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Flexible Use of Mutual Exclusivity in Word Learning

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Abstract

From an early age, children apply the "mutual exclusivity" (ME) assumption, demonstrating preference for one-to-one mappings between words and their referents. However, for the acquisition of referentially overlapping terms, ME use must be suspended. We test whether contextual cues to intended meaning, in the form of presence of a speaker, may be critical for flexible ME application. Four- to five-year-old children were tested on two word learning tasks requiring flexible use of ME, respectively. In Experiment 1, children saw video recordings of the speakers introducing the novel labels. All children successfully applied ME and succeeded in accepting lexical overlap. In Experiment 2, with audio recordings of speakers only, children were unsuccessful at accepting lexical overlap. Thus, flexible use of ME relies on a developing ability to utilise the contextual information present in communicative interactions.

Mutual Exclusivity (ME) refers to the assumption that children acquiring language apply one-to-one mapping relations between basic level word forms and their meanings (Markman, 1990). It operates in early lexical acquisition by biasing children to assign novel labels to unfamiliar rather than familiar referents (Golinkoff, Mervis, & Hirsh-Pasek, 1994; Markman & Wachtel, 1988; Merriman & Bowman, 1989). Under certain conditions, young children are able to acquire referentially overlapping terms, for instance, when the labels differ in frame of reference, hierarchical level, or language (Au & Glusman, 1990; Deák & Maratsos, 1998; Diesendruck, 2005; Hall, 1996; Haryu, 1998; Kobayashi, 1998; Mervis, Golinkoff, & Bertrand, 1994; Saylor, Sabbagh, & Baldwin, 2002). However, less is known about how children develop the ability to flexibly apply the ME assumption based on the context and communicative demands of each naming situation, i.e., deciding when to maintain it in order to establish one-to-one mappings, and when to map two overlapping basic-level labels to a single referent. The present research investigates this ability in children between the ages of four and five years, and the role that contextual information plays in facilitating children's acceptance of two basic-level labels for a single referent.

Savage and Au (1996) investigated children's ability to accept lexical overlap when input contradicts ME. In their study, two speakers each taught children aged 3;0 - 5;11 a different label for the same novel object. Only half the children successfully accepted these overlapping labels at test, and failure was suggested to be due to a lack of overt information about how the two novel labels related in meaning. Moreover, children who rejected overlap tended to assign the label that they heard first during testing to the target object and mapped the second label to an unfamiliar distracter. The authors

proposed that children used the available contextual and linguistic information, in this case the re-occurrence of one of the labels in the input, to identify the referents for the two novel words while preserving ME. They suggested that instead of rejecting one of the overlapping labels in the naming phase, children maintained the two labels in their memory, and then preserved only the label that they re-encountered in their linguistic input. However, Savage and Au did not speculate as to the reason why some of the children accepted lexical overlap while others used ME despite the contradictory information available from the input.

Two approaches to ME make different predictions as to the conditions under which lexical overlap might be accepted. The lexical constraints approach posits the ME assumption as a manifestation of a bias or principle that guides children's first guesses about the meaning of a novel word (e.g., the mutual exclusivity constraint, Markman, 1992; Woodward & Markman, 1991; the Novel Name-Nameless Category principle, Golinkoff et al., 1994; the Lexical Gap Filling hypothesis, Merriman, Marazita, & Jarvis, 1995; preference to novelty in novel label mappings, Horst, Samuelson, Kucker, & McMurray, 2011; Mather & Plunkett, 2012). Thus, children will override this bias to accept lexical overlap only if provided with *explicit* information about the meaning relations between the two labels (Callanan & Sabbagh, 2004; Clark & Grossman, 1998). That is, it predicts that children will successfully learn overlapping labels if provided with clear cues about how the two labels relate to each other and their referent (e.g., that children are instructed that the labels belong to different languages, represent different frames of reference or perspectives, or belong to different hierarchical levels). However, if no such information is available, children are expected to maintain the tendency to

establish one-to-one relations between basic level words and their referents (Merriman & Bowman, 1989). Alternatively, the social-pragmatic approach proposes that children rely on general pragmatic principles to identify the meanings of novel words by actively engaging in communicative interactions with their interlocutors (Tomasello, 2003), such as the expectation that adults use conventional terms, and that a change in the linguistic form denotes a change in meaning (Clark, 1990). Thus, when encountering a second label for a familiar referent, children will use the contextual and referential cues from the speaker about how the overlapping label contrasts with the familiar term (Clark, 1997). Note that these accounts are not incompatible – for instance, lexical constraints can operate in concert with contextual cues to indicate when ME should and should not apply in word learning. Thus, the accounts should be seen as different emphases on how contextual cues affect learning – whether they are dominant, or one of several cues to guide this process (Baldwin & Moses, 2001; Scofield, Williams, & Behrend, 2007).

