Monolingual and Bilingual Toddlers' Reliance on the Mutual Exclusivity Principle and Statistics to Learn Colour Labels

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Abstract

Monolingual toddlers reportedly rely more heavily on the Mutual Exclusivity Principle (MEP) than their age-matched bilingual counterparts when learning new words. Here, we revisit this issue by testing monolingual and bilingual 24-month-olds' reliance on the MEP to learn novel colour labels across multiple labelling instances, where cross-situational statistics link a particular label to a particular colour – but not a particular object. In addition, we ask whether the presentation of atypically-coloured objects (e.g., turquoise dogs) may have influenced how readily toddlers attached novel labels to colour terms rather than objects. Thus far, our results demonstrate that monolingual and bilingual toddlers are equally successful in learning colour labels when taught with atypically-coloured objects. However, only bilingual children are able to learn colour labels taught with typically-coloured objects. We conclude that researchers need to carefully consider the richness and statistical input in children's learning environments to better understand development in diverse language settings.

Keywords: Child development; Language acquisition; Bilingualism; Word learning; Statistical learning

Imagine you are talking to someone who speaks a foreign language and the speaker utters "gavagai" while pointing at a rabbit. How would you decide if the speaker is referring to the rabbit, part of the rabbit, or the movement of the rabbit? This is known as the Gavagai problem (Quine, 1969) that infants and toddlers have to face whenever they are hearing a new word from their environment. Despite an infinite number of possible referents for every label, children at age two are able to learn new words at a remarkable rate. How do they do this? And do bilinguals solve this problem the same way as monolinguals?

It has been suggested that children rely on word learning heuristics to narrow the search space for possible word-referent mappings (e.g., Markman, 1994). For example, children use the Whole-Object Assumption to predict a novel label refers to an object as a whole but not to its parts, colour, or other properties (e.g., Markman & Wachtel, 1988). Thus, upon hearing the word "*rabbit*", children will assume the word refers to the whole rabbit, rather than its ears or the colour white. Children will then use the Mutual Exclusivity Principle (MEP), an assumption that each object has only one basic-level label, to help them override the Whole-Object Assumption and consider the possibility that the novel label refers to properties of the object, for example "*white*" refers to the colour of the rabbit instead of the whole rabbit. However, our understanding of these word learning strategies has been based almost entirely on work with monolingual children. Given that bilingualism is the norm in many parts of the world, basing our theories of early word learning on work solely with monolinguals is risky because those theories may not generalize to bilingual children.

Bilingual children differ from monolinguals because they routinely encounter situations that violate the MEP (e.g. *dog* in English and *chien* in French). Therefore, compared to monolinguals, bilingual children might be less likely to use MEP in acquiring word meanings because they might perceive it as less useful. Indeed, past studies have shown that bilingual infants rely less on MEP than monolinguals (e.g. Byers-Heinlein, 2017; cf. Frank & Poulin-Dubois, 2002; Merriman & Kutlesic, 1993, find no differences in preschool- and school-aged children). Kandhadai, Hall, and Werker (2017) further asked whether bilinguals were simply confused in these novel word learning situations or in fact they were able to interpret the novel word systematically as a second object category label for the familiar object. In their experiment, 18-month-old monolinguals and bilinguals heard a novel label for a familiar object that had a salient colour (e.g. an aqua-coloured dog). They were then tested whether they interpreted the novel label as a second category label for the object (e.g. another label for dog) or as a label for its salient property (e.g. aqua). They found that bilinguals did not rely on MEP; instead, they systematically interpreted the novel word as a second label for the familiar object. Monolinguals, in contrast, rejected the novel word as a second label and showed a tendency to interpret it as a property term for the familiar object (i.e. colour label). Taken together, these studies suggest that language experience affects how strictly children follow the MEP. While these findings are interesting, they raise more questions than they answer – if bilingual children are less reliant on MEP, then how do they overcome the Whole-object Assumption and learn labels for object properties? In Kandhadai *et al.* (2017), bilingual children failed to learn colour labels at all – does this mean bilinguals at this age could not learn colour labels?

