J. Child Lang. **24** (1997), 3–24.

Monolingual and bilingual children's use of the mutual exclusivity constraint*

DENISE DAVIDSON, DIANA JERGOVIC, ZUBIA IMAMI AND VIOLET THEODOS

Loyola University Chicago

(*Received* 5 *September* 1994. *Revised* 6 *March* 1996)

ABSTRACT

The use of the mutual exclusivity constraint was examined in three-year-old and six-year-old children who were either monolingual in English ($N = 32$) or bilingual in English/Urdu ($N = 32$) or in English/Greek ($N = 32$). Three tests of the constraint were used: disambiguation, rejection, and restriction. On the disambiguation test, the mutual exclusivity bias was significantly more evident in five- and six-year-old monolingual children than in their same-age bilingual peers. Monolingual children were also more likely than bilingual children to reject a new name for a familiar object. However, using a restriction test, neither monolingual nor bilingual children readily accepted and restricted typical names for hybrid objects. Developmental differences were also found, as older (five- to six-year-old) monolingual children's responses on the tests were generally more consistent with the constraint than younger (three- to four-year-old) children's responses. Nevertheless, bilingual children did use the constraint, but not to the extent of monolingual children.

INTRODUCTION

During the first years of life, children learn new vocabulary at a staggering rate. It has been estimated that by age 6 or so, monolingual children know about 8–14,000 words (Carey, 1978; Kagen, 1981). Of interest to those

[*] This research was funded by grants from the United States Department of Education (P202A20081) and from the Spencer Foundation. The work itself and the conclusions reached are solely the responsibility of the investigators. Portions of this research were presented at the American Psychological Society Meeting, June 1993, Chicago, IL. We thank Lisa Lorick, Raabia Mustafa, Mary Tzotzolis, and Bobbie Viegas for their aid in data collection and coding. We also thank the children, parents, and staff at the following daycares and schools: Children's Campus, Muslim Educational Center, Rogers Park Children's Learning School, and St Andrew's Greek Orthodox School. Address for correspondence: Denise Davidson, Department of Psychology, Loyola University Chicago, 6525 N. Sheridan Road, Chicago, IL 60626, USA (e-mail: ddavids@luc.edu).

studying language development is how young children learn so many words in one, and sometimes more than one, language. Numerous researchers have argued that children are equipped with early biases or constraints that guide their word learning (e.g. Markman & Hutchinson, 1984; Mervis, 1984; Markman & Wachtel, 1988; Markman, 1989; Merriman & Bowman, 1989; Woodward & Markman, 1991). The purpose of the present research was to examine monolingual and bilingual children's use of one of these constraints, the mutual exclusivity constraint.

The mutual exclusivity constraint refers to the finding that children, at least monolingual children, often assume that an object has only one label (e.g. Markman & Wachtel, 1988; Markman, 1989; Merriman & Bowman, 1989). Although controversy surrounds the origins and usefulness of this constraint (see, e.g., Nelson, 1988; Gathercole, 1989; Woodward & Markman, 1991; Markman, 1992, for discussions), previous research has provided evidence for its operation in monolingual children (e.g. Vincent-Smith, Bricker & Bricker, 1974; Golinkoff, Hirsh-Pasek, Lavallee & Baduini, 1985; Markman & Wachtel, 1988; Taylor & Gelman, 1988; Merriman & Bowman, 1989; Au & Glusman, 1990). According to Merriman & Bowman (1989), evidence for the mutual exclusivity constraint can be seen in at least four different effects that result from children's use of the constraint: disambiguation, correction, rejection, and restriction effects.

The disambiguation effect involves how children decide about the referent and label of a new word, particularly in ambiguous situations (Merriman & Bowman, 1989). For example, suppose a child sees a gyroscope and a cup and is told, 'Bring me the gyroscope'. Even if the child does not know the word gyroscope, and has never seen a gyroscope before, he or she may readily hand over the gyroscope instead of the cup. That is, given that the child knows what a cup is, the child reasons that the cup could not be called both a cup and a gyroscope. Merriman & Bowman (1989) refer to this finding as the disambiguation effect.

A second way in which the mutual exclusivity bias manifests itself is the correction effect (Barrett, 1978; Merriman & Bowman, 1989). For example, if a new word is introduced for what the child believes to be the referent of a familiar word, the child might correct this belief. Thus, if 'wolf' is used to describe an animal that the child thought was a dog, he or she might react by removing wolves from the extension of dog (Merriman & Bowman, 1989). The child might also reject the new word ('No, it's a dog.'). This is referred to as the rejection effect (Mervis, 1984).

Finally, the bias may lead to the restriction effect. Once an object is known to have a certain name, other names should not be generalized to it. For example, if children see what appears to be a cross between a cup and a glass, but are told that it is a glass, they are likely to infer that it is not also a cup (Merriman & Bowman, 1989). Told nothing, they are likely to infer that it is

a cup or a glass but not both. In other words, children have a tendency to restrict the label of the object to one name.

Although controversy surrounds evidence for these effects (Nelson, 1988; Woodward & Markman, 1991), there are times when the mutual exclusivity bias is not useful and must be suspended. Clearly, children must suspend the bias so that they can learn names for overlapping categories (e.g. dog and animal). Moreover, when learning two languages, the mutual exclusivity constraint must be suspended, at least between languages. Nevertheless, few studies have examined potential differences in monolingual and bilingual children's use of the mutual exclusivity constraint. In fact, we found only two published studies (Au & Glusman, 1990; Merriman & Kutlesic, 1993) which have assessed the constraint in bilingual children.

In the first study, Au & Glusman (1990) found that bilingual children and adults accepted two names for an object when the names came from different languages. That is, English and Spanish-speaking preschool children (Study 4) and adults (Study 5) were found to accept two names for an object if it was clear that one of the names was in Spanish and the other name was in English. More recent work has also found that bilingual children suspend the constraint between languages (DeWitt, 1994). However, with the exception of a recent study by Merriman & Kutlesic (1993), most studies have not assessed bilingual children's use of the mutual exclusivity constraint within a language.