Previous research has also suggested that children's ability to learn multiple labels for a single referent is dependent on their information processing skills. Liittschwager and Markman (1994) demonstrated that 24-month-old infants successfully mapped two labels to a single referent. However, when the processing demands of the task increased, they became more likely to use the ME assumption. More recently, Piccin and Blewitt (2007) presented three-year-old children with two versions of a ME task. In a shared-label condition, children interacted with two puppets that both understood and used two labels for the same object. Thus, children could decide to use only one of the labels or use the two labels interchangeably. In a distinct-label condition, the puppets each understood and used a different label for the same object. That is, children had to adhere to the one

speaker-one label rule in order to successfully communicate with each puppet. This study showed that children preferred one-to-one mappings in the shared-labels condition, where lexical overlap was optional, but successfully used two labels for the target object in the distinct label condition, where lexical overlap was required for successful communication. Piccin and Blewitt (2007) concluded that young children are capable of accepting lexical overlap to achieve successful communication, but they tend to use ME by default because storing and manipulating overlapping labels seems to come at a greater processing cost.

Previous research, therefore, is inconclusive regarding the nature of contextual information, linguistic cues, and/or processing skills that facilitate children's ability to flexibly apply ME to achieve successful word learning. While some studies have found that three-year-old children are capable of accepting two labels for a single referent (Piccin & Blewitt, 2007), others have shown that even older children find this task challenging and fall back on the default ME assumption (Savage & Au, 1996).

It may be that, as suggested by Savage and Au (1996), linguistic information (i.e., the occurrence of two labels in the linguistic input) is sufficient for children to decide whether to use ME. Alternatively, it is possible that the availability of richer contextual information gathered from speakers using novel labels is essential to promote successful word learning in situations where lexical overlap is appropriate. These sources of information have been confounded in previous research where children were always involved in live interactions with one or two interlocutors, so isolating linguistic input, i.e., two novel labels introduced in the presence of a novel referent, from other contextual information from the speaker, i.e., gaze and pointing, was not possible. Thus, it remains possible that children's success in accepting lexical overlap is dependent not only on their

ability to flexibly apply the word learning assumption of ME, but on their ability to use the referential and contextual cues from the speaker or speakers introducing the novel labels.

Previous research has highlighted the importance of speaker's presence for successful early learning. Infants before the age of two years are significantly more successful in tasks such as word learning, imitation, and problem solving when the relevant information is presented in live and socially-contingent interactions rather than when it is pre-recorded and showed on a screen (also known as the video deficit, Anderson & Pempek, 2005; O'Doherty, Troseth, Shimpi, Goldenberg, Akhtar, & Saylor, 2011; Roseberry, Hirsh-Pasek, & Golinkoff, 2014; Troseth, Saylor, & Archer, 2006). Specifically in the case of word learning, while infants are capable of mapping a label to its referent when the speaker is not visible (e.g., Halberda, 2003; Scofield et al., 2007; Werker, Cohen, Lloyd, Casasola, & Stager, 1998), the assumptions that they hold about reference and speaker's knowledge are different when the labels are presented by a visible speaker with weighting given to the reliability of the informant available when the speaker is visible (Koening & Echols, 2003). Even though children after two-and-a-half years of age are capable of learning words presented via video (Anderson & Pempek, 2005), the occurrence of multiple cues is likely to facilitate learning (e.g., intersensory redundancy hypothesis; Bahrick & Lickliter, 2002). That is, when visual and audio information about the speaker is present during a labelling situation, it is more efficient in directing children's attention to the relevant mappings. This can be particularly relevant for situations that impose higher demands on children's processing skills such as in tasks of lexical overlap (Piccin & Blewitt, 2007). Thus, when novel labels are presented in the

absence of a speaker (e.g., in an audio only condition), the child continues to have access to the linguistic information that is relevant to word learning. Furthermore, presence of the speaker provides the child with additional rich contextual cues that have the potential to further highlight the referential intentions underlying the use of novel labels and increase the attentional salience of the naming situation. Hence, one of the primary purposes of the present study was to evaluate to what extent the presence of these cues is essential for children's ability to map novel labels via employing ME and accepting lexical overlap.

