instruction used by the experimenter. This opportunity was not taken as the great majority of foods recalled by bilinguals of the present study were stated in English, regardless of the fact that many of these were presented in Greek, even when recall instructions were stated in Greek.

Furthermore, bilingual subjects ignored the second set of recall instructions, which were stated in the opposing language in an effort to trigger possible language specific memory stores in bilinguals, and did not produce any additional answers from memory. Language, then, did not serve as an efficient retrieval cue, and recall for a particular food item did not depend upon whether or not it was presented in the same language of the retrieval instructions. These findings, in totality, suggest that bilinguals of the present study engaged in a memory search from a common store of knowledge, housing semantic information which may have been initially processed in a particular language but which was not organized by language but rather, by conceptual events.

Clustering by story or event would be impossible for bilinguals of the present study without adequate mastery of both their respective languages as well as conceptual mobility between languages. Each story of the present study consisted of two events, presented in two different languages. The varying language orders of the two stories (EGGE or GEEG) was such that each child heard each type of event- breakfast or party- in both English and Greek. Bilinguals would not have been able to organize their answers by story or event if they were not able to

conceptually migrate from event to event or from story to story, regardless of language. Clustering “breakfast foods” or “party foods” and “story one” or “story two” foods requires ignoring the language source. Their ability to accomplish such a feat, revealed through qualitative analyses of bilingual recall, speaks to the existence of a common semantic memory store in bilinguals, equally accessible to both languages.

The ability to both generalize between stories, among different language versions of the same event, was exhibited by bilinguals in each grade. Although children did not vary by grade in terms of their ability to produce B foods and P foods within a recall list, there was variation with respect to the number of foods within a B or P grouping, the origin of such foods (B1 and/or B2/P1 and/or P2), the ordering of such foods by respective event (B1,B1,P2,P2) or randomly (B1,B2,B1,P2,P1,P2), and the number of B food and/or P food groupings within a recall list (See Qualitative analyses in results section & in Appendix C).

These findings bring us to the third and fourth question of interest, with respect to bilingual memory organization. The third question asked whether or not bilinguals’ ability to generalize across different instances of the same event was facilitated, delayed, or simply more complex, due to the fact that a bilingual has two languages to cognitively contend with. The fourth question addressed the same issue but with respect to a bilingual’s ability to abstract information from one type of event to another. The quantitative and qualitative results of the present study support the notion of both complexity and facilitation.

Bilinguals in each grade of the present study exhibited adeptness, with respect to the tasks of generalization and abstraction. Moreover, with age, the degree to which bilinguals generalized and abstracted information within a given recall list increased, resulting in a change in the type of “breakfast food list” and/or “party food list” reported at recall. Such lists were initially quite orderly, for first and third graders, organized by specific event and/or story. These lists of “breakfast foods” and/or “party foods” subsequently became more random or mixed, among fifth graders, as evidenced by a decrease in four event, story, and LP clustering and an increase in two event clustering. These changes in organization patterns, with respect to bilingual recall, appear to be more complex, in comparison to the monolinguals of the present study and especially more intricate as compared with bilinguals who heard word lists, where clustering scores were close to zero. However, complexity, in the case of bilingual memory, does not denote inefficiency but, in fact, promotes facilitation, as evidenced by the fact that bilingual children remembered more foods overall than their monolingual counterparts as well as their bilingual counterparts who heard lists of words, not stories.

The Developing Role of Language

The characterization of the development of semantic memory as a progression from global to differentiated semantic memory structures (Ehrlich, 1979) is somewhat limited, with respect to bilingual memory, in that it does not fully encapsulate what appears to be a rather complex pathway of development.

The quantitative and qualitative results of the present study support the notion that bilinguals initially organize their memory somewhat globally, without being consciously aware of the fact they are cognitively contending with two different languages. Mean clustering scores, for bilingual first graders, attest to this, reflecting organization of knowledge via semantics and not language, that is clustering by event and story and not LP. Language as an organizer of knowledge was further contradicted by the fact that language of instruction had no significant impact on bilingual recall, in terms of mean number of recalled food items.

However, while bilingual first graders may not have been consciously aware or perhaps cognitively capable of the cognitive use of language as a memory organizer, conscious awareness of language in other respects was not lacking. For example, first grade bilinguals exhibited a preference for language of presentation as well as language used at recall, the former being Greek and the latter being English, regardless of language of instruction at recall. It is not surprising that bilinguals were able to remember significantly more food items that were presented and thus processed in one language(Greek) and yet report such recalled

food items in another (English), if there is a common memory store in bilinguals, equally accessible to both languages.

Such an accomplishment by bilingual first graders highlights the lexical and conceptual interconnectedness of both their languages and thus the dynamics of such a relationship. Speaking in English and transferring material from Greek into English may be a task which bilingual first graders have mastered through everyday use of their languages both at home and in school. The importance of considering language socialization patterns, with respect to bilingual memory, has been noted in earlier studies also using English-Greek bilinguals (Haritos & Nelson, 1993).

Using a language that is cognitively more comfortable may represent bilinguals' use of language as a cognitive coping strategy to maximize recall potential. It may be easier, in terms of information capacity, to hold knowledge in a common semantic store rather than two language specific stores. Processing recall instructions at the semantic level, that is, disregarding the stated language of instructions, and retrieving/recalling information in a language that one is used to or prefers to speak in may enable quicker access to semantically housed knowledge. A recent study, in fact, reported the null effects of language of instruction on English-Greek bilinguals' recall performance, concluding that such instructions are processed at the semantic level (Papaioannou & Padilla, 1982).

It is clearly evident that although bilinguals have two languages to cognitively contend with, participants in the present study were able to select encoding and

retrieval strategies that facilitated the recall process. Moreover, while bilingual first graders did not engage the option of using language to organize their memory, language was not precluded from other cognitive uses, namely that of translator, conceptual mediator, and communicator of knowledge.

Semantic memory structures for bilingual third graders appear somewhat more differentiated than those of first graders, in that memory appears to be organized in language specific ways, as evidenced by increases in LP clustering, as well as four event, two event, and story clustering. In fact, qualitative analyses of recall for bilingual third graders revealed the highest number of individual cases where LP clustering scores were actually equal to 1. Such recall lists were characterized by remembered food items grouped by language of presentation as well as specific event (B1 or B2/P1 or P2), and/or story.

