Eyes Meet Shape: Differences in Monolinguals and Bilinguals

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Eyes Meet Shape: Differences in Monolinguals and Bilinguals

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Abstract

Monolingual and bilingual children learn words differently due to the different environments they are raised in. This study used 16 monolingual and 16 bilingual children approximately 30-months old. Because of a different linguistic environment, the cues children attend to in the process of language acquisition may differ. Particularly, this study looked at the relative differences between bilingual and monolingual children’s tendency to attend to pragmatic, i.e. social-linguistic cues and object property cues, such as shape, when learning words. Overall, results conclude that monolingual children pay more attention to object property cues compared to bilingual children and suggest that bilingual children relatively pay more attention to pragmatic cues when they are available. Bilingual children are suggested to attend to pragmatic cues to a greater extent relative to monolinguals because of their attention to social context from hearing multiple labels in two languages and because of their flexibility in attending to linguistic cues in general.
Eyes Meet Shape: Differences in Monolinguals and Bilinguals

What impact do different language environments have on the process of language acquisition? A promising answer to this question may lie in testing the naturally occurring differences between monolingual and bilingual settings. All children, regardless of how many languages they speak, must infer the meaning of a word upon hearing it for the first time. Research suggests that the linguistic environment that children are exposed to may influence what information children attend to as they learn language (Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002). For example, if children receive training to attend to the shape of an object as a cue to a word’s meaning, they tend to pay attention to the shape of objects in the future. Therefore, different experiences with one’s environment may lead a child to attend to different types of linguistically-relevant information. This paper investigates the differences in language development in monolingual and bilingual environments, particularly whether a linguistic environment affects the information children attend to in a word learning task.

Example of a Difference in Monolinguals and Bilinguals: The Case of Mutual Exclusivity

The mutual exclusivity bias is a constraint that guides children to deduce the meaning of a novel word. Monolingual children in particular have been suggested to adhere more strongly to the mutual exclusivity bias, compared to bilingual children (Davidson & Tell, 2005; Davidson, Jergovic, Imami & Theodos 1997; Houston-Price, Caloghris, & Raviglione, 2010). Specifically, the mutual exclusivity constraint refers to the finding that children expect an object to have only one label (e.g. Davidson & Tell, 2005). For instance, if a child who knows the word ball was asked to find a honey-dipper between a ball and a honey dipper, and the child adhered to mutually exclusive labels, the child would assume honey-dipper referred to the unfamiliar object. The child knows what a ball is and looks like from previous experience, and even if he or she has
never seen a honey-dipper before, the child reasons that a ball could not have two labels -- honey-dipper and ball. This constraint lessens the number of hypotheses a child must consider by biasing the child to assign a novel label to an object that does not already have a label.

Variations in the use of the mutual exclusivity constraint by monolingual and bilingual children could stem from differences in early environments. Accounts to explain the disparities in monolingual and bilingual children’s use of the mutual exclusivity bias in learning words involve bilingual children’s increased readiness to accept multiple labels for the same word (e.g. Diesendruck, 2005) and bilingual children’s greater flexibility in word learning compared to monolinguals (e.g. Davidson & Tell, 2005).

Bilingual children’s increased tendency to accept multiple labels for one word, which explains some of the differences in their use of mutual exclusivity from monolingual children, may stem from differences in environment (Davidson et al., 1997; see also Davidson & Tell, 2005; Diesendruck, 2005). According to Davidson et al., because bilingual children must learn two labels for most words, one in each language, they need to suspend mutual exclusivity between the two languages. With continual exposure to two different languages, bilinguals attend to the constraint to a lesser extent in general compared to monolingual children; this results in their increased willingness to accept multiple labels (Davidson & Tell, 2005). Thus, because of the repeated suspension of mutual exclusivity between languages, and the repeated experience of learning more than one label for objects, bilingual children are less likely to depend on this constraint when learning a new name for an object.

A second account to explain the differences between bilingual and monolingual children’s maintenance of the mutual exclusivity constraint proposes that bilingual children may retain a greater flexibility in language development due to their language environment (Davidson
& Tell, 2005). Because bilingual children must switch between languages in various situations and on various tasks, they may have to develop more flexibility in cognitive tasks in general. For example, bilingual children must be aware of and remain flexible in situations in which they can speak their second language, as well as switch back and forth between a parent who is a native of the language and a teacher who is not. This flexibility of bilingual children in their use of language principles may result in their tendency to use the mutual exclusivity constraint to a lesser degree relative to monolingual children (Davidson & Tell, 2005), and this may emerge from their distinctive linguistic environment.

Sources of Information Used in Language Acquisition

What other realms of language learning does a particular linguistic environment influence? Research already shows that children flexibly attend to certain cues provided by their environment, which depend on the unique experiences that children have with language (Smith et al, 2002). For example, if a parent frequently highlights the shape of an object, children will most likely attend to shape in the future, thereby significantly increasing their vocabulary of shape-based words compared to children who did not receive the same training. In general, children use a variety of sources of information to learn words, such as social and behavioral cues, and cues about the properties of objects. Their environment may impact how much they attend to these different sets of linguistic cues. This paper will specifically focus on the relative differences in attention given to pragmatic cues, i.e., social-linguistic context, and object property cues between monolingual and bilingual children.

Use of Social-Pragmatic Cues. The relative difference in how monolingual and bilingual children make use of social-pragmatic cues may arise between the two language groups as a result of their different linguistic environments. According to the socio-pragmatic account,
children learn the meanings of words by using pragmatic cues the speaker provides, which could be through social discourse or behavioral gestures, which specify a speaker’s communicative intent (e.g. Akhtar, Carpenter & Tomasello, 1996; Baldwin, 1993; Clark & Grossman, 1998; Jaswal & Hansen, 2006). A simple example of a social cue is demonstrated in the following: if a speaker says, “Henry is hungry. Which object does he want?” In the choices between an apple and a pair of tongs, the child would choose the apple because the speaker indicated that Henry is hungry (Haryu & Imai, 2002). Therefore, in the mind of a word-learning child, he or she deduces the meaning of a word from what he or she infers as the speaker’s intended meaning.