The present research thus addresses this issue by investigating children's ability to flexibly apply the ME assumption (Experiment 1) and the role of contextual information in facilitating this ability (Experiment 2). In the present experiments, four- to five-year-old children were presented with two conditions of a word-learning task, which comprised situations where either applying ME (exclusivity condition) or accepting lexical overlap (overlap condition) was appropriate. In Experiment 1, in the exclusivity condition, children saw a speaker introducing a novel label for a novel object. At test, children saw the introduced object and another non-named novel object, and the same speaker asked them to find the referent for a label that they have not heard before. Thus, by relying on ME, children could infer that the novel label referred to the non-named object. In the overlap condition, children saw the video recordings of two speakers each introducing a different novel label for a novel object. At test, children saw the introduced object and another non-named novel object, and were asked by the speakers to find the referent for the novel labels previously introduced. This condition included two speakers in order to provide children with a more felicitous context for the use of lexical overlap.

When one speaker uses two distinct linguistic forms for a single referent in the same naming situation, children are more likely to assume that the speaker intends to convey a contrast in meaning. However, this assumption is weaker when the two labels are used by different speakers (Matthews, Lieven, & Tomasello, 2010). In addition, this design replicates previous studies investigating children's acceptance of lexical overlap (e.g., Piccin & Blewitt, 2007; Savage & Au, 1996). Experiment 2 also involved the exclusivity and overlap conditions. In this case, however, children only saw the novel objects on the screen and heard audio recordings of the speakers who were introducing the novel labels but did not see their images, thus reducing the contextual information available to children in guiding when to apply ME and when to accept lexical overlap.

We predicted success in the exclusivity condition in both experiments in line with previous findings that ME is not dependent on speaker presence (e.g., Halberda, 2006). However, for the overlap condition, if children only use the linguistic cue of a label's re-occurrence (Savage & Au, 1996), then we expect similar performance when the speaker is seen or unseen. However, if children rely on information from the context and the co-occurrence of multiple multisensory cues in the naming process, we expect acceptance of lexical overlap only when the speaker is seen.

Experiment 1

Method

Participants. Fifty-four monolingual English-speaking children (26 males) participated. The age range was 4;0 to 5;4 (*M* = 56.2 months, *SD* = 4.2 months). Children were randomly assigned to two experimental conditions: exclusivity and overlap. Thirty children participated in the exclusivity condition (13 male; *M* age = 57.1 months, *SD* =

4.3 months), and 24 children participated in the overlap condition (13 male, *M* age = 55.2; *SD* = 4 months).

Materials and apparatus. Sixteen images of familiar and unfamiliar objects (2.5 x 2.5 inches) were selected from the TarrLab Object Data Bank (1996). Figure 1 depicts the object-label pairings used in each trial of the task. These images were placed in eight video sequences (four sequences assigned to each condition), each depicting two objects and a video recording of one or two people. A female was recorded for the exclusivity condition. The same female and a male were recorded for the overlap condition. The videos were presented on a 15-inch MacBook computer using PsyScope (Cohen, MacWhinney, Flatt, & Provost, 1993). The keyboard was covered to prevent children interfering with stimulus presentation.

[Insert Figure 1 here]

Procedure.

Training. Children were presented with pictures of four familiar objects on the screen (cup, shoe, apple, teddy bear), and were asked to find (by pointing) two of the objects. If they responded correctly, they progressed to the main experiment.

Exclusivity condition. Each child completed one familiarization and three test trials consisting of three phases: naming, baseline, and test (Figure 2). The familiarization trial included familiar object-label pairings, and the test trials included unfamiliar object-label pairings. The purpose of the familiarization trial was to introduce the children to the procedure of the computerized task (i.e., watching the videos on the screen and pointing to the objects in response to the speakers' requests). Thus, these trials were identical to the test trials with the exception that familiar labels were used. All children were

successful in the familiarization trials of the exclusivity and overlap conditions and were able to proceed to the test trials.

Naming. The speaker in the video greeted the child, looked at the object, exclaimed "Look!" and named the object three times while pointing at it and alternating gaze between the object and the child.

Baseline. The objects moved (jittered) to maintain the child's attention, and were accompanied by only an audio recording of the speaker uttering, "Look, they are nice! Wow! They are pretty!" This was included to ensure that children had the opportunity to view both objects of the trial prior to the test.

Test. The speaker looked at the child and requested an object using a novel label different from that in the naming phase. Two carrier phrases were used, "Where is the [label]? [Label]!" and "Find the [label]! [Label]!" The child responded by pointing at one of the objects on the screen.

[Insert Figure 2 here]

Overlap condition. The procedure was identical to the exclusivity condition where each child completed one familiarization and three test trials (Figure 2).

Naming. This was identical to the exclusivity condition with the exception that children saw two speakers who each used a different label to name the same object.

Baseline. This was identical to the exclusivity condition except that voice recordings of both speakers were included to avoid preference toward one of the speakers.

Test. Speaker 1 appeared on the screen and made the request. The child was allowed time to respond (4 sec). This was repeated for Speaker 2. The speakers appeared in a counterbalanced order in naming and test phases.