Third graders did not have any difficulties abstracting information from one event type to another, that is, from remembering foods from a specific breakfast event and then subsequently recalling foods from a specific party event when both events were in the same language (B1-P2 or B2-P1) or in different languages (B1-P1/B2-P2). Qualitative analyses revealed that third graders preferred the former over the latter, that is, there were more instances of two events in the same language in recall lists, illustrating the vital role of language with respect to the organization of bilingual memory.

Although no significant differences were reported for third graders, with respect to memory for foods presented in Greek compared to English, there were

significantly more items reported in English, regardless of language of instruction. This latter finding suggests that these subjects were engaging in the same encoding and retrieval strategies used by first graders. The preference to recall in English may also reflect bilinguals' language socialization patterns. It is not unreasonable to assume that increased schooling in English strengthened and/or reinforced bilinguals' use of and preference for English.

While the role of language for third grade bilinguals incorporated the cognitive function of "memory organizer", the earlier uses of language as translator, conceptual mediator, and communicator of knowledge were not abandoned but rather strengthened and enhanced, as evidenced by significant overall increases in recall performance by third graders in comparison to first graders.

The developmental path of bilingual memory, beginning as a global organization of semantic structures among first graders, subsequently becoming a more differentiated organization, among third graders, progresses in a more integrated direction for fifth graders.

Unlike the recall lists of first and third graders which were characterized by breakfast and/or party food groupings, consisting of foods reported in order by specific event, recall lists for fifth graders were characterized by several consecutive breakfast and party food groupings, which consisted of both specific breakfast (B1&B2) and party (P1&P2) events, reported randomly. Reflecting this organization, four event, story, and LP were lower than in the other grades while

two event clustering remained high and was significantly higher than story clustering.

Bilingual fifth graders apparently had no difficulty generalizing from either one breakfast event to another (B1-B2) or one party event to another (P1-P2), and, thus, from one language to another, in reporting lists of breakfast food and party foods. Furthermore, in most instances, this movement was found several times within a given recall list.

On first glance, such results may appear to indicate that bilingual fifth graders were simply organizing their information globally and disregarding the language of presentation, as was the case for bilingual first graders. However, there are several important differences. Unlike first graders, who were recalling food items presented in Greek, with a few English food items interspersed throughout a given recall list, and who were clearly organizing such lists via specific event and story, fifth graders were mainly organizing their remembered food items by event, that is by breakfast and party, incorporating foods from both specific events (B1&B2/P1&P2) and from both languages, but in no specific order.

For bilingual fifth graders, this task illustrated first, how adept such subjects were, in terms of increased ability to conceptually migrate from one of their respective languages to another, abstracting information from B1 & B2/P1 & P2, successively, a multitude of times, within a given recall list; and second, the increased strength of the interconnected relationship existing between a

bilingual's two languages. This relationship appears to have been effected by bilingual fifth graders' patterns of everyday language use, as evidenced by a significantly higher number of remembered foods reported in English, not Greek. The preference for or necessity of speaking in English is understandable considering fifth graders' further schooling in and experience with the English language.

Furthermore, it is evident that among bilingual fifth graders the cognitive role of language as a translator and/or conceptual mediator of knowledge appears to have taken precedence over the role of language as a semantic memory organizer. However, the role of language as a organizer of memory can't exist without the ability of language to serve as a translator/conceptual mediator and was not entirely absent, with respect to recall for fifth graders. Qualitative analyses revealed that in addition to generalizing from one breakfast/party event to another within a given recall list, most recall lists for fifth graders also included abstracting of information from one event type to another both between stories as well as within the same story.

Abstracting information from one event type to another between stories afforded bilinguals the opportunity to organize their knowledge in language specific ways, in that remembering food items from a B event and then a P event between stories entailed the use of only one of their respective languages. It is reasonable to conclude, then, that although bilingual fifth graders were cognitively capable of using language as a semantic memory organizer, they opted

not to do so. Instead, these bilinguals organized their memory of food items via event, namely, breakfast and party, repeatedly within a given recall list, and in so doing maximized their overall recall performance. In addition to surpassing the memory performance of bilingual first and third graders, bilingual fifth graders recalled significantly more foods than their fifth grade bilingual counterparts who heard word lists as well as fifth grade monolinguals.

The Developing relationship of language to thought

It has been stated that it is not only language itself but the interdependent relationship of language with one's thought processes, within the culture in which one lives and engages in various types of activity, be it practical or theoretical, which contributes to the manner in which knowledge is organized from the world (Vygotsky, 1939, Luria, 1976, Haritos & Nelson 1993). The results of the present study, with respect to bilingual memory organization, support this claim in a variety of respects.

The developing relationship between language(s) and thought, among bilinguals of the present study, appears to have had a strong impact with respect to both the organization of bilingual memory as well as the role(s) or cognitive uses of language, in this regard. All bilingual participants in the present study were questioned with respect to everyday uses of each of their languages. It was revealed that, for the majority of bilinguals, the main language spoken at home was Greek, although bilinguals' parents did understand both English and Greek.

Therefore, it is plausible to assume that before entering school, engaging in formal instruction, and thus acquiring and developing scientific concepts in both English and Greek, these bilinguals initially constructed implicit knowledge systems and developed everyday or spontaneous concepts in Greek alone. This assumption may explain several key findings, with respect to recall and memory organization among first grade bilinguals.

For instance, first graders recalled significantly more food items presented in Greek, not English. If, indeed, these bilinguals had developed spontaneous concepts in Greek, prior to entering school, it makes sense that they would have no difficulty remembering foods from events such as breakfasts and/or parties, that were presented in Greek, since they had probably experienced such events, a number of times, in their everyday lives at home. Likewise, under the assumption (Nelson, 1992) that children initially organize their thinking through direct experience, it follows that when first grade bilinguals were instructed to recall as many "foods" as they could remember, they had probably attached an event restricted meaning to such a term. Further, given that they had experienced more instances of that event in Greek compared to English, first graders recalled more foods from those events presented to them in Greek. This, in turn, may explain why first graders tended to organize their memory via specific event and/or story.