Children use a variety of pragmatic cues to infer the meanings of new words. For instance, they use an adult’s instructions about the relation between two words (e.g. a dog is a kind of mammal, Clark and Grossman, 1998), attend to a speaker’s use of a word that is new to discourse (Akthar et al., 1996), and use their assumptions about a speaker’s knowledge to guide their inferences about the speaker’s referential intent (Diesendruck, 2005). Other types of pragmatic cues, behavioral cues, are those where the speaker would point to or look at an object when asking for it -- a clear sign that they are requesting a specific object. Previous research has found that young children attend to a speaker’s eye gaze to determine a speaker’s intended referent (Baldwin, 1993). Not only are children sensitive to gaze direction, but pointing can be used to refer to a new word as well. Grassmann and Tomasello (2010) found that when a speaker asked a child to choose between a familiar and an unfamiliar object, and asked for a referent to a novel name, while pointing to the familiar object, children followed the pointing gesture, and chose the object with a familiar name. Such receptiveness to pragmatic cues helps children make use of their environment during language acquisition.
Comparatively, how much importance is given to a pragmatic gesture when learning new words in monolingual and bilingual environments? Research suggests that bilingual children may attend more to pragmatic information than monolinguals (Diesendruck, 2005; Rosenblum & Pinker, 1983). Rosenblum and Pinker (1983) conducted a study in which they studied the application of two labels to one object and found that the reasons for which bilingual and monolingual children extended or did not extend a novel name differed significantly. In this study, when bilingual children were asked to justify their reasoning behind extending the novel name to one object, but not to another, they tended to cite reasons based on personal and social context, for instance, “because it’s in our game” or “because you told me and I know…I know what it is and you know what it is,” whereas monolinguals tend to refer to object properties such as color instead (Rosenblum and Pinker, 1983, p. 778). Therefore, this study suggests that bilingual children learn new words by virtue of exposure to different social contexts.

Additionally, because bilingual children are constantly faced with the possibility of others not knowing one of their spoken languages, they must continuously attend to whether a speaker knows two languages. Diesendruck (2005) concluded that children’s deduction about the referent of a novel word in a multilingual context is dependent on the number of languages spoken by an interlocutor. Specifically in this study, bilingual children were less willing to accept two labels for a novel object when the speaker was bilingual, believing each label came from a different language, than when the speaker was monolingual. Moreover, bilingual children more readily labeled a novel object with two names from the same language when an absent speaker (i.e. this speaker was absent when another speaker labeled the object with a novel word) asked for the referent of a novel word. Thus, bilingual children’s awareness of pragmatic context may lead them to hold more conservative assumptions regarding a speaker’s linguistic
knowledge, which eventually influences their tendency to extend a word to a new object.

Overall, it seems that differences exist between monolingual and bilingual settings, but what effect does a particular linguistic environment have on the use of pragmatic cues when compared to object property cues in word learning?

**Use of Object Property Cues.** Another mechanism through which children learn words is by attending to the general properties of objects, such as shape, color or texture, as a means to extend a label to other objects (Colunga & Smith, 2005; Smith et al., 2002). Differences between how monolingual and bilingual children use object property cues may also exist, due to the ways in which people in the children’s environment teach them novel words. When parents teach their children a new word, parents highlight characteristics of an object in order to help the child extend that word to other perceptually similar objects (Merriman & Kutlesic, 1993). For instance, in teaching the word *ball*, a parent may draw attention to its roundness in order to help the child extend the word to other balls. A highlighted feature “may be used as a criterion of necessity (i.e., to reject items that lack it) and/or sufficiency (i.e., to accept items that possess it)” (Merriman & Kutlesic, 1993, p. 230). For instance, when a parent teaches a child the word *zebra* by pointing out its stripes, having stripes is a necessary condition in order for the child to extend the word *zebra* to other zebras, because one is unlikely to encounter a zebra without this distinguishing feature. This criterion of necessity is more reliable than the criterion of sufficiency, because many other objects possess stripes, but are not necessarily zebras (Merriman & Kutlesic, 1993). Thus, the use of object properties helps children rapidly increase their vocabulary (Smith et al., 2002).

Relatively what is the difference in the tendency of a monolingual child and a bilingual child to use a property of an object when learning new words? Research shows that compared to
bilingual children, monolingual children attend more to object properties when learning a new word (Haryu & Imai, 1999; Merriman & Kutlesic, 1993; Rosenblum & Pinker, 1983). Merriman and Kutlesic (1993) found that monolingual children, compared to bilingual children, are more likely to use a highlighted feature of an object in learning a novel noun as a necessary prerequisite to extend the noun to other things. Likewise, in the study done by Rosenblum and Pinker (1983), in which participants were asked to cite a reason to explain why they applied a novel label to one object, but not to another, monolingual children were inclined towards justifying their reasons based on the object’s attributes, such as “because they’re both green” or “because it has four legs” (Rosenblum & Pinker, 1983, p.778). Recall that bilinguals in this task were more likely to refer to social-linguistic context. While bilingual children may believe names are subjective social conventions, monolingual children may assume they are inherent attributes of objects (Diesendruck, 2005, Rosenblum & Pinker, 1983). Therefore, language environment appears to have an effect on children’s word learning biases, but to what extent children from different environments attend to linguistically-relevant cues is still an open question.

**Current Study**

All children flexibly attend to linguistically-relevant information as they learn novel words, whether that information is pragmatic in nature or related to the object properties of new objects. Does the attention that is afforded to these cues *relative* to one another depend on one’s environment? Generally, one must bear in mind that both bilingual *and* monolingual children flexibly attend to cues such as pragmatic cues and object properties when extending a word to other objects, but that differences may exist between the two language groups in the degree of attention paid to the two types of cues. The question for this study will look at the comparative
differences between monolingual and bilingual children and how much attention they afford to object property cues and pragmatic cues when learning a new word. While prior research has found that monolingual children attend more to object properties compared to bilingual children, no previous research has pitted the two types of cues against one another, by looking at the relative differences between bilingual or monolingual children’s attention to pragmatic and object property cues when learning new words. Moreover, this study will aim to replicate the findings of Merriman and Kutlesic’s study (1993), to support monolingual children’s preference to attend to object features when extending a novel name to another object.