But in the real world, there is much more information available in the environment to help children determine word meanings than in a typical lab setting. For example, in the studies outlined above, children's tendency to use MEP to resolve ambiguity in word-referent mappings was only tested once after a single object was labelled. However, there are typically many words and many potential referents present in the same environment, where word-to-object pairing is not always as apparent as the experimental settings. Imagine when a mother asks her child during dinner, "Do you want more *water*?" On the table there are food, water, plates, forks, and napkins. How can the child identify the correct referent for *water* among all the irrelevant ones? One way for children to learn this is by keeping track the statistical evidence of which particular words and objects co-occurred across multiple situations. For instance, on the first night, the child may have used word learning heuristics to identify three potential referents for "*water*" – plates, water, napkins. On the second night, when the mother asks the same question again, the child may identify another three potential referents – water, apple, forks. Because *water* is the only object common in these two instances, the child will then be able to identify it as the correct referent even when the word-object pairing is ambiguous in each individual instance. Indeed, a growing body of literature suggests that both infants and adults are able to learn word-to-object mappings over multiple instances by tracking statistical evidence (e.g., Smith & Yu, 2008; Suanda, Mugwanya, & Namy, 2014; Yu & Smith, 2007), which is known as cross-situational word learning.

To date, no study has examined cross-situational word learning in bilingual children. However, recent studies from monolingual and bilingual adults have provided some initial evidence that bilinguals might be better than monolinguals at this task (e.g., Escudero, Mulak, Fu, & Singh, 2016). It has been argued that the advantage for bilinguals stems from their constant need to extract patterns from complex dual language input and, as a result, that bilinguals are more capable in tracking multiple regularities and structures simultaneously. This is evidenced in Antovich and Graf Estes (2017), where the authors presented 14-month-old monolinguals and bilinguals with two interleaved speech streams in artificial languages, which mimics code-switching in bilingual speech. They found that bilinguals, but not monolinguals, were able to learn the structure of the two interleaved languages and segment words from the speech stream using transitional probabilities alone. Similarly, Kovács and Mehler (2009) found that 12-month-old bilinguals were able to learn and generalize the mutually inconsistent regularities of two structures that were presented simultaneously, whereas their monolingual peers learned only one of them. These results reveal that the cognitive systems of bilingual infants are adapted to track multiple regularities in their environment.

Past studies that compared monolingual and bilingual children's word learning strategies have been focusing on children's learning after a single labelling instance (e.g., the use of MEP to learn labels for object properties); However, in a real-world word learning scenario, children typically have more than one opportunity to determine word meanings. Because children are able to learn new word-to-object mappings by tracking statistics in their environment, would they also be able to use these statistics to learn labels for object properties? This study sought to bring together these two explanations – MEP and cross-situational word learning – to examine how monolingual (Experiment 1) and bilingual children (Experiment 2) learn labels for object properties over the course of multiple labelling instances. In Experiment 1, we aim to replicate earlier work demonstrating that monolingual children can learn object property labels such as colour names with the help of the MEP. Moreover, we also examine whether the learnability of colour names through the MEP might be conditioned by factors such as colour typicality effects. We include this question because past studies examining the use of the MEP to learn colour labels have used colour pairings that are atypical according to the real-world statistics (e.g., turquoise dogs and purple elephants). This may have drawn children's attention to colour information in a way that facilitated the learning of a novel label as referring to the colour. As a result, children's reliance on the MEP might have been overestimated if the relationship between the colour and the coloured object is less salient (e.g., turquoise mittens). We therefore compare the ease of learning when the colour is typical for the object or not. In Experiment 2, we use the same materials and methodology to examine how bilingual children use cross-situational statistics to overcome the Whole-Object Assumption and learn colour labels.

In both of these experiments, the word-referent pairing in each individual trial was ambiguous such that the novel word could either be interpreted as a colour label or as an object label. However, the pairings were consistent over the trials so that a child could in principle deduce that the novel word referred to a colour label. All of the objects were in a colour that does not map onto any primary colour (i.e., non-focal colour) because children tend to learn primary colours first. We manipulated the saliency by dividing our stimuli into animate and inanimate objects. Although both types of objects have the same colours, it would be more salient in animate than in inanimate objects because these colours are atypical in animate objects (e.g., a turquoise dog) but possible in inanimate objects (e.g., turquoise mittens). We test 22- to 26-month-olds in the current study because at this age, most toddlers (1) have acquired productive vocabularies of at least 50 words (Dale & Fenson, 1996), (2) have begun to map words to object properties (e.g., Pitchford & Mullen, 2002), and (3) are more likely to know the noun labels for all the objects used in the experiment.