It is also important to note that while first graders may have initially developed spontaneous concepts in Greek, prior to their entrance to school, they were in school at the time of the study and thus, were being introduced to a variety of

scientific concepts in both English and Greek. Therefore, these bilinguals had to cognitively contend with both the acquisition and development of scientific concepts, in each of their respective languages, as well as the subsequent development of spontaneous concepts, in both English and Greek, illustrating the need for a dynamic interconnected relationship among both bilinguals' languages.

It is not surprising, therefore, that language, for first graders, would take on the role of translator, conceptual mediator, and communicator of knowledge as opposed to semantic memory organizer. This, in turn, may explain why bilinguals chose to report significantly more foods in English, not Greek. For first graders, it was evident that while language did not play an active role, in terms of organizing stored information, with respect to bilingual memory, language did play a vitally needed role, with respect to encoding and retrieval strategies.

A question of interest, with respect to the organization of bilingual memory among third graders, is why does language take on the added cognitive role of "semantic memory organizer"? One possible argument is that third graders' cognitive priorities were somewhat different than those of first graders. The cognitive priority of first graders, comprehension, was linked to the dynamic interaction taking place with respect to the acquisition/development of spontaneous and scientific concepts, in both English and Greek.

Having been exposed to additional years of schooling, third graders had the opportunity to further develop both their scientific concepts as well as their spontaneous concepts, as well as their verbal language skills, in each of their

languages. These key aspects of development, may, in turn, have afforded these bilinguals the opportunity to engage in more abstract, theoretical kinds of thinking, and to see “language” as a semantic memory organizer. The idea of language as a semantic memory organizer is rather abstract, in that in order to fully comprehend such a notion one must be able to view “language” as an objective set of rules or tools for communication as opposed to just looking through the “language” in which knowledge is presented to attain meaning.

Evidently, third graders were able to achieve this feat, to a degree, as indicated by increases in language clustering, as well as four event, two event, and story clustering. It is not unreasonable to assume that such an accomplishment, among third graders, may not have been achieved if it were not for the further development of the dynamic interdependent relationship existing between these bilinguals’ two languages. It is clear that the increased conceptual mobility between each language, for third grade bilinguals, facilitated their ability to organize their memories in language specific ways, and ultimately maximize their recall performance. Language socialization patterns, a vital component of this dynamic relationship, among third graders were consistent with those of first graders and as a result, again, significantly more remembered foods were reported in English, not Greek.

Still another question of interest arises, with respect to the role of language, in terms of the organization of bilingual memory among fifth graders. Although fifth graders were cognitively capable of using language as a semantic organizer of

memory they chose not to do so. It is quite possible, that for fifth graders, the further development of language skills and the further strengthening of the language(s)- thought relationship had reached a point where transfer of knowledge from one language to another was so automatic that it was not cognitively feasible to organize one's memory through language. For fifth graders, the use of "language" as a semantic organizer was superseded by the use of "event".

It is possible that fifth graders had become so used to thinking of food and/or categorizing foods in terms of events, through increased experience with such events and increased schooling, that they chose to use this cognitive tool to maximize their recall potential. These findings suggest that the organization and reorganization of knowledge, that occurs within a bilingual individual as she or he learns and uses her or his languages, and as each engages in concrete and/or abstract forms of thinking is perhaps best understood by the acknowledgment that such organization is rooted in a conceptual system, which according to Nelson (1992), is initially constructed from direct experience with the cultural world and is organized via event representations. Bilingual memory organization appears to have come full circle, in that, again, for fifth graders, it is being organized through event representations.

Conclusions

The quantitative and qualitative results of the present study, with respect to the organization of bilingual memory, substantiate the notion of one common memory store where knowledge is semantically organized and accessible to both languages, for bilinguals. The degree of accessibility to such knowledge is important since quicker access would facilitate the process of recall for bilinguals. Bilinguals, in each grade selected encoding and retrieval strategies that maximized their recall potential in this regard, as evidenced by significant gains in memory with age. Recall instructions were processed at the semantic level and retrieval of information from memory was primarily conducted in English.

It may be speculated that the preference to recall foods in English reflected bilinguals' language socialization patterns. Having mastered their Greek oral skills at home, bilingual first graders may have deemed it necessary to practice their English verbal skills since English was the main language in which they were instructed in and spoke in, in school everyday. Further schooling and increased exposure to experiences in English may have further strengthened this preference since it was also prevalent among bilingual third and fifth graders.

Language experience may also have played a role in terms of bilingual first graders' memory preference for foods presented in Greek. Since Greek was the main language spoken at home, it is not illogical to assume that event experiences

such as breakfasts and/or parties were in Greek. Having attached an event restricted meaning to the word “food”, first graders capitalized on their Greek experiences, using them to facilitate recall.

The fact that bilinguals have two languages to cognitively contend with did not put them at a disadvantage in terms of recall performance. In fact, bilinguals remembered overall significantly more foods than monolinguals. However, the organization of bilingual memory was somewhat more complex than that of monolinguals. The former had the added option of using language as a semantic memory organizer of knowledge, while the latter did not.

The dynamic role of language, with regard to the organization of bilingual memory, is evident if one considers the various cognitive uses language afforded bilinguals in the first, third, and fifth grade. For first graders, the roles of language included that of translator, conceptual mediator and communicator of knowledge. These cognitive uses of language were vital and necessary since most subjects at this grade were remembering foods presented in one language (Greek), retrieving/recalling them in another language (English), and being instructed to recall in both languages.

Among third graders, language took on the added role of semantic memory organizer, as evidenced by increases in LP clustering as well as four event, two event, and story clustering. For fifth graders, the role of language as translator and/or conceptual mediator of knowledge took precedence over the role of

language as an organizer of memory. Four event, story and LP clustering scores were lower than in the earlier grades, while two event clustering remained high.

The changing role of language, for bilinguals, is best understood if one considers language as a member of a dynamic developing relationship with thought as its' partner. Such a relationship cannot be realized without the culture in which one lives, that is, the everyday cognitive uses, functions, and experiences one has with one's language(s).

The initial role of language as conceptual mediator/communicator/translator of information was vital for first graders' cognitive priority of comprehension. If these subjects did initially acquire spontaneous concepts in Greek, prior to entering school, and were being introduced to scientific concepts in both English and Greek in school, subsequent development of both types of concepts in both languages would necessitate a conceptual and lexical link between those languages.