**Study Design**

In order to directly examine the dissimilarity in attention to pragmatic and object cues between monolingual and bilingual children, we tested whether the amount of attention devoted to the two types of cues would differ when they were incongruent. The cues must be provided simultaneously in order to test this comparison explicitly. To do this, monolingual and bilingual children were asked to identify an object named with a novel label among another set of objects. The objects were grouped in a distinct way to cue participants to a highlighted object property. The experimenter looked towards or away from these objects, thereby providing a congruent or incongruent pragmatic cue. Additionally, children’s preference for objects when they were just given object property cues (i.e. experimenter looks straight at the child) or just given pragmatic cues (i.e. property of an object is not highlighted, experimenter looks at objects) was also measured to provide a baseline on the relative difference in attention given to each by monolingual and bilingual children.

As an object property cue, shape was used as a highlighted feature. While the mutual exclusivity constraint is a bias thought to help children in word-learning, another such bias
thought to increase their vocabulary is a “shape bias”. Evidence shows that children show a bias to attend to the shape of an object when learning a new unfamiliar word (Landau et al., 1988). That is, when told that an unfamiliar object is a *mido*, they will call other objects a *mido* as well as long as it has the same shape as the original *mido*.

**Predictions**

In this study, bilingual children are predicted to afford more attention to pragmatic cues, such as eye gaze, than object property cues, such as shape, relative to monolingual children. It is likely that the differences in word learning strategies arise from dissimilarities in language environment, given that monolingual children only hear one language, whereas bilingual children hear two languages. While monolingual children also hear multiple labels, they do not hear labels for a word in two languages and thus may not be as receptive to pragmatic cues. This could result in monolinguals being more likely to attend to object properties when extending a novel word to an unfamiliar object because they may not need to focus on socio-pragmatic cues to the same extent as bilingual children.

**Experiment 1**

**Method**

**Participants.** A total of 16 monolingual (7 males, 9 females) and 16 bilingual (7 males, 9 females) children participated in the study. Bilingual children spoke English and at least one other language. As their second language, four children spoke French, two spoke Portuguese, two spoke Hindi and one child each spoke Russian, German, Farci, Korean, Spanish, Afrikaans, Bambara, and American Sign Language. The monolingual participants ($M_{age}=30.26$ months) were age-matched within ±7 weeks, to the bilingual participants ($M_{age}=29.87$ months), and the ages ranged from approximately 24 months to 36 months. Participants were recruited by phone
or email through a database listing children whose parents had voluntarily provided their information for the general use of the research lab’s studies.

Demographically, 75% of the monolingual participants were white (n=12), 18.7% were Asian (n=3), and one monolingual participant was Hispanic. On the other hand, 62.5% of the bilingual participants were white (n=10), 25% were Asian (n=4), and one participant each was African-American and Hispanic. All monolingual and bilingual participants had at least one parent who attained graduate education beyond a 4-year undergraduate degree. Thus, all subjects came from professional, middle-class families and there was no difference between the two groups in terms of socioeconomic status. All participants were compensated $5 and were given a book at the end of the study.

**Language Proficiency of Bilingual Participants.** The parents of the bilingual participants were asked to fill out a questionnaire regarding the extent of their child’s bilingualism. This questionnaire asked the parents to report the degree to which their children understood and spoke both English and the other language on a scale from one to five [i.e. “Please describe the level of fluency for English and other languages that your child speaks (where 1 represents poor/no fluency and 5 represents perfect fluency for the child’s age”)]. Parents were asked to report the level of fluency for understanding each language separately.

An absolute difference between the score for understanding English and understanding the second language was calculated. A similar score was also calculated for children’s ability to speak English and their second language. Children with a difference of 3 or lower were specified as bilingual and were used in the study. For example, if a parent indicated a fluency of 1 for English, and a fluency of 5 for the second language, the respective score was 4. This hypothetical participant would be classified as monolingual and would not be used in the study.
However, if the fluency score for English was 3, and the fluency score for French was 3, the corresponding score would be 0; this would indicate equal bilingualism, and the participant would be classified as bilingual. Parents reported that on average, the difference in fluency of speaking the two languages ($M=2.06, SD=1.00$) was higher than the difference in understanding them ($M=1.27, SD=1.16$). These data ensured that children were balanced bilinguals.

Other questions in the questionnaire asked the parents to indicate the different environments in which the child spoke each language and the duration and frequency of travel to the country in which the second language was spoken. Additionally, parents were asked to report an estimation of the number of hours the child spoke English and the other language on weekdays and weekends, and whether the child ever responded in a different language than in which he or she was addressed. Parents were requested to complete the questionnaire online before the experiment took place via email. A sample of the bilingual survey is attached as Appendix A.

**Materials.** A set of objects for the warm up phase was used in order for the children to get a sense of the task. Three dogs made of three different materials were used (fluffy, rubber and plastic), as well as a toy bird, a truck and a seahorse. Dogs were used because most children at 30 months have little to no difficulty in recognizing them (Dale & Fenson, 1996). Approximately 97.1% of children in this age group know the word “dog.”

A total of 36 novel items were created for this experiment, in four sets of nine each. In each set of nine, there was a target object with a novel name. The novel names used for the four sets were *zuly, flone, deej,* and *tizo.* The novel names were randomly applied to the four targets from the four different sets. Four of the objects in each set matched the target in shape. Of these four shape-match objects, two matched only in shape, while the third object matched in both
shape and color and the fourth object matched in both shape and texture. The other four objects in each set did not match the target object in shape, but matched in other dimensions. Two of these objects matched the target object in color and texture, while one matched the target object only in color, and the other matched the target object only in texture. Overall, in each set, four objects matched the target in shape, four objects matched in color, and four objects matched in texture. See Figure 1 for an example of the stimuli used in the study.