Experiment 1

In Experiment 1, we examine whether monolingual children can learn a novel word as a colour label by tracking cross-situational statistics. Specifically, 24-month-olds heard a novel word and saw a familiar object in a non-focal colour in each trial. Since the novel word could grammatically be either a noun or an adjective, children could interpret the novel word as a second label for the object or as a colour label. In one block of trials, children saw pairings that were atypical in nature (e.g., an animate object such as a dog paired with an unlikely color such as turquoise). In the other block of trials, children saw pairings that were possible (e.g., an inanimate object such as a mitten paired with a possible color such as turquoise). Children were presented with four novel words over the trials: two for animate objects (the Animate Block, always with atypical colors) and two for inanimate objects (the Inanimate Block, always with possible colors). In each block, the two novel words were paired with different familiar objects but of the same colour. Note that although the word-referent pairing was ambiguous in each of these individual trials, the consistency of the pairing across trials would in principle allow the novel word to be reliably paired with one of the two colours. To test children's understanding on the trained novel words, we pitted the two colours against each other as children heard the label (e.g. magenta-coloured elephant, coral-coloured elephant). If they successfully learned the novel word as a colour label, they should look longer at the object that was matched in colour. We predicted 24-month-olds would learn colour labels for both animate and inanimate objects, but more readily for animate objects because the atypical colours in animate objects are more likely to draw their attention.

Method

Participants Forty 22- to 26-month-old (M_{Age} = 720 days, range = 663-804 days; 22 females) monolingual English-learning children in the Greater Toronto Area were tested. All participants received at least 90% English language input (*M* = 97% English). Vocabulary size was measured by parental report (CDI percentile score: *M* = 47.8%). Fifteen additional children were tested but were excluded from the study prior to coding due to fussiness (8) and parental interference (1). We also excluded six children who reportedly did not know at least one of the labels for the objects used in the study.

Stimuli and Design The experiment was divided into two blocks. One block presented objects with atypical colours (the Animate Block); the other block presented objects with possible colours (the Inanimate Block). Note that although some animate objects can appear in a wide range of colours (e.g., birds and butterflies), we only included animate objects that would result in an atypical colour-object pairing with the colours chosen for the experiment (i.e., rabbits are never magenta in the real world). The order of the Animate and Inanimate blocks were counterbalanced across children. Children learned two novel words in each block, with a total of four novel words – *wug*, *teek*, *pog*, and *gaf*. In the training trials, each of the words was paired with different objects, but of the same colour – namely *coral*, *magenta*, *turquoise*, or *periwinkle*. The word-colour pairings were counterbalanced across participants. Each colour was labelled six times, with a total of 12 training trials in each block. Trial order was pseudo-randomized, with the same colour appeared no more than twice in a row. The visual stimulus consisted of an image in the centre presented on a white background. This was accompanied by a recording in which the colour of the object was labelled. Each novel word was preceded by an attention-getting speech sound ('Look!' or 'Wow!'). We avoided using grammatical cues that would suggest whether the novel word was a noun or an adjective (e.g., the use of a definite determiner or diminutive suffix). All auditory stimuli were produced in an infant-directed manner by a female native English speaker. To facilitate learning, all images were animated with a zoom effect that was synchronized with the audio (Gogate, Bolzani, & Betancourt, 2006).

In each test trial, two images were presented side-by-side on a white background along with an audio labelling the colour (e.g., "Look, *wug*! Can you see it?"). The side which the object was on was counterbalanced across children. Each word was tested twice – once after six training trials, and once after an additional six training trials. The order of which word was tested first was counterbalanced. We included test trials after both six and 12 training trials because we were uncertain how quickly children would learn the labels. In this way, we could maximize the likelihood of observing any potential differences in how the labels would be learned across conditions.

Procedure The study was conducted in a sound-attenuated booth, where children watched the video on a TV screen while sitting on their caregiver's lap. Their caregivers wore headphones and listened to masking music to prevent them from biasing their child's responses. The experiment started with the first six training trials in Block 1. Each trial was 5 seconds long. A novel word was played twice, once at 2 *s* into the trial and once at 4 *s* into the trial. A familiar object in a non-focal colour was shown on the screen. The novel words consistently occurred with the colour (see Figures 1 and 2). After the first six training trials, children were presented with two test trials in which the two colours used in the experiment were pitted against each other (see Figures 3). A 2 *s* flashing white star on a black screen was inserted before each test trial to attract children's attention to the center of the screen. Each trial was 10 seconds long and each of the two labels was tested once. Children were then presented with the next six training trials and two test trials in Block 1. After that, they completed Block 2 with the same procedure. A 4-second animated clip was inserted after each testing block in order to keep children engaged in the video. The entire procedure was videotaped for offline coding.