Moreover, the further development of spontaneous and scientific concepts in both English and Greek may have cognitively afforded bilinguals the opportunity to think of language abstractly, that is, as a semantic memory organizer. Mastery of verbal skills in both languages through increased schooling and further life experiences, which would strengthen the developing language-thought relationship, may have also contributed to third graders' ability to use language in such a capacity. The changing role of language may have contributed to third graders' significantly better recall performance, in comparison to first graders.

Although bilingual fifth graders were cognitively capable of using language as a semantic memory organizer, they opted not to do so. This decision may be a reflection of a conceptual and lexical link between languages that is so strong that transfer/translation of knowledge becomes automatic. In such instances organizing one's memory through language may be cognitively impractical. For fifth grade bilinguals the most cognitively suitable semantic memory organizer was event. It enabled these subjects to remember significantly more foods than bilingual first and third graders, monolinguals in each grade level, and all of their bilingual counterparts who heard word lists.

The poor recall performance of bilinguals that heard lists of words suggests the importance of the memory task when considering bilingual memory organization. Hearing lists of words in both languages did not apparently evoke a lexical or conceptual link between these languages. Subjects may have encoded such knowledge at a surface level, that is not at a deeper semantic level as was the case for story recall, and subsequently attempted to remember such information in a rote manner. The result was poor recall performance, in comparison to bilinguals and monolinguals who heard stories.

Without the context of an event that may allow bilinguals to practice their verbal skills and exercise the possible uses of language as translator or conceptual mediator, it is highly unlikely that subjects will be afforded the cognitive opportunity to think of language as a semantic memory organizer. Bilingual first,

third, and fifth graders that heard lists of words in both languages did not organize their memory by language and were not able to recall more than a few food items.

The findings of the present study overall, suggest that the developmental path of bilingual memory organization is complex but not detrimental, cognitively speaking. Such a path is driven by life (event) experiences and in some instances language. If one considers that the latter is a major part of the former one gets a better appreciation of the dynamics involved in the organization of bilingual memory. The results of the present study indicate that the complexity of bilinguals' memory organization did not hamper their memory but rather facilitated their recall performance.

APPENDIX A

STORIES

Story One

One morning Mary and Steven got up early to make breakfast for their parents. "What should we make?", asked Steven. "Why don't you get two slices of bread and put them in the toaster", Mary said, "and I'll fry up the eggs and sausages. I already made the coffee", she added. When all the food was ready, Steven and Mary placed it all on two trays along with a bowl of fresh strawberries and a cup of sugar. They took it and put it down on front of their parents' bedroom door, knocked and then ran away. "I bet they will be surprised", Steven said to Mary.

A week later was Mary's eighth birthday and her parent were giving her a surprise party. Her father was barbecuing some hamburgers and hot dogs and her mother was putting all the soda bottles in the refrigerator. Her brother Steven was filling up all the bowls in the living room with potato chips. When Mary's father finished barbecuing, he called evryone outside to eat inthe yard. Mary especially enjoyed dessert- chocolate cake covered with two scoops of cherry ice cream- her favorite. Mary got a lot of nice presents and all her friends said it was the best party they had been to.

Story Two

Today Mary and Steven's family were making breakfast together. Mom is making omelettes and cheese. Steven just finished making some freshly squeezed orange juice. "Dad something smells delicious", said Mary. "It's the biscuits in the oven", he said, "Well here are the melons", Mary added. "I cut them in half and put a teaspoon of honey over each of them". "Wonderful", her father said. "I'll just put them in the oven while it is still warm". "All the food is ready", Mary's mother said, "Let us eat".

A week later was Mary's father's fortieth birthday. Her mother was throwing him a surprise party. Mary's mother told her husband to take the kids out for some pizza. As soon as they all left, the guests arrived. The women put all the bowls, that were filled with pretzels, into the living room while the men carried in all the wine bottles and put them into the freezer along with the chocolate ice cream. Mary's mother was reheating the chicken she cooked the day before and putting candles on the lemon cake-her husband's favorite. At that moment everyone heard a noise. As Mary's father came in the front door they all yelled "Happy Birthday". The party was great.

APPENDIX A**Word Lists****Story One**

bread
eggs
sausages
coffee
strawberries
sugar
hamburgers
hot dogs
soda
potato chips
chocolate cake
cherry ice cream

Story Two

omelettes
cheese
orange juice
biscuits
melons
honey
pizza
pretzels
wine
chocolate ice cream
chicken
lemon cake

APPENDIX A

STORIES

Story One

Ένα πρωί, η Μαιρη και ο Στεφάνος εξυπνήσαν νωρίς να φτιαξουνε πρωίνο για τους γονείς τους. Τι να φτιαξουμε ερωτήσε ο Στεφάνος. Παρε μερικές φέτες ψωμί και βάλτα μέσα στη τούστiera ειπε η Μαιρη και εγω θα τσιγανισω τα αυγά μαζί με τα λουκανικά. Εχω φτιαξει τον καφέ. Όταν όλα τα φαγητά ήταν έτοιμα ο Στεφάνος και η Μαιρη τα βάλανε σε δυο δίσκους και τους αφήσαν έξω από την μπорта του δωματιου που κοιμοταν η γονείς τους, χτύπησαν την μπорта και έφυγαν. Δεν θα το περιμενουνε αυτο που καναμε ειπε ο Στεφάνος στην Μαιρη.

Την επομένη εβδομάδα ήταν τα γεννεθλια της Μαιρης. Ήταν οχτώ γρονον και οι γονείς της τις διναν ένα παρτη. Ο πατερας της εψυνε μπιφτεκια και φρανκφορες στα καρβουνα και η μητερα τις εβαζε όλες τις μπουκαλες τις σοδες στο ψυγειο. Ο αδελφος της ο Στεφάνος γεμιζε όλα τα βαθια πιατά με πατατες τσιπς στην σαλα. Όταν ο πατερας της τελειωσε τον ψυσιμο τον φαγητων εφωναξε όλους έξω να φανε στο κυπο. Της Μαιρης τις αρεσε πολλή η σοκολατενια τουρτα—ήτανε σκεπασμενη με δυο κουταλιες παγωτο κερασιου. Η Μαιρη πήρε πολλά ωραία δώρα και ολοι οι φίλοι της ειπανε πως ποτε δεν ειχανε πως ποτε δεν ειχανε παη σε τετοιο ωραιο παρτη.