In Merriman & Kutlesic's (1993) research, the correction effect was tested by training a second name to a referent which children had just selected as an example of the first name. They were scored as correcting the first name if they decided not to select this object again in the final test of the name. In addition, the restriction effect was assessed by measuring the extent to which children selected non-overlapping sets of referents for the two names in the final test.

In general, Merriman & Kutlesic (1993) found little difference in the extent to which monolingual and bilingual children corrected and restricted names within a language, although they did find that bilinguals were less likely to show these effects between languages. However, several limitations may exist with their procedures and their subsequent interpretations. First, the extent to which children corrected and restricted may have been dependent upon the extensive name-training procedures that both monolingual and bilingual children encountered, which in turn may have eliminated differences between lingual groups. Secondly, there are often problems with assessing for the presence of effects by inferring from an absence of performance. That is, children may have selected non-overlapping objects simply because they had not selected them before, not because they were correcting or restricting the names. In addition, the bilingual children may not have been completely bilingual, or at least balanced bilinguals, as

their Serbian scores on the Peabody Picture Vocabulary Test were lower than their English scores.

In the present research, an attempt was made to eliminate at least some of the potential problems noted in previous research. In the present experiment, disambiguation, rejection, and restriction effects were assessed with monolingual, English-speaking children and bilingual children (the design and rationale for each test are described below). In contrast to previous studies, two different samples of bilingual children were assessed: bilingual English/Urdu- and bilingual English/Greek-speaking children. Additionally, within the monolingual and the bilingual samples, two age groups were tested: three- and four-year-olds and five- and six-year-olds.

Two age groups were assessed because previous research with monolingual children has shown that the mutual exclusivity bias becomes more pronounced throughout the preschool and early grade school years (Merriman & Bowman, 1989; Au & Glusman, 1990; although see Woodward & Markman, 1991, for comments). In fact, some have suggested that the mutual exclusivity constraint is a heuristic that children learn to use as they get older (MacWhinney, 1991). Others have suggested that the constraint may be a default option that children use when other options are not available (e.g. Merriman & Bowman, 1989; Markman, 1992). However, it is possible that bilingualism may affect this pattern of development. That is, older bilingual children may be less likely than younger bilingual children to be constrained, given the extent to which they have had to suspend the mutual exclusivity constraint across languages.

DISAMBIGUATION TEST

In previous research, the disambiguation effect has been assessed with the following general procedures (e.g. Golinkoff *et al.* 1985; Vincent-Smith *et al.* 1974; Merriman & Bowman, 1989). First, two sets of objects are constructed, a familiar set and an unfamiliar set of objects. In the testing phase, or the disambiguation test, children are shown pairs of the objects, with each pair consisting of one familiar and one unfamiliar object. Half the time the familiar member is named and children are asked to point to it, and half the time a nonsense or artificial name is given, and children are asked to point to that object. The disambiguation effect refers to the finding that children often point to the unfamiliar object after hearing the artificial name. The purpose of the present experiment was to examine how both monolingual and bilingual children perform using a disambiguation test similar to that just described.

METHOD

Subjects

Ninety-six children participated: 32 monolingual English speaking children, 32 bilingual English/Urdu speaking children (Urdu is an Indic [Indo-Aryan] language used in Pakistan and India), and 32 bilingual English/Greek speaking children. In each language group, 16 were between three and four years old (age range 3;9 to 4;4, mean age 4;1) and 16 were between five and six years old (age range 5;10 to 6;4, mean age 6;2). All of the children were drawn from primarily middle-class communities in Chicago, Evanston, and Skokie, Illinois (U.S.A.). These bilingual children were sampled, in part, because they shared similar demographic characteristics as the monolingual children (e.g. middle-class). All of the monolingual and almost all of the bilingual children (about 98%) were born in the United States and had spent most of their life in the U.S. Across groups of children, approximately half were boys and half were girls.

Language proficiencies

Children's receptive vocabulary was measured in each language they spoke using the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981). All children were given the standardized English version. Following the general procedures of Bialystok (1988), bilingual children also completed a translation of the test in their native language. Different forms of the test were used so that there was no overlap in the specific vocabulary tested. Presentation of the English and the native language versions of the PPVT was counterbalanced so that half the children were tested in English first, and their native language second, and *vice versa* for the remaining children. Although this procedure may provide a rough measure of language proficiency, particularly in bilinguals, it has been used successfully in previous research with monolingual and bilingual children (e.g. Bialystok, 1988).

In the children tested, no significant differences were found between monolingual and bilingual children's knowledge of English. However, bilingual children knew English better than either Urdu or Greek ($p < 0{\cdot}05$). Nevertheless, all of the children who participated in the study were at their respective age level in the language(s) they spoke. That is, all of the bilingual children in this study were at least at their age level in both languages, although they generally knew English better. In fact, one problem with obtaining bilingual subjects was that it was nearly impossible to find children who were equally proficient in both languages. Therefore, the adoption of the age-level criteria assured us that the children in the final sample at least knew both languages at their respective age level, although they typically knew

more English. This problem is a common one when examining American bilingual children (Merriman & Kutlesic, 1993). One monolingual child and five bilingual children were replaced because they did not meet the age-level criteria; another monolingual child was replaced because her score was considerably above her age level.

Through the use of parent permission letters, it was also possible to select bilingual children from families where an emphasis was placed on children's successful mastery of both languages. Although this was accomplished by families in several different ways, including enrolling children in language programmes at community cultural centres, and parents making a conscious attempt to teach children both languages, the result was that it was possible to find young children that could be considered bilingual at least for their age level. Also, through the use of these letters, it was possible to assess bilingual children whose parents had rated them as knowing both languages. Thus, with the selection of children through parent permission letters, and also with the replacement of children in the manner noted above, the final sample of children tested were at least at their respective age level in all languages they spoke.