All children pointed unambiguously to one of the two objects. Since the focus of the present research was to assess the flexible use of ME, we were interested in comparing successful word learning across the two conditions. That is, in the case that children applied ME as a word learning strategy, but were unable to use it flexibly, more successful word learning would be observed in the exclusivity condition. However, if children were applying ME flexibly, then they would exhibit successful word learning in the two conditions. In the exclusivity condition, a score of 1 was assigned if the object not introduced in the naming phase was selected. In the overlap condition, a score of 1 was assigned only if the object introduced in the naming stage was selected in response to both speakers' requests. That is, although two responses were recorded per trial in the overlap condition, a child scored either 0 or 1 for successful or unsuccessful mapping of the two test labels. Thus, a maximum score of 3 was possible in each condition if successful performance was demonstrated in the three test trials.

The position of the target object on the screen (left and right) during the baseline and test phases was counterbalanced across trials. In the overlap condition, the order in which the speakers appeared on the screen during the naming and test phases was also counterbalanced between and within trials. Children completed the experiment in a quiet room at school or nursery and received a sticker for their participation.

Results and Discussion

Children's scores were converted into proportion of correct responses for the exclusivity and overlap conditions. The distribution of responses was not normal, and so non-parametric analyses were conducted. First, children's ability to establish correct mappings in each condition was assessed. A Wilcoxon signed rank test showed that

children learned words above levels predicted by chance (chance = 0.5) in the exclusivity (*Mdn* = 1, interquartile range = 0), $Z = 4.954$, $p < .001$, and the overlap (*Mdn* = 1, interquartile range = .58), $Z = 3.044$, $p = .002$, conditions (Bonferroni correction, $p < .025$). For the overlap condition, there were four possible responses – the child may accept or not each speakers' label. However, we chose the more conservative baseline level of chance performance of 0.5 as reflecting the child either accepting or not both speakers' labels for the object.

[Insert Table 1 here]

Individual response patterns were also assessed in each condition. Table 1 illustrates that the majority of children successfully learned the target labels in the exclusivity, $\chi^2(1, N = 30) = 22.533$, $p < .001$, and overlap conditions, $\chi^2 (1, N = 24) = 6.0$, $p = .014$, in at least two out of three trials. This is further illustrated in Figure 3 that depicts children's performance in each trial of the exclusivity and overlap conditions. It can also be seen that all children were successful in at least one trial in the exclusivity condition, but 12% of children failed to select the correct referent for the target label in all trials of the overlap condition. These patterns further confirm our prediction that the overlap condition represents a more challenging word learning situation.

[Insert Figure 3 here]

Performance between the two word learning conditions was next compared. A Mann Whitney independent-samples test showed no significant differences in performance between the exclusivity and overlap conditions, $U = 313.0$, $p = .275$. Therefore, children were not significantly different in word learning via applying the mutual exclusivity assumption in the exclusivity condition and via accepting lexical

overlap in the overlap condition. That is, despite the varying linguistic and processing demands of the two word learning conditions, children were successful at employing the linguistic and contextual cues present in each word learning situation to accurately establish word-to-referent mappings.

However, similar to previous research, this experiment does not clarify whether the children who succeeded in lexical overlap were relying only on the linguistic information about the co-occurrence of two labels with a single referent (Savage & Au, 1996), or were also utilising contextual cues from the speakers who introduced the labels. Experiment 2 repeated Experiment 1 except that we excluded the display of the speakers, and hence omitted the contextual information, which may have facilitated acceptance of lexical overlap. We predicted similar performance across the two experiments in the exclusivity condition given that previous studies have elicited the use of the ME assumption in the absence of a speaker (e.g., Halberda, 2006). On the other hand, we predicted a difference in performance for the overlap condition. If children rely on contextual information and the co-occurrence of multisensory cues about the reference of the novel labels in the naming process, then we anticipated reduced rates of acceptance of lexical overlap when the speaker is unseen (Experiment 2).

Experiment 2

Method

Participants. Thirty-two monolingual English-speaking children (16 males) participated. Ages ranged from 4;3 to 5;2 (M = 4;9, SD = 3 months), and were equivalent to the age range of Experiment 1 for comparison purposes, $t(85) = -1.129$, $p = .306$, $d = .245$. Children were randomly assigned to the two word learning conditions. Sixteen

children participated in the exclusivity condition (8 male; *M* age = 4;10, *SD* = 2.5 months), and 16 children participated in the overlap condition (8 male; *M* age = 4;8, *SD* = 3.3 months).

Materials and apparatus. Video sequences from Experiment 1 were edited to exclude the speakers' faces from the naming and test phase in the exclusivity and overlap conditions, but the dimensions, duration, audio track, and presentation of the videos were as for Experiment 1.