Story Two

Σήμερα οι οικογενια της Μαιρης και του Στεφάνου ολοι μαζί ετοιμαζανε πρωίνο. Η μητερα της Μαιρης θα φτιαξει ομυλετες με τυρι. Ο Στεφάνος εφτιαξε πορτακαλαδα φρεσκα. Κατοι μοιρηζει ωραιο ειπε ο πατερας της. Να τα πεπονια ειπαι η Μαιρη. Τα εκουσα στην μεση και εβαλα μια κουταλια μελη στο καθε ένα. Πολλή ωραιο ειπαι ο πατερας της. Θα το βάλω αμεσως στο φουρνο τωρα που είναι ζεστος. Όλα τα φαγητά είναι έτοιμα, ειπε η μητερα της Μαιρης ελατε να φάμε.

Την επομένη εβδομάδα ήταν τα γεννεθλια του πατερα της Μαιρης. Ήταν σαραντα χρονων. Η μητερα της Μαιρης του εδινε ένα σερπραις παρτη. Η μητερα της Μαιρης ειπε στον αντρος τις να παρη έξω τα παιδια φανε πιζζα. Μολις εφυγαν ηρθαν αμεσως οι επισκεπτες στο σπιτι. Οι γυναικες πήραν όλα τα βαθια πιατά που ήταν γεματα με κουλουρακια ξερα με αλατι μέσα στην σαλα. Οι ανδρες εφεραν μέσα τις πουκαλες κρασιου και τα βάλανε στην φρηζα μαζί με το παγωτο σοκολατα. Η μητερα της Μαιρης ξαναζεστανε την κοτα που ειχε ετοιμαση μια μερα πριν και εβαλε όλα τα κερια επανω σε μια τουρτα λεμονιου. Εκεινη την στοιγμη ολοι ακουσαν ένα θορυβο. Όταν ο πατερας της Μαιρης ανοιξε την προστινη μβορτα ολοι φοναξανε Χαρουμενα Γεννεθλια. Το παρτη ήταν πολλή ωραιο.

APPENDIX A**Word Lists****Story One**

ψωμι

λουκανικα

αυγα

καφε

φραωλες

ζαχαρι

μπιφτεκια

φρανκφορες

σοδα

πατατες τσιπς

σοκολατενια τουρτα

παγωτο κερασιου

Story Two

ομυλετες

τυρι

πορτοκαλαδα

μπισκοτα

πεπονια

μελι

πιτζα

κουλουρακια ξερα με αλατι

κρασι

παγωτο σοκολατα

κοτα

τουρτα λεμονιου

APPENDIX A

ARC(Adjusted ratio of clustering)

Adjusted ratio of clustering - chance clustering = 0/ perfect clustering = 1.

The proportion of actual category repetitions above chance to the total possible category repetitions above chance for any given recall protocol.

$$\text{ARC} = \frac{\text{R}-\text{E}(\text{R})}{\text{maxR}-\text{E}(\text{R})}$$

R = total number of observed category repetitions

(i.e. the number of times a category item follows an item from the same category)

maxR= maximum possible number of category repetitions

[N-K where N=total number of items recalled and K = # categories represented in the recall protocol.

E(R) = expected(chance) number of category repetitions

$$\text{ER} = \frac{\sum_i n_i^2}{N} - 1 \quad (n = \# \text{ items recalled from category } i / N = \text{total number of items recalled})$$

APPENDIX A**Language Questionnaire**

- | | | | | |
|---|---|-------------|------------|-------------------|
| 1. Do you speak to your Mommy in | ? | English | Greek | Both |
| 2. Does Mommy speak to you in | ? | English | Greek | Both |
| 3. Do you speak to your Daddy in | ? | English | Greek | Both |
| 4. Does Daddy speak to you in | ? | English | Greek | Both |
| 5. Is there anyone you spend more
time with | ? | Yes- Mommy | Yes- Daddy | No- Both the same |
| 6. Which language, if any,
do you speak most of the time | ? | English | Greek | Neither |
| 7. Is there a language that you
like to speak the most | ? | Yes-English | Yes-Greek | No |

APPENDIX B**Table B-1.**

Recall by language order, story order, and language used by experimenter at recall

	GRADE		
	FIRST	THIRD	FIFTH
Language Order	N =	N =	N =
EGGE	47 (23 in E) (24 in G)	56 (29 in E) (27 in G)	77 (39 in E) (38 in G)
GEEG	42 (21 in E) (21 in G)	64 (36 in E) (28 in G)	79 (38 in E) (41 in G)
Story Order			
(1,2)	48 (24 in E) (24 in G)	63 (35 in E) (28 in G)	77 (41 in E) (36 in G)
(2,1)	41 (20 in E) (21 in G)	57 (30 in E) (27 in G)	79 (36 in E) (43 in G)
Total	89 (44 in E) (45 in G)	120 (65 in E) (55 in G)	156 (77 in E) (79 in G)

APPENDIX B**Table B-2.**

Mean number of items recalled by grade, event, and language of presentation (and standard deviations)

	GRADE			
	FIRST	THIRD	FIFTH	
Breakfast				Total
Greek	1.25 (.90)	1.25 (1.09)	2.56 (1.22)	
English	1.06 (.97)	1.25 (1.35)	1.44 (1.06)	
Total	2.31 (1.49)	2.50 (1.51)	4.00 (1.15)	8.81
Party				
Greek	2.19 (1.29)	2.81 (1.42)	2.63 (1.22)	
English	1.06 (1.25)	2.19 (1.07)	3.13 (1.36)	
Total	3.25 (1.06)	5.00 (1.32)	5.76 (1.06)	14.01
Total Greek	3.44 (1.26)	4.06 (1.77)	5.19 (1.14)	12.69
Total English	2.13 (1.59)	3.44 (1.97)	4.56 (1.63)	10.13
TOTALS	5.57 (.89)	7.50 (1.67)	9.75 (1.18)	

APPENDIX B

Table B-3.