Materials and procedure

Children were tested individually in a quiet room of either their home, daycare, or school. The bilingual children were spoken to only in Greek or Urdu, except when completing the English version of the PPVT. Testing of bilingual children was conducted by the authors who were fluent in either Urdu or Greek. Similar to the bilingual children, the bilingual experimenters were all born in the United States, but had been raised in families in which an effort was made to maintain the native language (Greek or Urdu) of the family. All children completed the disambiguation test first, prior to the rejection and restriction tests (smaller samples of children were tested under different test orders [e.g. restriction first] in order to confirm these results, see below). For bilingual children, the disambiguation test was conducted in Greek or Urdu, although small samples of these children later completed a different version of the disambiguation test (i.e. with different objects) in English.

Published norms (Vincent-Smith *et al.* 1974; Goldin-Meadows, Seligman & Gelman, 1979) and pilot testing were used to obtain 18 familiar objects that even the three-year-olds would know (e.g. box, scissors, bottle). Pilot testing also revealed 18 unfamiliar objects (e.g. hole puncher, eyelash curler, drapery hook). Pilot testing was conducted with different children but from the same age groups and language communities as the samples ($N = 8$ per group). No significant differences were found in monolingual and bilingual children's responses on the pilot tests, which was expected given that both monolingual

and bilingual children were natives of the U.S. and were from similar demographic communities. From the set of 36 objects pilot tested, 12 familiar and 12 unfamiliar objects were used as testing materials. All objects were similar in size. The remaining objects were kept on reserve in case a child did not know the name of a familiar object, or knew the name of an unfamiliar object, and an object had to be replaced.

In phase 1, children were shown for several seconds each familiar and unfamiliar objects in a random order. The children were asked to name the objects, and their responses, including 'I don't know' for unfamiliar objects, were recorded. Based on the procedures of previous research (Merriman & Bowman, 1989), experimenters were instructed to handle children's requests for the names of unfamiliar objects with the statement 'I'll tell you a little later, ok?' However, none of the children requested this information.

Phase 2 consisted of a pre-exposure phase in which half the children (i.e. in each age/language group) were allowed to play with the familiar and unfamiliar objects for five minutes, while the remaining children were not. These conditions were used because previous research has suggested that children may have a tendency to pick up unfamiliar objects because of a novelty preference (Markman & Wachtel, 1988). In addition, children were allowed to play with all of the objects because some have argued that just having children play with the unfamiliar objects may bias children to select the familiar objects during testing (Woodward & Markman, 1991).

In the final phase, the disambiguation test, 12 pairs of objects were created, with one familiar and one unfamiliar object in each pair. Half the time the familiar member of the pair was named, and the child was asked to point to it, and half the time an unfamiliar (artificial) name was given and the child was asked to point to it. Artificial names were nonsense words either in English, Urdu, or Greek. Previous research has also used artificial names for the unfamiliar objects (e.g. Merriman & Bowman, 1989). The children were not allowed to pick up the objects. Following a label, the experimenter recorded whether children pointed to the familiar or unfamiliar object for each pair.

RESULTS

One point was given when a familiar object was labelled and subsequently selected, or when an unfamiliar label was given and the unfamiliar object was selected. A four-way ANOVA was performed on this data, with between-subjects variables age (three–four and five–six), language (English, Urdu–English, Greek–English), and condition (no exposure, exposure) and within-subjects variable type of object (familiar/unfamiliar). An age × language × type of object interaction was found, $F(2, 84) = 3{\cdot}97$, $p < 0{\cdot}02$, as were main effects of age, $F(1, 84) = 7{\cdot}07$, $p < 0{\cdot}01$, language, $F(2, 84) = 9{\cdot}68$, $p < 0{\cdot}0001$, and type of object (familiar/unfamiliar), $F(1, 84) = 63{\cdot}84$,

$p < 0{\cdot}0001$. Interaction comparisons and *post hoc* Tukey tests conducted on these results revealed that within an age group, no significant differences were found in monolingual and bilingual children's selection of the familiar objects, as both groups of children knew the names of the familiar objects and selected them when they were so named (see Table 1). Importantly, however, when an artificial name was used, five- and six-year-old monolingual children more readily pointed to the unfamiliar object in the pair than their same-age bilingual peers, $p < 0{\cdot}05$. In contrast, the younger monolingual and bilingual children showed the disambiguation effect equally often, although not as often as the older monolingual children (see Table 1).

TABLE 1. *Mean proportion of correct selections on the disambiguation test*[a]

Age	Type of object	
	Familiar	Unfamiliar
Three- and four-year-olds		
Monolingual English	0·89	0·69
Bilingual English/Urdu	0·81	0·65
Bilingual English/Greek	0·83	0·60
Five- and six-year-olds		
Monolingual English	0·95	0·92
Bilingual English/Urdu	0·93	0·67
Bilingual English/Greek	0·93	0·71

[a] Correct selections were either children's selection of a familiar object after its familiar name was given, or children's selection of an unfamiliar object following an unfamiliar name.

All of the five- and six-year-old children's responses were significantly above chance performance, all $p < 0 \cdot 05$. This was revealed with one-sample t tests, with children's performance on the familiar and unfamiliar items compared separately with chance expectancy (0·50). All of the three- and four-year-old children's responses were significantly different from chance ($p < 0{\cdot}05$), with one exception: bilingual English/Greek children's responses for unfamiliar items were not significantly different from chance, $t(15) = 1{\cdot}46$, $p < 0{\cdot}16$. In addition, no significant differences were found between exposure and no exposure conditions, perhaps because children only pointed to, but could not pick up, the objects.

DISCUSSION

Several findings were revealed from the results of the disambiguation test. First, older (five- and six-year-old) monolingual children showed the disambiguation effect considerably more often than their same-age bilingual peers. This was revealed with their responses to the artificial labels: given an artificial name, the older monolingual children were significantly more likely

than their bilingual peers to select an unfamiliar object. In fact, these older monolingual children almost always selected the unfamiliar object following an artificial name. Nevertheless, older bilingual children's responses did show evidence of the disambiguation effect as their selections of the unfamiliar objects following an artificial name were significantly above chance.

In contrast, older monolingual and bilingual children were equally likely to select the familiar object following its familiar name. This was also true for the younger monolingual and bilingual children, as they responded to familiar objects and labels in the same way. In contrast to the older children's responses, however, no significant differences were found in younger monolingual and bilingual children's responses to unfamiliar objects.