At the end of the experiment, caregivers were asked to fill out a vocabulary questionnaire to assess whether children could both understand and say the labels of all the objects used in the experiment, either in English or in another language. We also asked caregivers whether the novel words we used in the experiment resemble any word the child might know in other language(s). None of them reported any similarity.

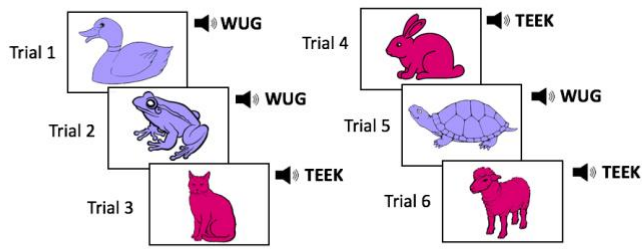

Figure 1: Sample stimuli used in the training trials for Animate Block.

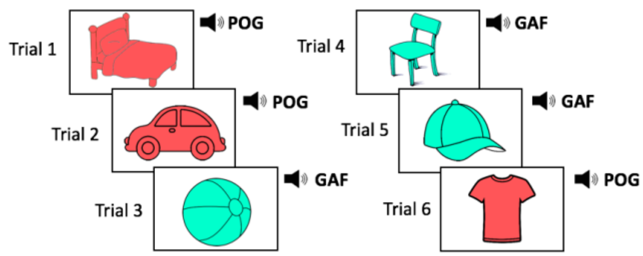

Figure 2: Sample stimuli used in the training trials for Inanimate Block.

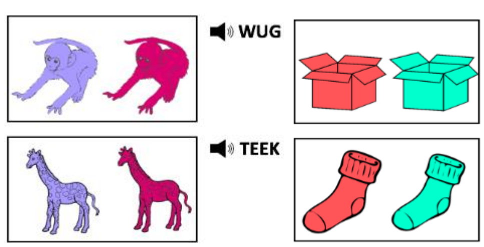

Figure 3: Sample stimuli used in test trials for Animate Block (left) and Inanimate Block (right).

Coding Children's eye movements were hand-coded frame-by-frame from silenced videos using SuperCoder (Hollich, 2005). Each 33 *ms* frame was coded as a look to the left image, right image, or away.

Results and Discussion

We first established children's baseline looking preferences in the test trials before any labels were provided. The baseline target proportion score was computed by dividing the time spent looking at the target by the total time spent looking at both object before the label onset (between 0 *ms* to 1500 *ms*; see Figure 4). The effect of labelling was then calculated using a difference score that compares looking to the target object before and after labelling. The proportion of fixations to the target object after labelling was computed by dividing the time spent looking at the target by the total time spent looking at both objects in the in a time window that began 500 *ms* following word onset and ended 3000 *ms* later.

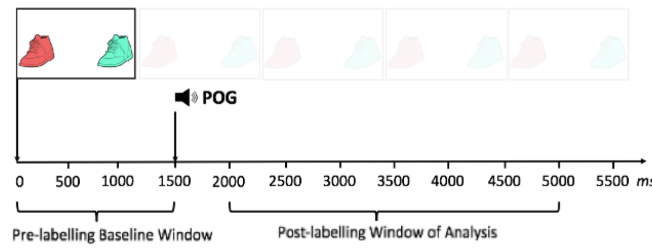

Figure 4: Difference scores were calculated by subtracting the proportion of fixations to the target object during the pre-labelling baseline window from the proportion of fixations to target during the post-labelling window.