<table>
<thead>
<tr>
<th>Shape-Match Objects</th>
<th>Target Object</th>
<th>Shape match</th>
<th>Shape match</th>
<th>Shape + Color match</th>
<th>Shape + texture match</th>
</tr>
</thead>
<tbody>
<tr>
<td>zuly</td>
<td>Shape match</td>
<td>Shape match</td>
<td>Shape + Color match</td>
<td>Shape + texture match</td>
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<td></td>
</tr>
<tr>
<td>Non-Shape-Match Objects</td>
<td>Color + Texture match</td>
<td>Color + Texture match</td>
<td>Color Match</td>
<td>Texture match</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Shape-match and non-shape-match objects sets used in this experiment.

**Procedure.** During the experiment, the child sat next to his or her parent, with the experimenter directly across the table, in order for the child to be fully aware of the direction of the experimenter’s eye gaze. The child sat approximately two feet away from the experimenter. This study was divided into three phases, a warm up phase, a training phase, and a testing phase.

**Warm up phase.** The purpose of the warm up phase was to allow the children to get a sense of the task. In this phase, the participants were shown the three different dogs, the bird, the truck, and the seahorse all placed randomly on a tray. The experimenter first asked the participants “Can you find me a dog?” Children received feedback during this phase. They were told that they were correct if they chose a dog and not if they chose another object, e.g. (“No,
that is not a dog.”) Once one dog had been identified the child was asked “Can you find me another dog?” This procedure was repeated until all three dogs were chosen. The experimenter then asked the participants once more to “find another dog”, with the intention of the child indicating that there were no more dogs or to correct the child if he or she handed the experimenter another object on the tray. The purpose of this phase was to illustrate to the children that more than one object, but not all of the objects, on the tray were included in the requested category.

**Training phase.** Across all four conditions, in the training phase the experimenter first presented the target object of a set placed in the center of a tray among the other objects in the same set, placed randomly about the target object. The experimenter named the target object with a novel name (e.g. “See the zuly”), repeating the novel label at least three times (e.g. Look at/See/That’s the zuly”). After the participant became familiar with the target object, it was removed from the tray, and the experimenter then quickly situated the remaining objects in different combinations and on different sides, depending on the conditions, which will be discussed later. The eight matching objects from the same set were then presented to each child on the tray.

**Testing phase.** In the testing phase, the experimenter would ask the participant to identify an object with the previously presented novel label (e.g. “Can you find a zuly?” “Do you see a(nother) zuly here?”) until they had chosen all eight objects or responded no.

The four conditions varied in two ways -- how the objects were grouped on each side of the tray (object property cue) and where the experimenter was looking (pragmatic cue). See Figure 2 for an example of how the shape-match and non-shape match objects were grouped, as well as the various directions of the experimenter’s eye gaze. The children were tested to see if
more attention was given to object property cues or to pragmatic cues in two conditions of interest: congruent and incongruent. In the congruent and incongruent conditions, all four shape matches were on one side of the tray and the non-shape matches were on the other side of the tray. This highlighted shape as an object property cue. In these conditions, pragmatic cues were also important. In the congruent condition, the experimenter continuously looked at the shape-match objects while requesting the novel object until the child made a selection, whereas in the incongruent condition, the experimenter constantly looked towards the non-shape-match objects instead, creating contrasting pragmatic and object property cues. This conflict was present to determine if the monolingual children did indeed pay relatively more attention to object properties, and whether bilingual children were more aware of the pragmatic cues. It was expected that if monolinguals relatively paid more attention to highlighted object features and bilingual children relatively afforded more attention to pragmatic cues, then on average, monolingual children would choose the shape-match objects in both conditions, whereas bilingual children would choose objects congruent with the experimenter’s eye gaze.

Figure 2. Depiction of layout of object grouping & experimenter’s eye gaze
In the pragmatic cue only control condition, two objects matching the target object in shape and two objects that differed from the object in shape were placed on each side of a tray and the experimenter continuously looked towards one side when asking for the novel object, until the child chose an object. The objects were grouped in this manner so that the same number of shape-, color-, and texture-matches were on each side of the tray. This eliminated the object property cue, because no one property (i.e. shape, color, texture) was explicitly highlighted. We predicted that either both language groups would choose the shape matches equally, or that monolingual participants would choose more objects matching the target object in shape. This is because monolingual children, relative to bilingual children, tend to focus more on object properties. However, monolingual children may pay some attention to eye gaze, and thus the both language groups could result in selecting the shape matches to the same extent.

Finally, an object cue only condition was also run as a control. As in the congruent and incongruent conditions, all four objects that matched the training object in shape were on one side, while the non-shape matches were on the other. The experimenter looked straight at the participant throughout the condition while asking for the novel object, thus eliminating the pragmatic cue. On average, monolingual participants were expected to pick objects matching in shape more than bilingual participants, because if monolingual children relatively tend to focus more on object properties, they should choose more objects matching in shape, the highlighted object feature.

Overall, each participant completed all four conditions and saw four sets of objects in addition to the initial training set. Throughout the experiment, the side of the tray on which objects were placed (i.e. the right and left of tray) was random. The novel names for each object and the order in which the objects were run were counterbalanced. The conditions were run in
the same order for each participant to prevent carry-over effects from one condition to the next. Conditions were run in the following order: pragmatic cue only, congruent, incongruent, object cue only. All sessions were videotaped with the consent of the participants’ parents.

Children’s choices of objects on both sides of the tray were calculated using the number of “incorrect” choices subtracted from the number of “correct” choices. In three of the conditions, congruent, incongruent and object cue only, “correct” choices denoted the number of shape-match objects. Thus, for these conditions, the number of non-shape objects chosen was subtracted from the number of shape objects chosen. For the pragmatic cue only condition, “correct” choices denoted the number of objects chosen from the side the experimenter was looking at, and the number of objects chosen from the opposite side, the “incorrect choices,” was subtracted from this value. This was done because in this condition, objects were not grouped by shape. Even if the participants chose more than four of the eight total objects, only the first four choices of objects were used for scoring with the purpose of including the order in which objects were chosen in the measure. Thus, a participant’s score on this measure could range from -4, where the child chose all four “incorrect” choices first, to 4, where the child chose all four “correct” choices first. For instance, if in the congruent, incongruent, and object cue only conditions, the child chose all four non-shape matches first, their score would equal -4, whereas if the child chose all four shape objects first, the score would equal 4. In the pragmatic cue only condition, if the experimenter looked at the left side while asking for the novel object and the participant chose all four objects on the left side, the score would equal 4.