These results suggest that bilingualism may affect the developmental pattern seen for the disambiguation effect. At least for monolingual children, it has been argued that the disambiguation effect is a word-learning heuristic that, with development, children learn to use (MacWhinney, 1991). In contrast, because bilingual children must routinely suspend the effect across languages (i.e. an object can have two names if the names are from different languages), perhaps they learn that the heuristic is not very useful.

However, it has been argued that the disambiguation effect cannot be used as the sole assessment of the mutual exclusivity constraint, because the disambiguation effect may simply be due to a desire to fill lexical gaps and acquire labels for unnamed categories (Clark, 1983; Merriman & Bowman, 1989). That is, a child might select an unfamiliar object over a familiar object, not because she wants to avoid having two names for the same object, but because she wants to avoid having no name at all for the object. Still, it is not clear why bilinguals would not have the same need as monolinguals to fill lexical gaps. In fact, given their history of learning at least two names for an object or category, it could be argued that they would have a greater need than monolinguals to fill such gaps. This would suggest that bilinguals would be even more likely than monolinguals to show the disambiguation effect, although this was not found to be the case in the present research. Nevertheless, additional tests of the mutual exclusivity constraint were carried out with these same children. These tests included tests of the rejection and restriction effects.

REJECTION TEST

According to Merriman & Bowman (1989), the rejection effect refers to the finding that children will sometimes reject a new word, when the new word is introduced for what the child believes to be the referent of a familiar word. Although Merriman & Bowman (1989) did not directly assess the rejection effect in children, they did assess the correction effect, which is due in part to the rejection of a new label for familiar object. Specifically, the correction

effect occurs when a new word is introduced for what the child believes to be a referent of a familiar word. The child then rejects the new word and goes on to 'correct' the speaker (Merriman & Bowman, 1989).

In previous research, the correction effect was assessed by presenting children with drawings of typical referents, for example, a truck or a shoe, and drawings of atypical referents (Merriman & Bowman, 1989). The atypical referents were 'hybrids', which possessed the properties of two basic-level categories from the same semantic field, such as a hybrid car-truck. The correction effect was assessed by the percentage of times children avoided selecting the target referents of the new name (see Merriman & Bowman, 1989, for details). However, other reasons why children avoided selecting certain objects were not assessed.

In the present research, similar pictures of typical and atypical, hybrid objects were shown to the children and referred to with artificial names. Of interest was whether children would more readily reject the new name for the typical objects than for the atypical, hybrid objects.

METHOD

Subjects

The same monolingual and bilingual children tested for the disambiguation effect were also used to assess the rejection effect.

Materials and procedure

Two sets of seven pictures were constructed. Set A consisted of seven individual pictures (from magazines) colour-copied onto a 27×42 cm sheet: two cars, two trucks, two hybrid car-trucks, and a picture of some cherries. The picture from the different semantic category (e.g. cherries) was included to determine if children were responding randomly (see Merriman & Bowman, 1989). Set B consisted of two foxes, two lions, two hybrid fox-lions, and a banana picture. The hybrid pictures were constructed with a mixture of parts from the two categories; for example, the animal hybrids consisted of a fox tail, half a fox torso and half a lion torso, a lion mane, and a fox face with lion ears. This combination of parts was used to eliminate the possibility that any one potentially defining part of the object (e.g. the head of the animal) would be used to name the object. The parts were sometimes photo-reduced so that all parts would fit together. In addition, by colour-copying the complete picture several times, distinguishable marks between parts were made less clear.

For set A pictures, the experimenter pointed to a car picture but did not call it a car. Instead, the experimenter said 'I'm going to show you a luga [or artificial name in Urdu or Greek]. Here is a luga. It is a luga. Can you say luga? Say luga for me.' Then the child was asked (*a*) if the other car picture

was a luga, (*b*) if a hybrid car-truck picture was a luga, (*c*) if the original car picture was a luga, and (*d*) if the original car picture was both a luga and a car (and why). Of interest was whether children would more readily reject the new name for the typical objects (car or fox) than for the hybrid objects.

For the animal pictures, the experimenter pointed to a hybrid fox-lion on the sheet and called it a bave (or its artificial name in Urdu or Greek). The experimenter then asked the child (a) if the other hybrid was a bave, (*b*) if a fox was a bave, (*c*) if the original hybrid was a bave, and (*d*) if the original hybrid could be both a fox and a bave. Half the children in each age group for each language sample completed the rejection test in this manner. The remaining children saw the same pictures, although for set A, a hybrid car-truck picture instead of a car picture was called a luga, and for set B, a fox picture instead of a hybrid was called a bave.

RESULTS

For the typical objects given an unfamiliar (artificial) name, the extent to which children rejected the new name for (*a*) a typical object similar to the original, (*b*) a hybrid object, and (*c*) the original typical object, was assessed. Also examined was (*d*) how readily children rejected two names for an object (e.g. car and luga). For example, the original car picture was pointed to and children were asked, 'Is this a car and a luga?' Likewise, for the hybrid objects, the extent to which children rejected the name for (*a*) a hybrid object similar to the original, (*b*) a typical object, and (*c*) the original hybrid object, were examined. Also examined was (*d*) how readily children would reject two names for the hybrid object. For each instance of rejection, one point was given.

A five-way ANOVA was conducted on children's responses to questions (*a–d*) for typical and hybrid objects, with between-subjects variables age (three–four and five–six), language (monolingual English, bilingual Urdu, bilingual Greek), and condition (i.e. typical car, hybrid animal or hybrid car, typical animal; see above), and within-subjects variables type of object (typical, hybrid) and type of question (*a–d*). This analysis revealed several interactions: age × type of object × type of question, $F(3, 252) = 7{\cdot}66$, $p < 0{\cdot}001$; age × type of object, $F(1, 84) = 6{\cdot}68$, $p < 0{\cdot}01$; language × type of question, $F(6, 252) = 2{\cdot}14$, $p < 0{\cdot}05$; and condition × type of question, $F(3, 252) = 5{\cdot}76$, $p < 0{\cdot}001$. Main effects of age, $F(1, 84) = 12{\cdot}14$, $p < 0{\cdot}001$, and type of question, $F(3, 252) = 3{\cdot}74$, $p < 0{\cdot}01$, were also found.