We predicted that, if children could learn the novel words as a colour label, the mean difference score would be significantly higher than zero. Following Kandhadai, Hall, and Werker (2017), we conducted one-sample t-tests for both animate and inanimate object test trials (see Figure 5). For animate objects, there was no effect of labeling after six training trials (M = 0.01, SE = 0.04, $t(39)$ = 0.36, p = .36), but we found a positive difference score after 12 training trials, indicating a significant increase in the proportion of looking to the colour-matched object (M = 0.09, SE = 0.03, $t(39)$ = 2.66, p = .005). For inanimate objects, however, the difference scores were not significantly different from zero after either six (M = -0.06, SE = 0.04 , $t(39)$ = - 1.37, p = .91) or 12 training trials (M = -0.001, SE = 0.05 , $t(39)$ = -0.03, p = .51). Next, we averaged across their performances after 6 and 12 training trials and conducted a paired-sample t-test for the Animate Block versus the Inanimate Block. Overall, colour labels in Animate Block (M = 0.05, SE = 0.03) were easier to learn than in Inanimate Block (M = -0.03, SE = 0.03, $t(159)$ = 2.00, p = .04).

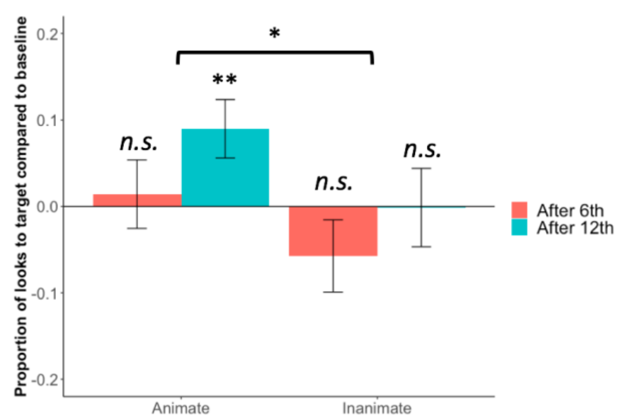

Figure 5: Mean difference scores in Animate Block and Inanimate Block after 6 and 12 training trials in monolingual children. Error bars indicate the standard error.

These results only provide evidence for the learning of colour labels in the Animate Block; and even then, evidence for learning was only apparent after 12 training trials. Thus, colour label learning appeared to be a difficult task for the monolinguals in our study.

Experiment 2

In Experiment 2, we repeat Experiment 1 with only one modification: we test bilingual children instead of monolingual children. Two different outcomes are possible: either (1) bilingual children will be less successful than monolinguals tested in Experiment 1 because bilinguals rely less on the MEP to learn labels for object properties, or (2) bilingual children will outperform monolinguals in view of the evidence that adult bilinguals are better than monolinguals at cross-situational learning.

Method

Participants Twenty-nine 22- to 26-month-old (M_{Age} = 712 days, range = 670–787 days; 15 females) bilingual children Greater Toronto Area were tested. All bilinguals received a range of 30% to 70% exposure to English (*M* = 56% English). English vocabulary size was measured by parental report (CDI percentile score: *M* = 32%). The differences between the vocabulary size in bilinguals (*M* = 190, *SE* = 1.12) and monolinguals (*M* = 303, *SE* = 0.88) in Experiment 1 was marginally significant, $t(67) = 1.82$, $p = .08$, with bilinguals had a lower vocabulary score than monolingual. Ten additional children were tested but were excluded from the study prior to coding because of fussiness (6). We also excluded four children who reportedly did not know at least one of the labels for the objects used in the study. An estimate of socioeconomic status (SES) of participating families, measured by family income and maternal education, revealed no differences between monolinguals and bilinguals.[1]

Stimuli and Design The stimuli were the same as in Experiment 1.

Procedure The procedure was the same as in Experiment 1.

Coding Same coding procedure was used as in Experiment 1.

Preliminary Results and Discussion

The effect of labeling was again measured using difference scores, calculated in the same manner as in Experiment 1. As in Experiment 1, we conducted one-sample t-tests for both animate and inanimate object test trials (see Figure 6). For animate objects, learning did not occur after six training trials (*M* = 0.005, *SE* = 0.04 , $t(28) = 0.12$, $p = .45$) but only after 12 training trials, with a difference score significantly higher than zero (*M* = 0.19, *SE* = 0.07 , $t(28) = 2.65$, $p = .007$). For inanimate objects, again, bilingual children did not learn the novel words as a colour label after six training trials (*M* = -0.02, *SE* = 0.05 , $t(28) = -0.73$, $p = .76$). However, learning was successful after 12 training trials (*M* = 0.12, *SE* = 0.05, $t(28) = 2.45$, $p = .01$). Next, we conducted a paired-sample t-test to compare the overall performance in Animate Block (*M* = 0.10, *SE* = 0.04) and Inanimate Block (*M* = 0.11, *SE* = 0.04; $t(102) = 1.12$, $p = .27$). The results show that bilingual children were equally capable to learn colour labels in Animate Block and in Inanimate Block.

