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# Twenty-four-month-olds' Use of Attentional Cues in Lexical Acquisition

by

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Abstract

Twenty-four-month-olds' use of different attentional cues to map new words onto new objects was examined in three studies. In each study, children were presented with two novel objects which were each directed one type of attentional cue. Orienting attention was a general attentional cue, attention to a property of an object was a more specific type of attention than orienting attention, and affective attention was considered to be more personal to the speaker than the other types of attention. Children heard either a novel label (Label condition), or (b) neutral language (No Label condition). Unexpectedly, children in the Label and No Label conditions did not differ in their performance, indicating that children cannot use attentional cues to understand the speaker's referential intent. However, productive vocabulary was found to be related to performance in the Label condition only, indicating that children's use of attentional cues may be linked to vocabulary development.

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TABLE OF CONTENTS

List of Tables

# Twenty-four-month-olds' Use of Attentional Cues in Lexical Acquisition

## Introduction

Infants increase their vocabulary size at a remarkable rate during their second year of life. During this time, they can acquire up to five or six new words a day, moving from a vocabulary of about 6 words at 12 months of age to a vocabulary of over 300 words by the age of 24 months (Anglin, 1993; Fenson et al., 1994). This is quite an accomplishment considering the demands of the word learning task. When a child first hears a novel word, he or she is challenged with the task of finding the appropriate referent for the word amongst the many possible referents existing in his or her environment. He or she must then map the novel word to the correct referent and learn to generalize the label to any other appropriate referents. For example, when a child hears the word "cup", he or she must first discover that this label refers to the whole object "cup" and not its color, shape, or a part of the object (e.g., the handle). Once the child has mapped the word "cup" to the object, then he or she must generalize the label "cup" to all variations of colors, sizes, and shapes of cups.

This extraordinary ability of children to acquire vocabulary rapidly and seemingly easily has motivated researchers to examine the types of information that guide children in disambiguating word reference. Some researchers have examined external sources of guidance such as lexical form class (e.g., Hall, 1994; Hall & Graham, 1999) and socio-pragmatic cues (e.g., gaze direction, affect, and discourse novelty; e.g., Akhtar, Carpenter, & Tomasello, 1996; Baldwin, 1993; Baldwin et al., 1996; Tomasello & Barton, 1994). Other researchers have examined internal expectations or default assumptions that children may have about word reference as a source of guidance in word

mapping (e.g., whole object assumption, the taxanomic assumption, and the mutual exclusivity assumption; e.g., Golinkoff, Mervis, & Hirsh-Pasek, 1994; Markman, 1989; Markman & Wachtel, 1988). Finally, researchers have found young word learners attend to object characteristics, such as shape and function, when establishing appropriate mappings between words and objects (e.g., Graham & Poulin-Dubois, 1999; Graham, Williams, & Huber, 1999; Poulin-Dubois, Frank, Graham, & Elkin, 1999).

The goal of the present studies was to examine the types of information that may guide children's disambiguation of object label reference, particularly when presented with two nameless objects. The focus of the studies was on examining whether directing different types of attention towards nameless objects helps children disambiguate the referent of a novel word.

To date, a number of studies have examined how children map words onto objects in situations where they are presented with both familiar and unfamiliar objects. When children are presented with two objects, one a familiar object for which they already know a label (e.g., a cup) and one an unfamiliar object for which they know no label (e.g., an apple corer), and asked for the referent of a novel label (e.g., a dax), most children will map the novel word to the unlabeled object (Graham, Poulin-Dubois, & Baker, 1998; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Merriman & Schuster, 1991). This tendency to select the unlabeled object has been named the **disambiguation effect** by Merriman and Bowman (1989), as it is thought to help resolve the ambiguity of the referents of words. A number of different mechanisms have been proposed to underlie the disambiguation effect, including the Mutual Exclusivity (ME) constraint. Markman and colleagues (e.g., Markman & Wachtel, 1988) have proposed

that children are guided by a ME constraint in which they assume that objects can only have one name, and thus avoid mapping a second label onto an object that is already labeled. This constraint is one of many under the lexical constraint theory; the view that when faced with the task of finding the referent of a novel word, children are cognitively constrained to consider particular hypotheses for certain word meanings over other possible meanings (Golinkoff, Hirsch-Pasek, & Hollich, 1999; Markman, 1989; Woodward & Markman, 1998). Lexical constraints are one of many sources of guidance thought to help children map novel words onto their appropriate referents.