Procedure. The procedure for the exclusivity and overlap conditions was identical to Experiment 1.

Results and Discussion

Proportion correct and categorical scores were computed for each condition as in Experiment 1. Children's ability to establish correct mappings in each condition was assessed first. Wilcoxon signed rank tests showed that children in this experiment successfully learned words above levels predicted by chance (chance = 0.5) in the exclusivity (*Mdn* = 1, interquartile range = 0), $Z = 3.755$, $p < .001$, but not in the overlap condition (*Mdn* = .17, interquartile range = 1), $Z = .534$, $p = .594$ (Bonferroni correction, $p < .025$). The individual response patterns confirm these results. As seen in Table 1, all children were successful in two or three trials of the exclusivity condition, and there were no children who failed to select the correct referent for the target label in all trials. On the contrary, 50% of children in the overlap condition were unsuccessful in all trials, χ^2 (1, $N = 16$) = .250, $p = .617$.

To compare performance across the two conditions, a Mann-Whitney test yielded a significant difference between the exclusivity and overlap conditions, $U = 58.50$, p

= .003. That is, children were significantly more successful in establishing word-to-referent mappings via applying ME than via accepting lexical overlap in this experiment.

A cross-experimental comparison of children's performance in the exclusivity and overlap conditions was conducted to further investigate the effect of the presence of the speakers' visual displays. A 2 (experiment: Experiment 1, Experiment 2) by 2 (condition: exclusivity, overlap) Analysis of Variance, with bootstrapping to mitigate against effects of non-normality of the distributions of the dependent variables, showed significant main effects of experiment, $F(1, 82) = 4.975$, $p = .028$, $\eta^2 = .057$, condition, $F(1, 82) = 20.255$, $p < .001$, $\eta^2 = .198$, and an experiment by condition interaction, $F(1, 82) = 6.789$, $p = .011$, $\eta^2 = .076$. These results indicate that children were more successful in word learning in the exclusivity condition across the two experiments (for the estimated marginal means derived from the bootstrapping ANOVA, exclusivity: $M = .924$, 95% *CI* [.874, .968]; overlap: $M = .608$, 95% *CI* [.471, .744]). However, further analyses showed that this difference was mainly driven by the experiment by condition interaction (Figure 4). Children's performance in the two experiments did not differ in the exclusivity condition, Mann-Whitney $U = 234.00$, $p = .841$, but this difference was significant for the overlap condition, Mann-Whitney $U = 116.00$, $p = .018$ (Bonferroni correction, $p < .025$). As predicted, children's word learning scores in the overlap condition were significantly lower when only audio recordings of the speakers introducing novel labels were used. Hence, children did not require overt contextual cues and the visual display of the speakers to apply the default ME assumption and establish one-to-one mappings between novel words and their referents. However, the presence of the speakers was essential for them to successfully accept two labels for the same referent.

[Insert Figure 4 here]

General Discussion

In the present experiments, we assessed pre-school aged children's ability to fast-map novel labels by employing the ME assumption or accepting lexical overlap and the role of linguistic and contextual cues in facilitating these mappings. Experiment 1 showed that four- and five-year-old children successfully learned novel labels in both the exclusivity and overlap conditions. This further demonstrates that the ME assumption is used robustly in word learning (Au & Glusman, 1990; Markman, Wasow, & Hansen, 2003; Markman & Wachtel, 1988). Yet, when faced with a situation where lexical overlap is appropriate, contrary to the ME assumption, children are also capable of mapping two basic-level labels to the same object. Experiment 2, however, suggested that the type and amount of contextual information present in the naming paradigm can significantly affect children's word learning. Similar performance in the exclusivity condition in Experiments 1 and 2 demonstrated that presence of the video recording of the speaker did not affect children's tendency to use the ME assumption confirming that it is employed even in the most ambiguous naming situations, consistent with children's ability to achieve successful word to form mappings from indirect (Jaswal & Markman, 2003) or overheard speech (Akhtar, 2005). However, when the visual display of the speakers was absent, performance in the overlap task decreased significantly. This finding supports the notion that children do not readily accept two overlapping labels for the same referent (Banigan & Mervis, 1988). Instead, they infer the relations between the labels and their referents by assessing the context of each communicative interaction.

Experiments 1 and 2 manipulated the type and quantity of contextual cues available for word learning. In Experiment 1, the cues were abundant combining linguistic (i.e., the co-occurrence of a label and a referent), visual (i.e., the image of the referent and the dynamic displays of the speakers), referential information (i.e., speakers' pointing and gaze alternating between child and object), and an indication of how the overlapping labels related to their referent and to each other (i.e., one speaker – one label relation). On the other hand, in Experiment 2, only linguistic and reduced visual (i.e., only the image of the referent) information was present. This experiment also preserved the indication of a one speaker-one label relation. Given that the two speakers differed in gender, it remained clear that a female used one label and a male used the other label even when their visual displays were absent, but all referential cues were not available in this paradigm. This reduced number of contextual cues was sufficient for children to employ the ME assumption and accurately select the referent of a novel label. However, their absence led to a significant decrease in children's ability to accept lexical overlap.