Results

A 2 (cue congruency: congruent, incongruent) x 2 (language group: bilingual, monolingual) mixed-factorial ANOVA was conducted with cue congruency as a within-subjects
factor and language group as a between-subjects factor (see Figure 3). The mixed-factorial ANOVA used the dependent variable described above in which the number of non-shape matches was subtracted from the number of shape matches chosen by each participant. Overall, data analysis did not show a main effect for cue congruency, such that children chose the shape-matches equally often in the congruent and incongruent conditions $F(1,30)=.36$, $\eta^2=.01$, n.s. The main effect of cue congruency did however interact with language group, $F(1,30)=4.08$, $\eta^2=.12$, $p=.05$, indicating that bilingual children chose the shape-match objects marginally more in the congruent conditions than incongruent conditions, $t(15)=1.73$, $p=.10$. Monolingual children on the other hand, showed no difference across the two trials, $t(15)=1.09$, n.s. Finally, data showed a main effect for language group, such that overall monolingual children chose the shape-match objects more often than the bilingual children, $F(1,30)=4.26$, $\eta^2=.13$, $p<.05$.

Comparing the two language groups in the incongruent trials was especially important, as the main question was to determine if children would pay more attention to pragmatic cues or to object property cues. Results from a planned comparison t-test showed that monolingual children noticeably paid more attention to object property cues by choosing more shape-match objects than did the bilingual children in this condition, $t(30)=3.07$, $p<.01$. When the pragmatic cues and object property cues were congruent, monolingual and bilingual children did not differ in the degree to which they chose the shape-match objects, $t(30)=.27$, n.s.

To see what children would do if only one of the cues was available (i.e. either pragmatic cue or object cue), the two control conditions were analyzed separately. When children received only the pragmatic cue, both monolingual and bilingual children chose the objects at chance levels, $p’s>.05$, suggesting that neither group attended significantly to the pragmatic cues when this was the only cue available. Overall, in the object cue only condition, children performed
similar to the congruent condition (i.e. objects grouped by shape but experimenter looks at the child). There was no difference in the children’s choices of shape-match objects in this condition, \( t(30)=.27, \) n.s., nor did these conditions differ from either the congruent or incongruent condition together or for each language group separately, all \( p’s > .05. \)

![Figure 3. Results for congruent, incongruent and control conditions for Experiment 1.](image-url)

A one-sample t-test was run to compare each of the four conditions to chance for both language groups separately (see Table 1). In this study, since a child received a score ranging from -4 to 4, a score of zero would indicate chance, meaning that the children showed no bias to choose either the shape-match or non-shape-match objects. A score above zero alternatively, would indicate a shape bias, since the participant picked more shape-match objects than non-shape objects. Overall, monolinguals chose shape-match objects relatively more than chance in three of the four conditions including the congruent, \( t(15)=3.61, \) \( p<0.01, \) incongruent, \( t(15)=8.03, \) \( p<0.01, \) and object cue only, \( t(15)=4.12, \) \( p=0.001, \) conditions. However, in the pragmatic cue only condition, monolingual children chose the shape-match objects equally as often as the non-shape match objects, \( t(15)=3.12, \) \( p<0.01. \)
Bilingual children showed a bias to choose the shape-match objects in the congruent condition more than expected by chance, $t(15)=2.83, p<0.05$. In the incongruent condition, they chose both the shape and non-shape match objects equally, $t(15)=0.67, p=n.s$. This suggests that bilingual children may have less of a shape bias compared to monolingual children. On the other hand, this data may suggest that bilingual children paid more attention to the pragmatic cues and thus ceased to show a shape bias when the cues were incongruent. Otherwise, in the pragmatic cue only condition, compared to chance bilingual children chose neither the shape or non-shape match objects more, $t(15)=1.45, p=n.s$. In the object cue only condition, bilingual children chose shape-match objects more than chance, $t(15)=2.75, p<0.05$.

Table 1. Results for conditions compared to chance for Experiment 1.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Language Group</th>
<th>Bilingual</th>
<th>Monolingual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congruent</td>
<td></td>
<td>2.00*</td>
<td>2.25**</td>
</tr>
<tr>
<td>Incongruent</td>
<td></td>
<td>0.50</td>
<td>3.06**</td>
</tr>
<tr>
<td>Pragmatic Only</td>
<td></td>
<td>0.38</td>
<td>0.50</td>
</tr>
<tr>
<td>Object Cue Only</td>
<td></td>
<td>1.81*</td>
<td>2.06**</td>
</tr>
</tbody>
</table>

*p < .01, **p < .05

A series of Pearson’s correlations were conducted for the bilingual group between the average number of shape matches chosen minus the number of non-shape matches chosen and the difference in understanding and speaking their two languages. This was done separately for each of the four conditions. No significant correlations were found between any of the conditions, all $p’s < .05$.

Discussion

Overall, both monolingual and bilingual children attend to the object property cue when it was the only cue available or when both cues were available and were congruent. Yet when both the object property and pragmatic cues were available but incongruent, bilingual children
comparatively attended less to the object property cue, suggesting some attention was diverted to the pragmatic cue. Monolingual children in comparison paid extensive attention to the object property cue. In sum, these results suggest that bilingual children are more likely to attend to pragmatic cues than monolingual children, when the two cues are incongruent.

We chose to run a second experiment to confirm that running the order of the conditions in the same manner, instead of counterbalancing them, did not influence our results (i.e. if running the congruent condition before the incongruent condition varied from running it vice versa). Intriguingly, monolingual children showed a (non-significant) trend to choose shape-match objects comparatively more in the incongruent condition than the congruent condition. It is unclear why monolingual children would choose shape-match objects to a greater extent when the experimenter was looking towards the non-shape match objects. Monolinguals were expected to pick more shape-match objects relative to bilinguals in the incongruent condition, but not more so than the congruent condition, when the pragmatic and object property cues do not conflict. This is because they were expected to pay at least some attention to pragmatic cues in the incongruent condition, but to attend more to object property cues relative to bilinguals.