Although the pattern of results was complicated, interaction comparisons, simple main effects analyses, and Tukey tests conducted on the significant results revealed several interesting findings (all ps $< 0{\cdot}05$). For typical objects, five- and six-year-old monolinguals more readily rejected an artificial, new name for typical objects that were similar to the target (question *a*), as well as for the original object (question *c*), than either group of same-age

bilinguals. In contrast, both monolingual and bilingual children were equally likely to reject the artificial name for a similar hybrid (question *a*) as well as for the original hybrid (question *c*). However, because the rejection rate for hybrids was relatively low, it was apparent that both older monolingual and bilingual children were about equally accepting of the artificial name for the hybrids.

A similar pattern of findings was obtained with the younger children: younger monolingual children more readily rejected the artificial (new) name for similar typical objects (question *a*) and the original typical object (question *c*) than either group of bilingual children. However, monolingual and bilingual children were equally likely to reject the artificial name for similar hybrids and target hybrids. The lack of difference between lingual groups for hybrid objects appeared to be due to the fact that children more readily accepted an artificial name for the hybrid objects than for the typical objects, regardless of age and bilingualism.

Note in Table 2 that older children were generally more rejecting than younger children (all ps $< 0{\cdot}05$), although this effect was more pronounced for monolinguals than for bilinguals. In most cases, children's responses were significantly different from chance, although there were some exceptions (see Table 2). It should also be noted that the results of the rejection test were not altered when the rejection test was presented to similar types of children but either before or after the disambiguation and restriction tests. Finally, after we began testing we realized that children might more readily accept two names for the typical car (i.e. car and luga), than for the typical animal, because children might think that 'luga' referred to the brand name of the car. However, no significant evidence was found for this.

DISCUSSION

This experiment examined the rejection effect (i.e. rejection of a second label), which is present when children maintain the mutual exclusivity constraint. The results of the rejection test revealed that both younger and older monolingual children more readily rejected an artificial name for a typical object that bilingual children. In contrast, both monolingual and bilingual children were about equally accepting of an artificial name for hybrid objects. These findings suggest that children were not responding randomly, or were simply responding yes or no in a biased manner. For example, if children always responded in the affirmative regardless of type of object this would suggest that they were biased in their responding. These results suggest that an assessment of the rejection (and perhaps acceptance) effect can be assessed through the use of yes/no type of questioning, at least with children who are about four years old. Given that previous research has found that children younger than three do not show the rejection effect, at least when the procedures involve the selection of objects (Merriman &

TABLE 2. *Mean proportion of times children rejected an unfamiliar name for typical and hybrid objects*

	Type of object							
	Typical object				Hybrid object			
	Type of Question[a]							
	(a) Similar object	(b) Hybrid object	(c) Original object	(d) Two names	(a) Similar object	(b) Typical object	(c) Original object	(d) Two names
Three- and four-year-olds								
Monolingual English	0·50	0·63	0·44	0·25	0·38	0·63	0·31	0·50
Bilingual/Urdu	0·31	0·50	0·19	0·31	0·38	0·68	0·38	0·56
Bilingual/Greek	0·38	0·44	0·28	0·38	0·38	0·44	0·38	0·50
Five- and six-year-olds								
Monolingual English	0·69	0·69	0·69	0·44	0·38	0·88	0·69	0·69
Bilingual/Urdu	0·44	0·69	0·44	0·38	0·31	0·38	0·63	0·50
Bilingual/Greek	0·38	0·56	0·38	0·31	0·31	0·56	0·63	0·50

[a] See text for details on each question (a–d).

Bowman, 1989), it may be interesting to note whether a similar lack of effect would be found with more direct yes/no questioning.

The final experiment examining the mutual exclusivity constraint involved an assessment of monolingual and bilingual children's use of the restriction effect.

RESTRICTION TEST

As previously noted, the restriction effect can be illustrated with the following example: suppose children see an object that is a cross between a cup and a glass. If told, 'This is a glass', then, according to the restriction effect, they should infer that it is not a cup; if told nothing they should infer that it was either a glass or a cup but not both (e.g. Labov, 1973). In previous research with monolingual children (Merriman & Bowman, 1989), one method for assessing the restriction effect was to show children either hybrid pictures (which possessed the properties of two familiar basic-level categories from the same semantic field, e.g. a spoon and a fork), or to show children a picture of a typical referent (e.g. a spoon). A set of six pictures to which the named drawing belonged was then shown, and the children were asked to put their finger on another 'Y' (e.g. spoon) and then to point to any more 'Y's (spoons). That is, 'Y' was one of the two familiar basic-level names (e.g. spoon) represented in the set. By then repeating this questioning with the other familiar name (e.g. fork), the extent to which children restricted to one category could be determined.

Several differences should be noted in the methodology used to assess the restriction effect in the present research. First, only hybrid pictures were used because the hybrids were in line with the definition of the restriction effect: restriction occurs when the name of an object is limited to one of its two parts; for example, either its glass or cup parts (Labov, 1973; Merriman & Bowman, 1989). Thus, the hybrids should be the best type of objects to use to test the restriction effect. Furthermore, because the children had already completed the other tests (or were going to have to complete the other tests), we did not want unduly to extend our procedures with the addition of typical object pictures so that testing became too onerous for children.

A second difference between this research and previous research was that the hybrids were composed of either inanimate parts (i.e. knife and fork parts), or animate parts (i.e. bird and fish parts). This manipulation was used in order to assess the restriction effect across inanimate and animate objects. It may be that children think that it is less plausible that an animal could be of two types than that a utensil could be of two types.

METHOD

Subjects

The same monolingual and bilingual children tested for the disambiguation and rejection effects were tested for the restriction effect.