The visual display of a speaker conveys additional referential information and increases attentional saliency of word learning situations. Previous research has confirmed the importance of contingent referential cues to achieve learning in video-based paradigms. Young infants' ability to learn information presented via video increases significantly when the image of the actor introducing the information and interacting with the child from the screen is available (Anderson & Pempek, 2005; O'Doherty, Troseth, Shimpi, Goldenberg, Akhtar, & Saylor, 2011; Roseberry, Hirsh-Pasek, & Golinkoff, 2014; Troseth, Saylor, & Archer, 2006). The present study further shows that older children continue to rely on these cues to successfully identify the

referents of novel labels. Even though children after the age of two years can successfully learn words from audio-only paradigms (Scofield et al., 2007), in a more challenging and referentially ambiguous task, their performance decreases in the absence of contextual information from the visual display of the speakers.

In addition, convergence of redundant sources of sensory information also facilitates early perceptual learning processes (Bahrick & Lickliter, 2002). In this case, the conditions where the dynamic display of the speaker was present provided concurrent audio and visual information that directed children's attention to the relevant mappings. Word learning is indeed a complex process that is supported by a number of co-occurring sources of information including contextual, linguistic, and referential cues (Baldwin & Moses, 2001), and infants and children use the combinations of these cues to successfully encode word to referent associations (Axelsson, Churchley, & Horst, 2012; Hollich, Hirsh-Pasek, & Golinkoff, 2000; Moore, Angelopoulos, & Bennet, 1999). Our findings further confirm that older children who are more experienced word learners also integrate the redundancies encountered in the input to support their learning in complex and ambiguous situations such as the acquisition of lexical overlap.

It must also be considered that even though the exclusivity and overlap conditions were employed to assess word learning, they demanded the use of intrinsically different learning mechanisms. In the test phase of the exclusivity condition, children were required to establish a new one-label-to-one referent mapping based on the information that they received in the naming phase. However, in the test phase of the overlap condition, children were required to retain the two-labels-to-one referent mapping that they observed in the naming phase. That is, in the exclusivity condition, successful word

learning relied on the ability to infer the reference of a novel label via exclusivity reasoning, while in the overlap condition, it relied on the ability to accept and retrieve two referentially overlapping labels. Thus, it is possible that children's differential reliance on the contextual information for each task was due to these differences in task demands, suggesting that while multisensory sources of information may not be required to select a referent for a novel label, they are required for retaining and retrieving recently learned labels. It is also to be noted that, in Experiment 1, the exclusivity and overlap conditions were not found to be significantly different in accuracy, suggesting that the tasks are not quantitatively different but rather qualitatively distinct regarding the cues that are important to promote their solution.

Evidence from the present study does not permit us to clearly discriminate whether children's successful performance in the overlap condition of Experiment 1 was due to the availability of referential cues from the speaker, the re-occurrence of multisensory sources of information, task demands, increased attention to the stimuli, or the combination of these and other potential factors. Notwithstanding, this evidence supports the view that preschool aged children are capable of flexibly using the ME assumption in word learning situations. That is, while children employ ME by default, they are also able to accept two labels for the same referent when the naming situation indicates that lexical overlap is appropriate. However, the qualitative communicative and processing demands of these two learning tasks, as described above, have an effect on the type and amount of contextual information that children require to successfully establish novel label-to-referent mappings. Although young children are capable of fast mapping in non-ostensive situations where only auditory linguistic information is available (Halberda,

2006; Scofield et al., 2007), we suggest that in more challenging situations, such as when input contradicts a default lexical assumption, their learning relies on convergent contextual and linguistic cues.

The present findings do not perfectly conform with Savage and Au (1996) who reported a 50-50 performance in a lexical overlap task among three- to five-year-old children. That is, only half of the children in their experiments were capable of accepting lexical overlap, while the other half maintained ME despite being directly taught two distinct labels for the same object. Savage and Au presented children with a single lexical overlap trial and reported the number of children who successfully accepted two labels for the same object in that trial. It is possible that the present design with multiple trials per condition was more successful in capturing the variability in performance between children of different ages. However, 22 out of 25 children accepted lexical overlap in the first trial of the overlap condition of Experiment 1 in the current study, which is significantly more than chance, Binomial test: $p < .001$. Given this discrepancy, we speculate that the distinct results are related to differences in procedure (i.e., live interactions with two adult speakers), number of trials (i.e., one trial per condition), and number of requests for the target and distracter objects.