Perhaps monolingual children learned with time that because the objects are grouped by shape, they must be the “right” referents for the novel word. Thus, we proposed to run Experiment 2 in the exact same manner, but switched the congruent and incongruent conditions; we ran the incongruent condition first, and then the congruent condition. The trials were run in this order: pragmatic cue only, incongruent, congruent, and object cue only. If monolingual children do pay relatively more attention to object property cues than pragmatic cues, there should be no difference in the results from Experiment 1 and Experiment 2, and the findings of Experiment 1 will be supported.
Experiment 2

Method

Participants. A total of 10 monolingual children (4 males, 6 females) participated in the study. The ages ranged from 26 months to 36 months and $M_{age}=31.58$. Participants were recruited in the same manner as that of Experiment 1. The 16 monolingual children who participated in Experiment 1 were used for comparison. All monolingual participants recruited for Experiment 2 were Caucasian. All participants had at least one parent who attained graduate education beyond a 4-year undergraduate degree. Thus, all children came from professional, middle-class families so there was no difference in socioeconomic status between this group of monolinguals and the group of monolinguals from Experiment 1. All participants were compensated $5 and were given a book at the end of the study.

Materials. The same materials were used in Experiment 2 as those in Experiment 1, with the exception of the bilingual survey, as this experiment only used monolingual children.

Procedure. Roughly the same procedure was used in Experiment 2 as that of Experiment 1, with the exception of the order in which conditions were run. The incongruent condition was run before the congruent condition. Thus, the conditions were run in the following order for all participants in Experiment 2: pragmatic cue only, incongruent, congruent and object cue only. The incongruent condition was run before the congruent condition to determine if a “learning effect” had occurred from grouping objects of the same shape, especially given that in Experiment 1, monolingual participants on average chose more shape objects in the incongruent condition than the congruent condition. The rest of the procedure was exactly the same as Experiment 1.
Results

Once again, participants’ choices of objects on both the left and right side of the tray were calculated by computing a score where the number of non-shape objects chosen was subtracted from the number of shape objects chosen. A 2 (cue congruency: congruent, incongruent) x 2 (experiment: monolingual participants from Experiment 1, participants from Experiment 2) mixed-factorial ANOVA was conducted with cue congruency as a within-subjects factor and experiment as a between-subjects factor. There was no main effect of cue congruency, such that monolingual participants from Experiment 1 and monolingual participants from Experiment 2 chose the shape-match objects equally, $F(1,24)=1.54, p=n.s$. Additionally, the interaction between cue congruency and experiment was not significant, $F(1,24)=0.03, p=n.s$ (see Figure 4). Thus, monolingual children from Experiment 1 and monolingual children from Experiment 2 chose shape-match objects on average equally in both experiments, even when the order of the congruent and incongruent conditions was switched (i.e. incongruent condition run first), indicating there were no order effects in the study.

![Figure 4. Results for incongruent and congruent conditions in Experiment 2.](image)

Discussion

Since there were no differences in the choices of monolingual participants between the two experiments, the finding that monolingual children attend more to object property cues is
further supported. Overall, monolingual children chose shape-match objects equally when the incongruent condition was run before the congruent condition, and when the congruent condition was run first. This indicates that it is highly unlikely that the pattern of results was due to order effects from the order in which the conditions were run; monolingual children did not necessarily learn with time that just because the objects were grouped by shape in the final three conditions, they were the “right” referents of the novel word.

General Discussion

In the current study, we investigated the consequences of linguistic environment on word learning. In particular, we tested how a bilingual environment might influence the way children attend to different sources of information in the process of language acquisition. Children learn words through a variety of means, by attending to the many cues provided by the caregivers in their environment. The type of environment to which children are exposed may have a significant impact in the way children learn words. Different environments may ultimately lead children to attend to particular linguistic cues more than others, depending on whether certain types of cues are provided to a greater extent or are more predictive of success in learning words in that environment. For instance, if a child learns that attending to the properties of an object helps him or her learn words at a faster rate, he or she may come to rely more on object property cues. On the other hand, if a child discovers that pragmatic cues from a speaker aided more in acquiring language, he or she may attend more to this type of cue when learning new words.

Summary of Results

In this study, we compared the difference in attention to pragmatic and object cues among monolingual and bilingual 30-month olds. We tested whether bilingual and monolingual children differed in the extent to which they attended to pragmatic and object cues, particularly
when the two cues were incongruent. In this study, participants were asked to identify objects given novel names by the experimenter. Objects were grouped in a manner to draw the children’s attention to a major property of the object; in this case, shape. During the study, the experimenter simultaneously provided pragmatic cues (e.g. looking towards these objects or away from these objects). Data were analyzed to determine which type of cue bilingual and monolingual children attended to a greater degree, when the pragmatic and object property cues were incongruent.

Overall, monolingual children chose more objects matching in shape, and they always chose shape-match objects even when the experimenter looked away from the shape-match objects while asking children to extend the novel label they learned in training (e.g. *zuly*). Furthermore, they chose shape-match objects more than chance in three of the four conditions -- congruent, incongruent and object cue only, indicating a strong shape bias regardless of pragmatic cue. This result supports previous research indicating that children around two years of age exhibit a shape bias, and ignore other dimensions such as color and texture (Colunga & Smith, 2005; Landau et al., 1988; Smith et al., 2002). The speculation as to why monolinguals chose neither shape-match nor non-shape match objects in the pragmatic cue only condition will be discussed later.