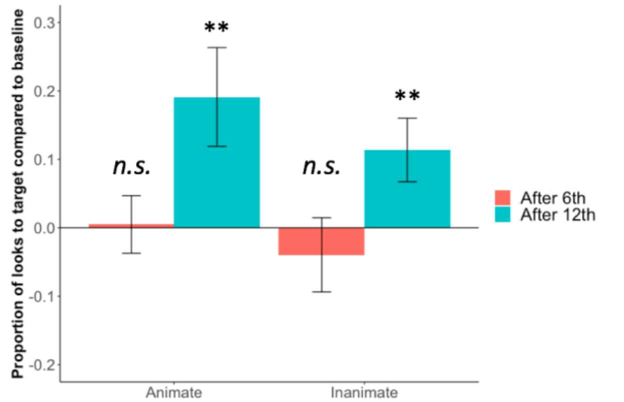

Figure 6: Mean difference scores in Animate Block and Inanimate Block after 6 and 12 training trials in bilingual children. Error bars indicate the standard error.

Our results revealed that bilingual children were able to learn colour labels for both animate and inanimate objects; however, the task appeared to be difficult for bilinguals because they learned the colour labels only after 12 training trials.

Since learning only occurred after 12 training trials for both monolingual and bilingual children, we compared performance in the monolinguals and bilinguals after 12 training trials (see Figure 7). Data were analyzed using a repeated-measures analysis of variance (ANOVA) with animacy (animate, inanimate) as a within-subjects factor and group (monolinguals, bilinguals) as a between-subjects factor. Based on this preliminary data set with only 29 bilinguals tested, our analysis revealed a significant main effect of group, ($F(1, 131) = 4.86$, $p = .03$), and a marginally significant effect of animacy, ($F(1, 131) = 3.15$, $p = .08$). However, the interaction was not significant. This suggests that, overall, bilinguals outperformed monolinguals in learning colour labels. In addition, colour labels in animate objects seemed to be easier for children to learn than in inanimate objects. We will be able to draw a firmer conclusion after collecting additional bilingual data.

[1] Family income was measured in Canadian dollars on a 4-point scale (<$45000; $45000 to $89999, $90000 to $140000; and >$140000. Thirty-five caregivers of monolinguals and 27 caregivers of bilinguals provided this information. A Mann-Whitney U test indicated that family income did not differ between monolinguals (*Mdn* = 3) and bilinguals (*Mdn* = 3), *U* = 356, *p* = .22. Maternal education was measured on a 5-point scale (some high school education, high school graduate, some college or university education, college or university graduate, and postgraduate education). Thirty-nine caregivers of monolinguals and 28 caregivers of bilinguals provided this information. Maternal education did not differ between monolinguals (*Mdn* = 4) and bilinguals (*Mdn* = 4), *U* = 530, *p* = .43.

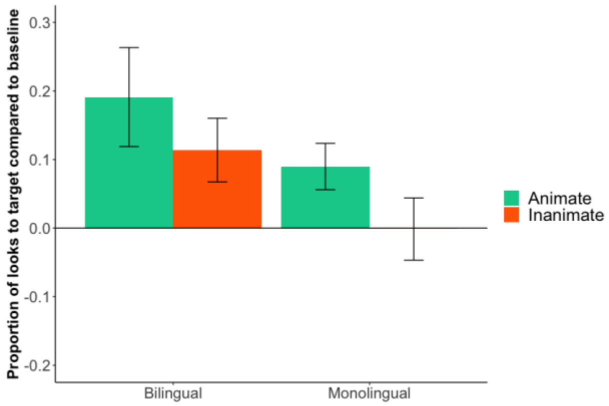

Figure 7: Comparison of performance after 12 training trials in monolingual and bilingual children.

General Discussion

In the current study, we examined the acquisition of novel colour labels by monolingual and bilingual 24-month-olds. Our results suggest that when provided with appropriate contextual information (i.e., cross-situational statistics), all children were able to acquire novel colour labels. However, the task was not easy. Evidence for learning was only observed after 12 (but not six) training trials, and, importantly, only highly salient atypical colour-object pairings (e.g. turquoise dogs) triggered the mapping of novel labels to colour properties in monolingual children.