Previous research has demonstrated that young children around the age of two years are reluctant to accept referentially overlapping labels for familiar referents (e.g., “it's not an animal; it’s a dog”, Clark, 1987). However, around the ages of three and four years children become able to produce overlapping basic and non-basic level labels for familiar objects (e.g., a rose, a flower, and a plant, Waxman & Hatch, 1992). Language indeed contains multiple instances of referentially overlapping labels. Thus, the ability to acquire

lexical overlap flexibly is essential for the acquisition of these labels and understanding of the taxonomic and hierarchical relations between them. Moreover, this flexibility and successful use of contextual information in word learning may allow young children to take further advantage of the explicit information provided by adults when novel overlapping labels are introduced (e.g., a flamingo is a kind of bird; *mesa* is the Spanish word for table; Callanan & Sabbagh, 2004).

The present study shows that the quantity and kind of information required for successful mappings of novel words varies depending on the communicative context of each naming situation. These findings confirm that children apply ME by default in non-ostensive or pragmatically ambiguous naming situations from an early age. However, overt contextual information gathered from the speaker is required for the acceptance of lexical overlap and the ability to employ ME as a flexible word-learning strategy. In summary, this evidence posits word learning as an interactive process that requires children to exploit default lexical assumptions, their developing linguistic experience, and the ability to recruit from a host of contextual cues available in communicative interactions.

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Table 1. Number (percentage) of children who were successful in 0, 1, 2, or 3 trials of the exclusivity and overlap conditions in Experiments 1 and 2.

		0 trials	1 trial	2 trials	3 trials
Experiment 1	Exclusivity	0 (0%)	2 (3.33%)	4 (6.67%)	24 (80%)
	Overlap	3 (12%)	4 (16%)	1 (4%)	17 (68%)
Experiment 2	Exclusivity	0 (0%)	0 (0%)	3 (18.8%)	13 (81.2%)
	Overlap	8 (50%)	1 (6.25%)	1 (6.25%)	6 (37.5%)

List of Figures

Condition/Trial	Labels	Objects
Exclusivity Familiarization	Introduced: Banana Requested: Cup	
Test 1	Introduced: Modi Requested: Toma	
Test 2	Introduced: Therry Requested: Blicket	
Test 3	Introduced: Parloo Requested: Jegger	
Overlap Familiarization	Introduced: Dog/Puppy Requested: Dog/Puppy	
Test 1	Introduced: Mido/Koba Requested: Mido/Koba	
Test 2	Introduced: Gazzer/Teega Requested: Gazzer/Teega	
Test 3	Introduced: Zepper/Dawnoo Requested: Zepper/Dawnoo	

Figure 1. Objects and labels used in the exclusivity and overlap conditions. Note: In the overlap condition, each label corresponded to one of the speakers (e.g. *mido* was introduced and requested by Speaker 1, and *koba* was introduced and requested by Speaker 2).