What exactly was the relative difference between monolingual and bilingual children in the attention paid to the object property cue and the pragmatic cue when the two conflicted? When the object property and pragmatic cues were *congruent*, both monolingual and bilingual children chose shape-match objects at a relatively equal rate, suggesting that they both attended to the cues. Furthermore, when the experimenter looked straight at the child while asking for the novel object, in order to provide only the object property cue (e.g. objects grouped by shape), the
children performed similarly to the congruent condition, suggesting that both groups of
participants attended to the object property cue. Interestingly, in the *incongruent* condition,
when the cues conflicted, and the experimenter looked towards the group of non-shape match
objects while requesting the novel object, monolingual and bilingual children showed different
behavior; monolingual children chose shape-match objects significantly more often than
bilingual children. Bilingual children chose objects at chance, in that they selected shape-match
and non-shape objects equally. This suggests that monolingual children paid relatively more
attention to object property cues than bilingual children, *when the cues were incongruent.*

If the relative attention given to object properties when cues conflict varies among
monolingual and bilingual children, do they exhibit a difference in attending to the shape of an
object when those same cues conflict? Overall when results were compared to chance, bilingual
children showed a shape bias only on the trials in which the experimenter looked straight at the
shape-match objects when asking for the novel object and when the experimenter looked straight
at the child, providing only object property cues. In both of these conditions, bilingual children
chose the shape-match objects more than chance. These results support our predictions, as we
expected bilingual children to exhibit a shape bias in these trials, but the question lies in their
relative difference in behavior from monolinguals in the incongruent condition. Thus, when the
experimenter gave conflicting cues, bilingual children chose both the shape-match and non-shape
match objects equally. These patterns of behavior suggest that bilingual children may have been
following the experimenter’s eye gaze in this condition, instead of using a significant object
property cue -- shape, and thus stopped showing a shape bias when the cues were *incongruent.*

When the experimenter only provided the pragmatic cue, monolingual children and
bilingual children chose the objects at chance levels, and this contradicts previous research (e.g.
Baldwin, 1993). Our finding suggests that neither group afforded overwhelming attention to pragmatic cues. Reasons as to why children exhibited this behavior may be due to the fact that it was always run as the first condition; thus they did not perform at optimal levels. Alternatively, the unlike grouping of the objects (see Figure 2 for example), where shape was not highlighted as an object feature, may have confused the monolingual children. Perhaps in order to attend to object features, one feature must have been explicitly highlighted, such as shape or texture. In this condition, equivalent matches of features were presented on each side of the tray: two shape matches and two color matches on one side, and two shape matches and two texture matches on the other side. This particular assortment of objects may have overwhelmed the participants and hindered their attention to extend a novel word based on a highlighted object property. However, it is unclear why bilingual children did not pay attention to pragmatic cues in this condition, but as our results suggest, they did attend to these cues when they conflicted with object property cues. As suggested by Grassman and Tomasello (2010), simply staring at the objects may not have been a natural form of communication, instead of looking back and forth between child and object. Otherwise, because it was the first trial, bilingual children might have paid attention to the pragmatic cues at chance.

Differences in Linguistic Environments

In general, it appears that bilingual children attend to pragmatic and object property cues differently relative to monolingual children; specifically, they appear to pay more attention to pragmatic cues than object property cues when available. It is doubtful that such a pattern of results was observed because bilingual children simply did not understand the task. Bilingual children showed clear differences in preference when pragmatic cues were incongruent and when they were congruent with object property cues. Bilingual children also performed above chance
in two of the conditions, implying they clearly followed the directions of the task at hand. Moreover, no significant correlations were found between fluency in understanding and speaking both languages and performance in conditions. This brings us to the question of why do monolingual and bilingual children differ in the importance they give to pragmatic and object property cues when the two cues conflict? Exactly how do the linguistic environments of monolingual and bilingual children vary that ultimately lead to the relative differences in attention afforded to object property and pragmatic cues?

For one, bilingual children must manage learning two labels for each word, which obviously depends on the degree of exposure to each language. Not only must bilinguals undergo the cognitive task of determining the language of each object name, but objects are named in different ways for bilingual children. One such disparity is that bilingual children might be more likely than monolingual children to hear objects given two names because the two names come from different languages. Because of this difference, they are more likely to learn multiple names for the same object (Au & Glusman, 1990; Davidson et al., 1997; Houston-Price et al., 2010). In order to ease the acquisition of learning multiple labels, bilingual children may look for extra cues from the environment in order to learn words, such as eye gaze or pointing. For example, when a bilingual child hears a new word for an object, the usage of that word will differ in social context (e.g. *verde* at home, *green* at school); in contrast, monolingual children can arguably learn multiple labels as well, but upon hearing a new word will differ “semantically from the known name” (e.g. *animal* refers to any animate creature, *dog* refers to only those that are hairy and bark) (Rosenblum & Pinker, 1983). Our data directly tested these speculations and show that bilingual children do pay attention to social context such as eye gaze when learning
new words, but monolingual children attend more to highlighted object features, such as the shape of an object, when learning a new word.

Another possibility to explain why bilingual children use pragmatic gestures to a greater degree is that bilingual children simply learn to attend more to this type of information because they constantly hear two languages and must take notice of who speaks which language (Grassman & Tomasello, 2010). Moreover, people communicate very successfully in a foreign culture whose language they do not speak by using pragmatic gestures such as pointing and eye gaze. Thus, bilingual children may be more used to attending to pragmatic gestures. It may also be possible that a socio-pragmatic cue such as eye gaze may be more subtle for monolingual children (Jaswal & Hansen, 2006). While monolingual children also pay attention to pragmatic gestures, they may give them less importance because they do not need to attend to different languages spoken around them.

A third possibility is that bilingual children’s vocabulary may be significantly smaller within each language because they have less experience in each language than monolingual children have in their one language. Because of this fluency difference in each language, bilingual children may be lagging in certain biases that aid in learning words. Some evidence in the present study suggests that this account is correct. According to Landau et al. (1988), children attend to shape more heavily than any other object feature, such as color or texture. In this study however, bilingual children exhibit less of a shape bias compared to their monolingual peers, which may suggest that their shape bias is not developed as strongly. Bilinguals may be less shape-biased because they have less experience with naming shape-based objects in either language than monolinguals have in their one language, English. To compensate for this lag, bilingual children may need to rely more on pragmatic cues in order to help them determine the
rightful name of an object. This may be clearer if the vocabulary of monolingual children who have a strong shape bias was compared to monolingual children who have a preference to attend more to pragmatic cues when learning novel words. Furthermore, the English language itself may encourage attention to object features when learning new words. Previous research by Cook, Benedetta, Chise, Miho and Takahashi (2006) found that Japanese adults exhibited a stronger shape bias the longer they stayed in an English-speaking environment; thus a higher fluency in the English language may be indicative of a stronger bias to attend to shape when extending novel words. Subsequent research will show whether this correlation would be reliable with a larger sample size.