Our results demonstrate that both monolingual and bilingual children are able to use cross-situational consistencies to learn second order property labels. Since the grammatical category of our novel words is ambiguous, and could either be interpreted as a noun or an adjective, children, especially bilinguals, would need to rely on cross-situational consistency in order to accurately map them to the object property. Based on our preliminary results in Experiment 2, bilingual children outperformed monolinguals in this colour label learning task. This provides the first evidence that bilingual children are better than monolinguals in tracking cross-situational statistics. To be successful in this task, children would need to track the two word-to-referent pairings simultaneously. Bilinguals might have benefited in this task due to their constant need to track multiple regularities and structures in their environment.

Our finding also suggests that colour typicality might play a role in how easily children could learn a colour label. Children seemed to bring their knowledge of real-world statistics into the task, such that the atypical colours in animate objects might have drawn their attention more, which, in turn, facilitated a mapping between the adjective and the perceptual property. Another possibility is that children tend to pay more attention to objects with faces than those without (Fantz, Fagan, & Miranda, 1975). Children might simply pay more attention during the animate object block than the inanimate object block, leading to the higher performance with animate objects. To tease apart whether the pattern in monolinguals is due to the colour typicality or an attentional bias, we are currently running a follow-up study with colours that are probable in both animate and inanimate objects, such as yellow. If the advantage of animate objects disappears, this would mean colour typicality influences how easy children can map a novel adjective to a colour.

Another important finding is that monolinguals did not perform better than bilinguals in this task. This implies monolingual children do not, as previous studies suggested, reliably use MEP in learning labels for second order properties. Instead, the tendency to use MEP might depend on the specific paradigm and specific properties being tested. Akathar and Montague (1999) found that children could use cross-situational consistency to learn labels for shape and texture, so why did monolingual children in our experiment not reliably learn colour labels? A possible explanation comes from another body of literature that has repeatedly demonstrated toddlers and young children attend to shape when classifying inanimate objects but instead attend to both shape and texture when classifying animate objects because these dimensions are critical to lexical category membership (e.g., Jones & Smith, 2002). This means that children might bias their attention more towards shape and texture than colour when searching for commonalities between the objects used in the task, which helps them to more easily identify the potential referent as shape or texture as opposed to colour.

This study provides three important contributions. First, we found that bilinguals do not, as previously suggested, always suspend the MEP or systematically infer a novel word as a second label for a familiar object. Instead, when given more contextual information, they are able to take other cues in the environment into account in resolving referential ambiguity. This finding underscores the importance of considering multiple cues, and the rich information sources children have at their disposal in the real world. Second, monolinguals did not make use of the MEP equally well in all conditions. In particular, they appeared to successfully use the MEP only when the colour-object pairings were atypical. This suggests that children at this age are aware of the real-world colour likelihood of animate versus inanimate objects, and this knowledge can subsequently influence their word learning. Third, this study also adds to the growing literature that young children can make use of cross-situational statistics in word learning. Thus far, there is only a handful of studies of cross-situational word learning in children and no study has been done on bilingual children. In fact, word-to-object pairings are often learned across multiple situations in everyday contexts due to the many potential referents in the environment. Future studies can directly compare monolingual and bilingual children's abilities in tracking cross-situational statistics. This strategy could help tease apart possible explanations for the results in current study, such as whether children are using both the MEP and statistical information, or only statistical information in learning colour names, in order to explain the difference found between monolingual and bilingual children.

To conclude, this study highlights the importance of considering the ecological validity as well as the richness of the word learner's home environment. It also highlights the importance of linguistic background in shaping children's word learning strategies. Given differences in their linguistic input, monolingual and bilingual learners appear to adapt to their environments by developing different approaches to word learning. But note that neither monolingual nor bilingual approaches to word learning are necessarily superior – they are simply adaptive to the world children find themselves in. More studies, like the current one, that compare monolingual and bilingual word learning abilities when multiple sources of information are available are needed. Only by comparing monolingual and bilingual children's performance on a multitude of tasks with different types of information available, can we hope to obtain a fuller picture of how children with different linguistic backgrounds are weighing and integrating the various cues to word meaning. Such an approach is crucial to developing a comprehensive model in early language acquisition.

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