Materials and procedure

Two sets of hybrid objects, set A and B, were composed for the restriction test. Both sets consisted of five pictures of hybrids, colour-copied onto separate 22 × 27 cm sheets. Set A were hybrids composed of knife and fork parts and set B were composed of bird and fish parts. For the knife-fork hybrids, the very beginning of the handle was a fork handle, the remaining handle was a knife handle, and the ends of the knives were shaped like forks. The bird-fish hybrids had a fish tail, bird wings, and a round head with a fish mouth and a bird beak. This combination of parts for each particular set of hybrids was used to eliminate the possibility that any one potentially defining part of the object (e.g. the head of the 'animal') would be used to name the object. The size of all hybrids were within a 6 × 6 cm range.

Half the children saw the pictures and completed the questions for set A first, and the remaining children saw the pictures and completed the questions for set B first. The children were shown the hybrids for a given set, and the experimenter pointed to the target hybrid at the top of its respective sheet. For example, for set A, the experimenter pointed to the very top picture on the page of knife-forks and called it a knife. Specifically, the children were told: 'I am going to show you a knife. Here is a knife [points to hybrid at top of page with remaining hybrids covered]. So this is a knife. Isn't that neat? It's a knife.' Pointing to different hybrids on the respective sheet, the experimenter asked, in a counterbalanced order, if two of them were knifes and two were forks (e.g. 'Is this another knife?'; 'Is this a fork?'). In line with the glass-cup example, if children accepted the name 'knife' for the hybrids, then children should have rejected the name fork when it was used. In other words, in terms of the mutual exclusivity bias, children should restrict the name of the hybrid to one category or label (i.e. knife).

Following this questioning, the experimenter pointed to the target hybrid picture again from the set and asked 'What is this?' This last question was used to assess the children's retention of information about the target hybrid, and also as a final assessment of children's acceptance of the label for the hybrid. The same types of questions were asked about set B hybrids composed of bird-fish pictures (with the target hybrid called a bird). Thus, the extent to which children would restrict a name was assessed by examining how readily they accepted this name for other similar-looking hybrids, as

TABLE 3. *Mean proportion of times children rejected other name (fork/fish) and mean proportion of times children accepted given name (knife/bird)*[a]

Age	Reject other name (fork/fish)	Accept given name (knife/bird)
Three- and four-year-olds		
Monolingual English	0·56/0·56	0·16/0·13
Bilingual/Urdu	0·41/0·41	0·41/0·25
Bilingual/Greek	0·38/0·41	0·22/0·16
Five- and six-year-olds		
Monolingual English	0·63/0·94	0·53/0·25
Bilingual/Urdu	0·53/0·66	0·38/0·31
Bilingual/Greek	0·41/0·63	0·44/0·22

[a] See text for explanation.

well as rejected the other name for the objects (e.g. the other part's name, fork).

Thus, these questions and methodology differed from Merriman and Bowman's (1989) in subtle ways. In their research, children were shown the set of pictures and the children were asked to put their finger on a 'Y' (e.g. spoon) and then to put their finger on another 'Y' (e.g. spoon). The experimenter then repeated this questioning with the other familiar name (e.g. fork). The extent to which children selected overlapping sets of drawings (e.g. at least one drawing was selected for both 'spoon' and 'fork') was then determined and was used to assess the extent to which they would restrict a name. One limitation of this methodology is that children may have selected different, non-overlapping objects because they were simply pointing to objects that they had not pointed to before. This may have been particularly true when children were asked to 'point to another one'. In the present research, this potential limitation was avoided by assessing children's restriction with direct questions pertaining to their rejection and acceptance of labels.

RESULTS

The first set of analyses was conducted on children's rejection of the other names (i.e. fork and fish labels). It should be recalled that if children were restricting the name of the hybrid to the name given to it by the experimenter, then children should have rejected the other names (i.e. fork or fish) for similar hybrids. One point was given each time children rejected these labels for the other hybrids, for a total of four possible points.

Children's rejection of the other names is shown in Table 3. A three-way

ANOVA was conducted on children's responses, with between-subjects variables age (three–four and five–six) and language (monolingual English, bilingual English/Urdu, and bilingual English/Greek), and within-subjects variable type of object (inanimate, animate). This analysis revealed main effects of age, $F(1, 90) = 9{\cdot}25$, $p < 0{\cdot}003$, and language, $F(2, 90) = 5{\cdot}22$, $p < 0{\cdot}007$. Age × type of object, $F(1, 90) = 3{\cdot}03$, $p < 0{\cdot}08$, and type of object, $F(1, 90) = 3{\cdot}67$, $p < 0{\cdot}059$, approached but were not significant. *Post hoc* Tukey tests revealed that both older and younger monolingual children more readily rejected the other labels (fork and fish) than bilingual children (all ps $< 0{\cdot}05$). These results are shown in Table 3. Overall, older children rejected the names more than younger children. In addition, because type of object was implicated in two effects, additional simple main effects and *post hoc* Tukey tests were conducted on these effects. These analyses revealed that older monolingual children more readily rejected the animate name (fish) than the inanimate name (fork) than any other group.

A second set of analyses was conducted in order to determine how readily children accepted the restricted names (i.e. knife and bird) for the objects. If children accepted these names, this would provide further support that children were actually restricting the names of the objects to one label. On the other hand, it may be that children not only rejected the other names (fork and fish), but also rejected the given names as well (knife and bird).

Children's acceptance of the restricted names are shown in the right-hand column of Table 3. A three-way ANOVA, with between-subjects variables age and language, and within-subjects variable type of object, was conducted on the data. Main effects of age, $F(1, 90) = 6{\cdot}54$, $p < 0{\cdot}012$, and type of object, $F(1, 90) = 4{\cdot}44$, $p < 0{\cdot}038$, were found. *Post hoc* Tukey tests revealed that, overall, older children more readily accepted (restricted) the labels than younger children, and all of the children more readily accepted the names for the inanimate hybrids than the animate hybrids (all ps < 0.05). Bilingualism, however, did not enter into any significant effects.

Taken together, these results suggest that neither monolingual nor bilingual children liked either of the names (e.g. knife of fork) given to the hybrids. Of interest was whether children had forgotten what we had called the target hybrid. Thus, children's responses to the question asked about the target (i.e. 'what is this?') were examined.