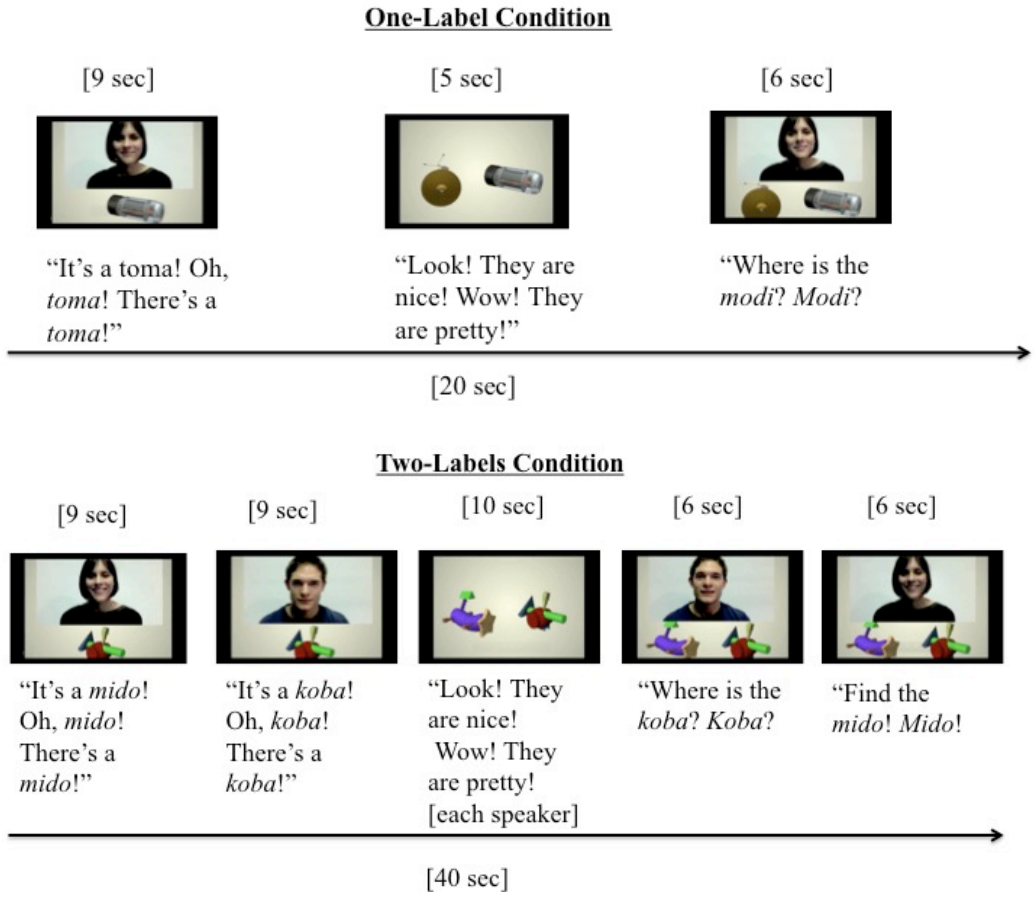

Figure 2. Graphical representation of the exclusivity and overlap conditions.

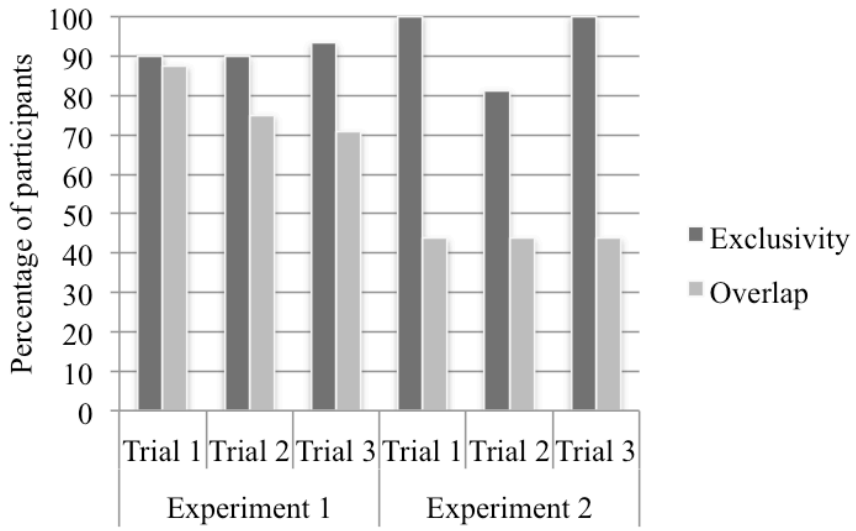

Figure 3. Percentage of participants who were successful in each trial of the exclusivity and overlap conditions in Experiments 1 and 2.

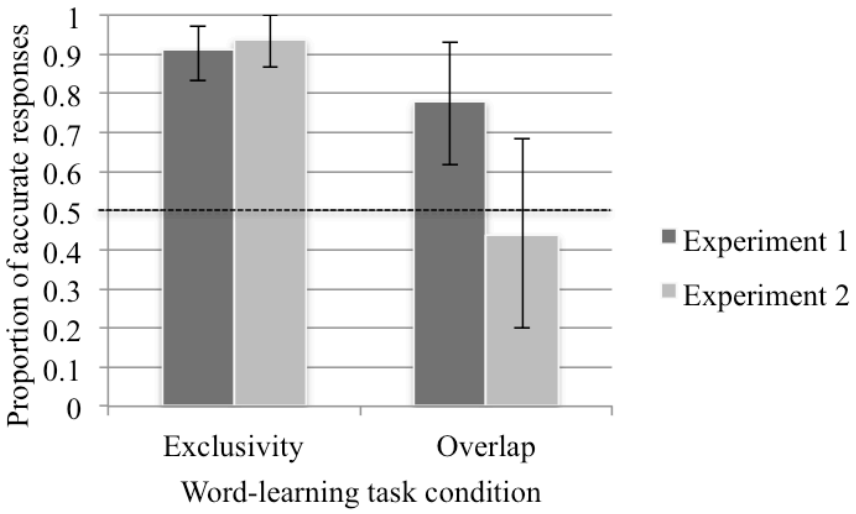

Figure 4. Estimated marginal means from ANOVA bootstrapping on proportion of correct responses in exclusivity and overlap conditions for Experiment 1 and Experiment 2. Error bars represent 95% CI.