Recall analysis via language of presentation and language used by subjects at recall [English-(E) or Greek-(G)]

	GRADE		
	FIRST	THIRD	FIFTH
Presented and Recalled in E	2.13 (1.59)	3.38 (2.03)	4.44 (1.63)
Presented E & Recalled in G	0 (0)	.06 (.24)	.12 (.48)
Total Presented in English	2.13 (1.59)	3.44 (1.97)	4.56 (1.63)
Presented and Recalled in G	.44 (.81)	.81 (1.33)	.81 (1.07)
Presented G & Recalled in E	3.00 (1.21)	3.25 (1.34)	4.38 (1.5)
Total Presented in Greek	3.44 (1.26)	4.06 (1.77)	5.19 (1.14)
Recalled in English	5.13 (1.20)	6.63 (2.31)	8.81 (1.80)
Recalled in Greek	.44 (.81)	.88 (1.57)	.94 (1.44)
Total items recalled	5.56 (.89)	7.50 (1.67)	9.75 (1.18)

APPENDIX B

Table B-4.

Recall analysis for Bilinguals(B) versus Monolinguals(M)

		GRADE		
		FIRST	THIRD	FIFTH
B1	B	1.44 (1.09)	1.06 (1.24)	2.38 (1.54)
	M	1.42 (1.08)	2.08 (1.51)	2.25 (.87)
B2	B	.88 * (.72)	1.44 (1.26)	1.56 (.96)
	M	.25 (.45)	1.08 (.67)	1.25 (1.06)
P1	B	1.88 (1.54)	3.19 (1.17)	3.63 (.89)*
	M	2.58 (1.24)	2.58 (1.56)	2.58 (.90)
P2	B	1.38 (1.26)	1.81 (1.11)	2.13 (1.31)
	M	1.00 (.85)	1.67 (1.50)	1.92 (1.00)
1st B hd	B	1.50 (.89)*	1.19 (1.05)	1.62 (1.26)
	M	.67 (.89)	1.33 (1.15)	1.67 (1.15)
2nd B hd	B	.81 (.91)	1.31 (1.45)	2.31 (1.35)
	M	1.00 (1.13)	1.83 (1.34)	1.83 (1.03)
1st P hd	B	1.38 (1.15)	2.50 (1.51)	2.56 (1.46)
	M	1.66 (.98)	1.66 (1.23)	2.17 (1.11)
2nd P hd	B	1.88 (1.63)	2.50 (1.15)	3.19 (1.17)*
	M	1.92 (1.62)	2.58 (1.78)	2.33 (.89)
Bkfst	B	2.31 (1.49)	2.50 (.51)	4.00 (1.15)
	M	1.67 (.98)	3.16 (1.85)	3.50 (1.30)
Party	B	3.25 (1.06)	5.00 (1.32)	5.75 (1.06)*
	M	3.58 (1.24)	4.25 (1.66)	4.50 (1.38)
Story 1	B	3.31 (1.30)	4.25 (1.61)	6.06 (1.81)*
	M	4.00 (1.48)	4.75 (2.53)	4.83 (.83)
Story 2	B	2.25 (1.44)*	3.25 (1.44)	3.69 (1.70)
	M	1.25 (.87)	2.67 (1.15)	3.17 (1.47)
Total	B	5.56 (.89)	7.50 (1.67)	9.75 (1.18) *
	M	5.25 (1.22)	7.42 (2.61)	8.00 (1.21)

* bilingual-monolingual comparison significant at $p < .05$

APPENDIX B

Table B-5.

Mean number of items recalled by Grade and Story between Bilinguals who heard stories(BS) and Bilinguals who heard word lists (BL).

		GRADE		
		FIRST	THIRD	FIFTH
Story One				
	BS	3.31 (1.30) *	4.25 (1.61) *	6.06 (1.81) *
	BL	.75 (.71)	1.00 (.75)	2.75 (.71)
Story Two				
	BS	2.25 (1.44)	3.25 (1.44) *	3.69 (1.70) ***
	BL	1.25 (.89)	1.00 (1.07)	2.13 (.64)
Brkfst				
	BS	2.31 (1.49) ***	2.50 (1.51) *	4.00 (1.15) *
	BL	1.00 (1.07)	.37 (.52)	2.87 (.89)
B1				
	BS	1.44 (1.09) **	1.06 (1.24) ***	2.38 (1.54)
	BL	.38 (.51)	.13 (.35)	1.63 (1.06)
B2				
	BS	.88 (.72)	1.44 (1.26) **	1.56 (.96) ***
	BL	.63 (.74)	.25 (.46)	.63 (.92)
Party				
	BS	3.25 (1.06) *	5.00 (1.32) *	5.75 (1.06) *
	BL	1.00 (.93)	1.62 (1.18)	2.63 (1.41)
P1				
	BS	1.88 (1.54) **	3.19 (1.17) *	3.63 (.89) *
	BL	.38 (.74)	.88 (.94)	1.25 (1.03)
P2				
	BS	1.38 (1.26)	1.81 (1.11) ***	2.13 (1.31)
	BL	.63 (.74)	.75 (1.03)	1.38 (1.18)
Total				
	BS	5.56 (.89) *	7.50 (1.67) *	9.75 (1.18) *
	BL	2.00 (.51)	2.00 (.92)	4.87 (.64)

- * BS -BL comparison significant at $p < .01$
 ** BS -BL comparison significant at $p = .01$
 *** BS -BL comparison significant at $p < .05$

APPENDIX B**Table B-6.****Mean Clustering Scores for Bilinguals (BS)**

	GRADE		
	FIRST	THIRD	FIFTH
STORY	.40 (.60)	.57 (.49)	.19 (.46)
TWO EVENT	.42 (.57)	.52 (.47)	.51 (.29)
FOUR EVENT	.49 (.65)	.65 (.46)	.39 (.40)
LP	.29 (.72)	.35 (.63)	.22 (.53)

APPENDIX B**Table B-7.****Mean Clustering Scores for Monolinguals**

	GRADE		
	FIRST	THIRD	FIFTH
STORY	.22 (.66)	.02 (.83)	.04 (.72)
TWO EVENT	.25 (.83)	.65 (.58)	.46 (.37)
FOUR EVENT	.65 (.63)	.19 (.77)	.27 (.51)

APPENDIX B**Table B-8.****Mean Clustering Scores for Bilinguals who heard word lists (BL)**

	GRADE		
	FIRST	THIRD	FIFTH
STORY	0 (0)	-.13 (.35)	.09 (.53)
TWO EVENT	.13 (.35)	0 (0)	.10 (.28)
FOUR EVENT	.13 (.35)	-.13 (.35)	.03 (.61)
LP	.13 (.35)	-.13 (.35)	.18 (.37)

APPENDIX C

Qualitative analyses

Bilinguals

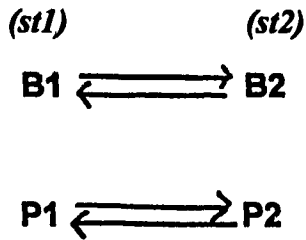
Recall was further analyzed in order to reveal and compare actual patterns of organization among bilinguals. For example, do bilinguals tend to remember foods from the same event type from both stories, that is, recall B1 and B2 foods or P1 and P2 foods, thereby stating/producing lists of “breakfast foods” and/or “party foods”. In such a scenario it must be noted that B1 items and B2 items (or P1 & P2 items) would be presented to subjects in two different languages.