It was found that many of the children did not simply say 'knife' or 'bird', but instead qualified their responses with statements like: 'You said it was a bird' or 'You said it was a knife.' When further prompted, 'Do you think it is a knife (bird)?', most of the youngest children just shrugged their shoulders and/or did not verbally respond. In contrast, almost equal numbers of the older monolingual and bilingual children either agreed with our label, or said 'I don't know', or said 'I think it is a knife-fork.' These types of responses suggest that while children readily remembered what we

had called the hybrids, they were much less inclined to accept, and subsequently restrict, these names.

It should be noted that these results were also obtained with additional samples of monolingual and bilingual children who performed the restriction test before the disambiguation and/or the rejection tests.

DISCUSSION

In the present experiment, an examination of just children's rejection of other names suggested that monolingual children more readily restricted the names than bilingual children. However, the results of the restriction test also revealed that it is important to examine not only the degree to which children restrict a name by rejecting another name, but also how much they accept the name given to the objects in the first place. In the present research, both monolingual and bilingual children remembered what the names of the targets were; however, they were not convinced that these hybrids nor the other hybrids should have these names. This may have been the case because these strange hybrids were labelled with a familiar name. Perhaps with the use of artificial, nonsense names children would have restricted the artificial name and not accepted other artificial names for the hybrids. However, because the restriction effect is often described with an example of a hybrid object being described with the name of only one of its typical parts (i.e. the glass-cup example of Labov, 1973; or Merriman & Bowman, 1989), the present assessment of the restriction effect used only typical names. Because of the lengthy nature of the experiments, and because all of the children completed each experiment, it was not possible to examine the restriction effect with artificial names.

It may also be that with repeated training children would have restricted familiar names to other hybrids. However, one limitation of training procedures is that children may be learning to restrict in that one particular condition or experiment; training may also artificially eliminate differences between monolingual and bilingual children. Of interest in this research was the extent to which children would restrict on their own, in part because children are assumed to be restricting without the aid of formal training in their everyday learning of language.

RELATIONSHIP BETWEEN DISAMBIGUATION, REJECTION AND RESTRICTION TESTS

Significant correlations were found only between rejection and restriction tests for English/Urdu ($r = 0{\cdot}54$, $p < 0{\cdot}05$) and English/Greek ($r = 0{\cdot}21$, $p < 0{\cdot}05$), three- and four-years-olds, with low scores on the rejection test correlated with low scores on the restriction tests. The general lack of significant correlations across tests replicates Merriman and Bowman's

(1989) findings, and may be due to the difficulties in assessing correlations between these tests (see Merriman & Bowman, 1989, for a discussion).

GENERAL DISCUSSION

The purpose of the present research was to examine monolingual and bilingual children's use of the mutual exclusivity constraint. Of interest was the extent to which bilingual children might preserve mutual exclusivity within a language. That is, how likely were bilingual children to accept two names for an object if it was clear that the names came from the same language? Previous research has shown that bilingual children more readily accept two names for an object than monolingual children, at least when the names come from two different languages (Au & Glusman, 1990; Merriman & Kutlesic, 1993). However, it was not clear the extent to which bilingual children might preserve mutual exclusivity within a language, particularly across disambiguation, rejection, and restriction tests.

Specifically, it has been suggested that the use of the mutual exclusivity constraint results in at least three different effects: disambiguation, rejection, and restriction effects (Merriman & Bowman, 1989). Based on this premise, tests of these effects were carried out in the present research. In order to feel more confident about our results two samples of bilingual children (English/Urdu and English/Greek) were assessed in the present research, along with their monolingual peers. In addition, only bilingual children who were at their age-level in both languages were assessed. In order to note potential developmental patterns, within each language sample two age groups were assessed: three- and four-year-olds and five- and six-year-olds.

Across tests, both similarities and differences were noted in the responses of monolingual and bilingual children. Developmental differences were also apparent. On the disambiguation test, the disambiguation effect (i.e. selecting an unfamiliar object following an unfamiliar name) was significantly more evident in five- and six-year-old monolingual children than in their same-age bilingual peers (no significant differences were found between the two groups of bilingual children). In fact, older monolingual children selected the unfamiliar object following an unfamiliar name over 90% of the time. In contrast, same-age bilingual children selected the unfamiliar object following an unfamiliar name only 69% of the time. Note, however, that older bilingual children's use of the disambiguation effect was significantly above chance, which provided evidence for their use of the mutual exclusivity constraint. Still, the disambiguation effect was less evident in older bilingual children's responses than in older monolingual children's responses.

A developmental increase in the disambiguation effect was found for monolingual children, as the disambiguation effect was significantly more apparent with older monolingual children than with younger monolingual children. In contrast, older bilingual children's performance on the

disambiguation test was not significantly different from three- and four-year-old bilingual children's performance. Perhaps because bilingual children learn to suspend the bias between languages, they in turn become less willing or less likely to maintain the bias within a language. The results of the present research, however, do not appear to be due to differences in monolingual and bilingual children's need to fill lexical gaps.

That is, a child might select an unfamiliar object over a familiar object, not because she wants to avoid having two names for the same object, but because she wants to avoid having no name at all for the object. However, it is not clear why bilinguals would not have the same need as monolinguals to fill lexical gaps. As previously noted, given their history of learning at least two names for an object or category, it could be argued that they would have a greater need than monolinguals to fill lexical gaps. Importantly, the results of the disambiguation test were not due to differences in how monolingual and bilingual children responded to the objects in general. That is, both monolingual and bilingual children were equally likely to select the familiar object following its familiar name.

In addition, the results of the rejection test (i.e. rejection of a second name for a familiar object) revealed that both younger and older monolingual children more readily rejected an artificial, second name for a typical object than bilingual children. In contrast, both monolingual and bilingual children were equally likely to accept an artificial name for hybrid, atypical objects. These findings suggest that children were not responding randomly, or simply in a biased (i.e. affirmative or negative) manner.