Because bilingual children are suggested to attend more to pragmatic cues, they may have an enhanced ability to learn words at a faster rate. Results of a study done by Kaushanskaya and Marian (2009) examine the effects of early exposure to two languages on word-learning ability. Their results suggest a bilingual advantage, with bilingual adults outperforming monolingual adults in learning novel words. Specifically, bilinguals achieved higher accuracy rates when tested for the meaning of a novel word, and performed superiorly in recall and recognition tasks of the novel word a week after testing. It is possible that bilinguals outperforming monolinguals in their aptitude to learn novel words arises from the relatively higher attention given to pragmatic cues in their early environment. Added attention to these cues may facilitate word learning. In the present study, bilingual participants were able to attend to pragmatic information when the object property cue and pragmatic cue were conflicting, whereas monolingual participants were not. Monolingual participants preserved their attention to highlighted object properties -- specifically shape. As suggested previously, bilingual children may be more flexible in attending to linguistic cues, which may heighten their cognitive ability in language
acquisition. This early experience with a second language may encourage more attention to pragmatic cues and result in rapid novel word learning.

Our results are also consistent with the larger literature on word learning in monolingual children. Research shows that monolingual children, relative to bilingual children, pay more attention to object property cues when learning a new word (Haryu & Imai, 1999; Merriman & Kutlesic, 1993; Rosenblum & Pinker, 1983). Parents of monolinguals may be more likely to highlight characteristics of an object aimed to assist the child in distinguishing the referent from nouns that are perceptually similar. For instance, in an example used in Merriman and Kutlesic’s study (1993), in teaching the word zebra, a parent may draw attention to its stripes in order to help the child differentiate it from a horse. A bilingual parent may instead tell their child, this is a horse in English, and a caballo in Spanish, thus diminishing the importance given to object properties. However, it must be noted that bilingual children did indeed pay attention to object property cues when the experimenter looked towards the objects matching in shape. Thus, our results do not suggest that bilingual children do not use object property cues at all, but that in some instances they are more likely to attend to pragmatics than monolingual children.

**Future Directions**

The differences in monolingual and bilingual word learning suggest that linguistic environments influence how attention is deployed to different types of linguistically-relevant cues, such as pragmatic information and object property information. A preference in choosing one cue over the other is likely shaped by the monolingual or bilingual linguistic environment. Follow-up studies should investigate the degree to which a bilingual child or monolingual child looks at the speaker of a particular word. Furthermore, studies that measure the precise attention children give to these different types of cues, such as on-line measures of eye gaze, instead of
comparing behavioral choices, could reveal the definite role that experience plays in shaping children’s attention in word learning tasks. Finally, a future study must include a measure to ascertain an equivalency in vocabulary between the two groups of monolingual and bilingual children, as vocabulary may have an effect on a child’s readiness to extend a novel word to an object.

Conclusion

This study compared strategies used by monolingual and bilingual children in language acquisition, particularly in situations where cues conflict. In sum, monolingual children may rely less on pragmatic gestures, because they hear only one language. On the other hand, bilingual children are simultaneously taught two labels for a word and thus may need pragmatic cues to a greater degree relative to monolinguals in order to learn a word. For example, if a parent is talking about a *perro* and the child has no clues as to what his or her parent is referring to, he or she may unconsciously follow his or her parent’s eye gaze to determine the intended referent. While monolingual children most likely exhibit the same behavior when learning a new word, they do not hear two labels for a word as often as bilingual children. Thus, a monolingual child may utilize a pragmatic cue to learn a word *less often* than a bilingual child, and vice versa. Overall, a child’s relative attention to different sources of information in the process of language acquisition appears to depend on his or her exposure to a unique linguistic environment.
References


Appendix A

Bilingualism Survey

1. Please describe the level of fluency for English and other languages that your child speaks (where 1 represents poor/no fluency and 5 represents perfect for the child’s age). If the child only speaks 2 languages, please only fill out the first two sections.

<table>
<thead>
<tr>
<th>Poor -- 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Language</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Language</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

2. Please describe the level of fluency for English and other languages that your child understands (where 1 represents poor/no fluency and 5 represents perfect fluency for the child’s age). If the child only understands 2 languages, please only fill out the first two sections.

<table>
<thead>
<tr>
<th>Poor -- 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td></td>
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<tr>
<td>Other Language</td>
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<tr>
<td>Third Language</td>
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</tbody>
</table>

3. Sometimes children speak different languages in different environments. For instance, they might speak one language at school and a different language at home. Please think of different ENVIRONMENTS (such as home, school, playground, travel) in which your child speaks different languages. Please check all the appropriate boxes that apply and provide comments where appropriate.

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>Other Lang</th>
<th>Third Lang</th>
<th>Both/Mixed</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preschool/Daycare</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Playground</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Travel</td>
<td></td>
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</tbody>
</table>
4. If you checked Both/Mixed for any of the environments, please give more details about the situations in which this happens:

5. How often does your child travel to a country where the “other language(s)” is/are spoken (e.g. traveling to France if your child speaks French)? Please choose the best response.
   a. Never
   b. Once in life
   c. Twice in life
   d. Once a year
   e. 2-3 times/year
   f. Over 3 times/year

6. How long does your child stay in that country typically? Please choose the best response.
   a. N/A
   b. Less than a week
   c. A few weeks
   d. A few months
   e. Up to a year
   f. Several years

7. On a typical WEEKDAY please estimate the number of hours per day that your child speaks:
   a. English (in hours):
   b. Other language (in hours):

8. Are there cases in which your child is addressed in one language, but typically responds in another language? Please choose the appropriate response.
   a. Yes
   b. No