Another option would be for subjects to remember foods from different event types (breakfast or party) either within the same story (i.e. B1 & P1 foods or B2 & P2 foods) or between stories (i.e. B1 & P2 food items or P1 & B2 food items). The former alternative entails food items presented to subjects in two different languages while the latter choice consists of food items presented in the same language. A third option would be some combination of the former two while a fourth option would consist of recalling food items from a single event. These options are depicted in Diagram 1.

In addition to delineating the actual organization patterns of bilingual recall, a distinction was made between lists of remembered foods that were “mixed” and lists of remembered foods that were “not mixed”. The latter entailed at least two consecutive food items from every event represented within that list. For example if a list had foods from a B2, P1, and B1 event respectively, then there had to be at least two consecutively stated foods (two in a row) for each respective event (B2 food, B2 food, P1 food, P1 food, and B1 food, B1 food).

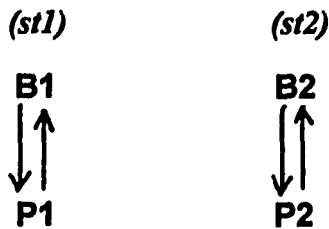
APPENDIX C

Diagram 1 Patterns of Organization for Bilinguals' Recall Lists

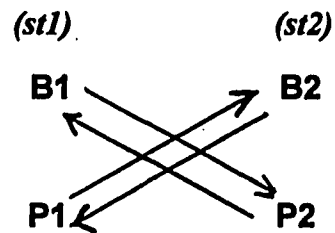


1 = Remembering foods from the same event
type(breakfast or party) between stories

2 = Remembering foods from different event types (Breakfast and Party)

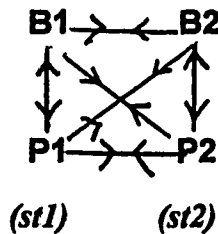


A) within the same story
(each event in a different language)

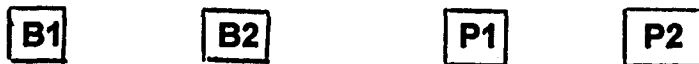


B) between stories
(each event in same language)

3 = Any combination of "1" and "2"



4 = Remembering foods from the same event



By contrast, a “mixed” list of remembered foods could contain one item from one event (B1), followed by two items from another event (P2), and then one item from a previously represented event (B1), and four items from another event (P1) etc. Notably, 39/48 recall lists of bilinguals were “mixed” while the remaining 9 were “not mixed”. Furthermore, no identical organization patterns were discovered among any of the 48 lists, mixed or not.

Table C-1 depicts qualitative analyses of bilingual recall, in terms of the four possible patterns of organization mentioned earlier. It is evident that most of the lists of remembered foods, produced by bilingual subjects at recall, (34/48), represent a pattern of organization which combines many or all of the above mentioned options, also depicted in diagram 1. These combinations include memory for foods from the same event type (breakfast and/or party) as well as recalling foods from different event types both within the same story (B1 & P1 or B2 & P2) as well as between stories (B1 & P2 items or B2 & P1 items).

Although no identical organization patterns were discovered among any bilingual subjects, comparisons of patterns among first, third, and fifth graders revealed some interesting commonalities among respective grades of subjects. First graders’ recall lists, for the most part, consisted of two - three breakfast foods and two - three party foods. Other food groupings included Party foods (P’s); B’s, P, B, P; P, B’s, P’s; P, B, P, B’s; and P’s, B’s, P, B, P, respectively. These groupings are listed in Table C-2.

APPENDIX C

Table C-1.

Qualitative Analyses of Bilingual recall, via four possible organization patterns*

“Nonmixed” Lists

<u>Organization Pattern</u>	<u># cases (Bilingual subjects)</u>
1	3
2A	1
2B	1
3	3 (2=2B&2A, 1= 1,2B)

“Mixed” Lists

<u>Organization Pattern</u>	<u># cases (Bilingual subjects)</u>
1	1
2A	1 (2A,2A,2A)
2B	1
3 (2A & 2B)	5/=(2B,2A,2A),(2A,2A,2B),(2A,2B) (2B,2A), (2B,2A,2B,2A)
3 (1, 2A)	9/=(1,1,1,1,1,2A,1), (1,1,1,1,2A,1,1) (1,2A,1), (1,2A,1,2A,2A),(2A,1) (2A,1,1,2A,1,2A,1) (2A,2A,1) (1,2A,1,2A,2A,1), (1,2A)
3 (1, 2B)	11/=(2B,1,2B,1), (1,2B,1), (1,1,2B) (2B,1-(P2=E)), (2B,1-(P1=G)), (1,2B-(B2=G)), (1,2B-(B1=E)) (2B,1,1), (2B,2B,1,1,1,2B,1), (1,2B,1,2B,1), (1,2B-(B2=E))
3 (2A, 2B, 1)	11/=(2B,1,2A,2B,2A),(1,2B,2A) (2B,2B,2A,2B,1), (1,2A,2B,2A) (2B,2A,2A,1),(2A,1,1,1,2B), (1,1,1,1,2A,2B,1,2A),(2A,2A,2B,1,1) (2B,2A,1,2A,1,2B),(2A,2A,2B,2A,1) (11,1,2A,2B,1,2A)

* patterns are depicted in Diagram 1

APPENDIX C

Table C-2.