Children's rejection of a typical name for a hybrid object was also apparent on the restriction test. Although previous research has found that children will restrict a nonsense or artificial name to a hybrid object (e.g. Merriman & Bowman, 1989; Merriman & Kutlesic, 1993), the results of the present research suggest that neither monolingual nor bilingual children will readily accept a typical name when the object is clearly made up of parts from two typical semantic categories. In addition, the type of object affected children's responses, as children were less willing to accept a typical name for an object made up of animate parts (e.g. animals) than an object made up of inanimate parts (e.g. utensils). Thus, the restriction effect may vary as a function of the type of object used to assess the effect.

Based on these results, it appears that bilingual children do not use the mutual exclusivity constraint to the same extent as monolingual children, at least by five or six years of age. This does not mean that bilingual children do not use the constraint. As Markman (1992) points out, violations or negative instances do not necessarily mean that the constraint does not exist. Instead, word-learning constraints should be treated as default options, or as Markman (1992) puts it, as probabilistic biases that can be overridden. These constraints are useful, provided that information to the contrary is not

provided, or, we would argue, that the child has not repeatedly learned to suspend the bias between languages.

It may be, however, that a different pattern of results may emerge as bilingual children grow up. For example, Au & Glusman (1990) found that bilingual adults maintain mutual exclusivity to the same extent as monolingual adults even within languages. However, it is possible that bilingual adults' use of the constraint may be due to the fact that bilingual adults are better able to separate the languages they know than bilingual children. Unfortunately, because of lack of access to older bilinguals we were not able to assess this assumption, although it does suggest a direction for future research.

The results of the present research also suggest that additional studies examining bilingual children's use of other word-learning constraints, such as categorical (see, e.g., Taylor & Gelman, 1988) or shape (e.g. Smith, Jones & Landau, 1992), is needed. Furthermore, while the languages used in this research were all Indo-European in origin, the languages do differ substantially from each other (e.g. English is Germanic and Urdu is Indo-Aryan). Thus, it is not known how similarities and differences between languages may affect children's use of the mutual exclusivity constraint. Additional research is needed to examine this issue.

REFERENCES

Au, T. K. F. & Glusman, M. (1990). The principle of mutual exclusivity in word learning: To honor or not to honor? *Child Development* **61**, 1474–90.

Barrett, M. D. (1978). Lexical development and overextension in child language. *Journal of Child Language* **5**, 205–19.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. *Developmental Psychology* **24**, 560–7.

Carey, S. (1978). The child as word learner. In M. Halle, J. Bresnan & G. A. Miller (eds), *Linguistic theory and psychological reality*. Cambridge, MA: MIT Press.

Clark, E. V. (1983). Convention and contrast in acquiring the lexicon. In T. B. Seiler & W. Wannenmacher (eds), *Concept development and the development of word meaning*. New York: Springer.

DeWitt, J. E. (1994). How a word-learning principle might interact with metalinguistic knowledge and input: Bilingual preschoolers' use of the mutual exclusivity assumption. Papers and reports on child language development. *Proceedings of the Child Language Research Forum* Vol. 26, pp. 159–66. Stanford University.

Dunn, L. M. & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test – Revised*. Circle Pines, MN: American Guidance Service.

Gathercole, V. C. (1989). Contrast: A semantic constraint? *Journal of Child Language* **16**, 685–702.

Goldin-Meadows, S., Seligman, M. E. P. & Gelman, R. (1976). Language in the two-year-old. *Cognition* **4**, 189–202.

Golinkoff, R. M., Hirsh-Pasek, K., Lavallee, A. & Baduini, C. (1985). What's in a word? The young child's predisposition to use lexical contrast. Paper presented at the Boston University Conference on Child Language, Boston.

Kagan, J. (1981). *The second year: The emergence of self-awareness*. Cambridge, MA: Harvard University Press.

Labov, W. (1973). The boundaries of words and their meanings. In C.-J. N. Bailey & R. Shuy (eds), *New ways of analyzing variations in English*. Washington, DC: Georgetown University Press.

MacWhinney, B. (1991). Constraints on learning as default assumptions: Comments on Merriman and Bowman's 'The mutual exclusivity bias in children's word learning': A Reply. *Developmental Review* **11**, 192–4.

Markman, E. M. (1989). *Categorization and naming in children: Problems of induction*. Cambridge, MA: MIT Press.

—— (1992). Constraints on word learning: Speculations about their nature, origins, and domain specificity. In M. R. Gunnar & M. Maratsos (eds), *Modularity and constraints in language and cognition*, Minnesota Symposium on Child Psychology, Vol. 20. Hillsdale, NJ: Erlbaum.

Markman, E. M. & Hutchinson, J. E. (1984). Children's sensitivity to constraints on word meaning: Taxonomic vs thematic relations. *Cognitive Psychology* **16**, 1–27.

Markman, E. M. & Wachtel, G. A. (1988). Children's use of mutual exclusivity to constrain the meanings of words. *Cognitive Psychology* **20**, 121–57.

Merriman, W. E. & Bowman, L. L. (1989). The mutual exclusivity bias in children's word learning. *Monographs of the Society for Research in Child Development* **54** (3–4, Serial no. 220).

Merriman, W. E. & Kutlesic, V. (1993). Bilingual and monolingual children's use of two lexical acquisition heuristics. *Applied Psycholinguistics* **14**, 229–49.

Mervis, C. B. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (ed.), *Origins of cognitive skills*. Hillsdale, NJ: Erlbaum.

Nelson, K. (1988). Constraints on word learning? *Cognitive Development* **3**, 221–46.

Smith, L. B., Jones, S. S. & Landau, B. (1992). Count nouns, adjectives, and perceptual properties in children's novel word interpretations. *Developmental Psychology* **28**, 273–86.

Taylor, M. & Gelman, S. A. (1988). Adjectives and nouns: Children's strategies for learning new words. *Child Development* **59**, 411–19.

Vincent-Smith, L., Bricker, D. & Bricker, W. (1974). Acquisition of receptive vocabulary in the toddler-age child. *Child Development* **45**, 189–93.

Woodward, A. L. & Markman, E. M. (1991). Constraints on learning as default assumptions: Comments on Merriman and Bowman's 'The mutual exclusivity bias in children's word learning'. *Developmental Review* **11**, 137–63.