General Patterns of Recall for Bilingual first graders

"Nonmixed" Lists

4 out of 16

General Patterns

Listed Party foods (P2,P2,P1,P1,P1)

Listed P2 foods

Listed P foods and B foods (P1s,B1s)

Listed B's,P's, & B's

"Mixed" Lists

12 out of 16

General Patterns

5 started with Breakfast (B) foods

- | | |
|---|---|
| 4 | List B foods & P foods, mixed or from same event

a)listing mixed "B" foods & P1s or P2s
i.e. B1,B2,B2,P1,P1/ B2,B1,B1,P2,P2,P2
b)listing B1s & P foods-mixed
i.e. B1,B1,P1,P2,P2,P2
c)listing B foods-mixed & P foods-mixed
i.e. B1,B1,B2,P1,P1,P1,P2 |
| 1 | Listed B1 foods, a P2 food, a B2 food, & a P2 food |
| | <u>7 started with Party (P) foods</u> |
| 2 | Listed Party foods from one event & Breakfast foods from either the same event or mixed
i.e. P1s, B2, B1s/ P2s and a B1 |
| 2 | List P food, B foods (mixed or same event) and P foods(same event or mixed)
i.e. P2,B1,B2,P2,P2/ P1,B1,B1,P1,P2 |
| 1 | List P1 food, B1,P1, & B foods (mixed)
i.e. P1,B1,P1,B2,B2,B1,B2 |
| 1 | List P2 foods- B1,B2,P2,B1,P1 |
| 1 | List P foods- P1,P2,P2,P2 |

It is evident from Table C-2 that first graders were grouping their answers in terms of “Breakfast foods” and “Party foods” and in a rather orderly manner, by specific event.

Third graders’ recall patterns of organization were a bit more complex than first graders, in that food groupings within a given list were much more varied than simply P foods from one event and B foods from another event. These groupings are reported in Table C-3.

It is evident from Table C-3 that for third graders, in most instances, “Breakfast foods” and/or “Party foods” consisted of food items from a single event, B1 or B2/ P1 or P2, much more so than first graders, as indicated by an increase in event (two and four), story, and even LP clustering for the former as opposed to the latter. There was also more movement, within a given list, naming a food item from a party event, followed by several foods from a breakfast event, followed by foods from a party event, etc., in comparison to first graders.

APPENDIX C

Table C-3.

General Patterns of Recall for Bilingual third graders**“Nonmixed” Lists****General Patterns**

5 out of 16

- | | |
|---|--|
| 2 | List P foods/ P1,P1,P1,P2,P2,P2 |
| 2 | List P foods, B foods, & P foods
i.e. P2,P2,P2,B1,B1,B1,P1,P1,P1
i.e. P2,P2,P2,B1,B1,P2,P2 |
| 1 | List B foods & P foods/ B2,B2,B2,P1s,P2s |

“Mixed” Lists**General Patterns**

11 out of 16

3 started with Breakfast (B) foods

- | | |
|---|--|
| 2 | List B foods & P foods (mixed or same event)
a) B1s,P2,P1,P2,P2
b) B2,B2,B2,B1,P1,P2,P2 |
| 1 | List B foods, P foods, & B foods all mixed
but in order
i.e. B1,B2,P1,P1,P2,P2,B1,B1,B2,B2 |

8 start with Party (P) foods

- | | |
|---|--|
| 3 | List P foods (mixed but in order) & B2s or B1s
or Bs- (mixed)
i.e. P1,P1,P2,P1,B2,B2
i.e. P2,P2,P2,P1,B1,B1
i.e. P2,P2,P2,P1,P1,B1,B2,B2 |
| 2 | List P1s, a B1, & Ps from same event (P1 or P2) |
| 2 | List P2s, B2s, a P2, and a B1 |
| 1 | List random mix of Ps, B2s, P1, & B2s |
| 1 | List P1s, a B1, a P1, B2s, P2s, and P1s |

The patterns of organization revealed among bilingual fifth graders incorporate even more successive event groupings within a given list as opposed to third and first graders. These groupings are listed in Table C-4. It is apparent from Table C-4 that B foods and P foods within a fifth grader's recall list, consisted, for the most part, of either a single food item or rather random lists of foods from both B1 & B2 or P1 & P2, clearly indicating two event clustering. It is also worth noting that none of the recall lists of fifth graders were "non-mixed" (i.e. consist of two or more consecutively stated food items from each respective event represented within a given recall list).

APPENDIX C

Table C-4.

General Patterns of Recall For Bilingual fifth graders"Mixed Lists"General Patterns

100 %

9 started with Breakfast (B) foods

- 6 Movement from B to P to B to P (events) B or P events may be random mixes, single food items or single event items.
 a) B2,B1,P1,P1,P2,B2,P2,P2
 b)B1,B2,B2,P2,P2,P1,P1,B1,B1,P2
 c)B2,B2,B1,P1,P1,P1,P1,B2,P2
 d)B1,B2,B2,B2,B2,P2,P2,P2,P1
 e)B2,P2,P1,P2,P2,B2,B2,B2,B2,P2
- 1 Movement from B to P to B to P to B
 (B1s, mix Ps,B1,P1,B2)
 i.e. B1,B1,P2,P1,P2,P1,P2,B1,P1,B2
- 1 Movement from B to P (mix Bs, P2s)
 i.e. B2,B1,B1,P2,P2,P2,P2
- 1 Movement from B to P to B (B1s, mix Ps & mix Bs)
 i.e. B1,B1,P2,P2,P1,P1,B2,B1,B1

7 started with Party (P) foods

- 2 Movement from P to B (mix of both)
 i.e. P1,P2,P1,P1,P2,P1,P2 P2,B2 B1
 i.e. P2,P1,P2,P1,P2,P2,B2,B1,B2
- 1 Movement from P to B to P (mix Ps,B2s,P2s)
 i.e. P2,P1,P2,P1,B2,B2,P2,P2,P2
- 4 Movement from P to B to P to B to P
 a)P1, B2, Mix Ps, Mix Bs, P2
 i.e. P1,B2,P1,P2,P1,P2,B1,B2,B2,P2
 b)P1, B2, Mix Ps, Mix Bs, P1s
 i.e. P1,B2,P2,P1,B1,B2,B1,B2,P1,P1
 c)P2, B1s, P2, B2, Mix Ps
 i.e. P2,B1,B1,B1,P2,B2,P1,P2,P1,P2
 d)P2s, B mix, P1s, B2s, P2
 i.e. P2,P2,P2,B1,B2,B1,P1,P1,B2,B2,P2

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