Lexical Constraints

As mentioned above, the lexical constraints view suggests that children approach word learning with default assumptions or constraints about what words are likely to mean (Markman, 1989). These constraints then help narrow down possible referents of words. There are a number of research studies demonstrating the validity of lexical constraints, such as the whole object assumption which leads children to assume that new words name objects rather than parts or properties of objects (e.g., Markman, 1989), the taxonomic assumption which leads children to assume that new labels should be extended to objects which are taxonomically related to the originally named object rather than objects thematically associated (e.g., Markman & Hutchinson, 1984), and the mutual exclusivity assumption which leads children to assume that objects only have one name (e.g., Markman & Wachtel, 1988). For example, Markman and Wachtel (1988) conducted a study providing supportive evidence for the whole object assumption and the mutual exclusivity assumption. In this study, children were shown novel and familiar objects (both with salient parts) and taught a novel noun (e.g., "This is a trachea.") for

each. When presented with a novel object, young children interpreted the novel noun as a label for the whole object. However, when the object was familiar, the children interpreted the novel noun as a label for the salient part. Thus, these findings demonstrate that children have the tendency to interpret novel words as labeling whole objects rather than parts of objects when the objects are novel. The findings also demonstrated that when children already have a label for an object, they will reject a novel label for the object and instead look for another meaning of the noun (i.e., the salient part).

Although lexical constraints do play an important role in guiding young children's word learning, these constraints offer no guidance for word-object mappings when children are faced with more than one nameless object (e.g., an aardvark and a wombat). That is, the whole object assumption does not help children disambiguate the referent of a word if there are two or more novel objects in the situation. Similarly, the mutual exclusivity assumption does not guide children towards an appropriate word-object mapping when there are two or more objects without known names. In these types of situations, children may rely on linguistic cues such as lexical form class cues and/or on socio-pragmatic cues.

Lexical Form Class Cues

Studies have found that preschoolers' knowledge of the semantic roles of words from different form classes can help them in determining the referent of a novel label (e.g., Hall, 1994; Hall & Graham, 1999). That is, children are assisted by the knowledge that a count noun, represented by a syntactic frame such as "This is a fep", names an object category; a proper name, represented by a frame such as "This is named Fep"

signifies that the object is an individual; and, an adjective, represented by a frame such as "This is very fep", denotes a property of the object (Hall & Graham, 1999). Given this information, children can then extend new labels to the proper referents. For example, if children are told, "This is a fep", they may extend the word fep to other objects in the same category, and if told "This is very fep", they may extend the word fep to other objects with the same property.

Recently, Hall and Graham (1999) conducted a series of studies demonstrating that form class information guides children's tendency to make mappings between words and objects in situations involving more than one object. They presented three- and four-year-olds with a novel label, modeled syntactically as either a proper name (e.g., "This dog is <u>named</u> Daxy") or an adjective ("This, dog is <u>very</u> daxy") for a stuffed animal of a familiar kind (e.g., a dog). The experimenter then brought out a second object of the same kind and asked children to choose one of the two objects as the referent of a second novel label, also presented as either a proper name or an adjective. The children were also asked to decide whether the second novel label could apply to the object they did not choose. Children rejected two proper names for the same object, and mapped a new proper name onto the previously unlabeled object. In contrast, children did not reject two adjectives for the same object, and did not reject the combination of one proper name and one adjective for the same object. The results of these studies demonstrate that information about lexical form class contributes to the formation of linkages between words and objects. That is, children's understanding that a proper noun designates a unique individual while an adjective does not helped them disambiguate the referent of a new proper noun. Therefore, once children have knowledge about lexical form class

(e.g., the knowledge that a proper noun labels a unique individual while an adjective can describe many objects) they can use this information to help them identify the referent of novel words.

Socio-pragmatic Cues

Another source of information that children can rely on to help establish appropriate mappings between words and objects are socio-pragmatic cues. Socio-pragmatic cues are cues in social situations provided by advanced language users to indicate what they may be referring to in the discourse context. For example, an adult may point to and look towards the object they are labeling.

The examination of the role of socio-pragmatic cues in guiding word-object mapping is motivated by the social pragmatic theory of language acquisition. According to this theory, language is a set of social conventions whose primary function is to communicate or to enable an individual to manipulate the attention of other individuals in very specific ways (Carpenter, Nagell, & Tomasello, 1998). Thus, language is viewed as a social-cognitive skill. This is in contrast to other theories of language development that neglect the social dimensions of word learning. These theories include the lexical constraints theory (described above) that emphasizes internal word-learning constraints or principles (Markman, 1989; Golinkoff, Mervis, & Hirsh-Pasek, 1994), and the associative perspective that asserts that general processes of association and learning are sufficient to explain lexical acquisition (Smith, Jones, & Landau, 1996).

The foundation of the social-pragmatic theory of language is based on cultural psychology (e.g., Bruner, 1975; Tomasello, Kruger, & Ratner, 1993). Cultural psychology focuses on the structured cultural environments that children are immersed in

and on how this structure, along with children's social-cognitive and social learning abilities, make possible the acquisition of many human cultural skills, including language (Tomasello, 1992). Bruner (1977) suggested that young children begin to learn language in cultural routines such as feeding, bathing, book reading, as well as other social interactional routines. In these routines, children are able to build up knowledge and expectations about adults' intentions, giving a foundation for language, and adults are able to make predictions about children's intentions and attentional focus and use language accordingly.

According to the social-pragmatic theory of language acquisition, new words are learned through the child entering into some type of social interaction with an advanced language user (Tomasello, 1992). In particular, this social interaction must involve some form of joint attentional focus. The term joint attentional focus refers to a sharing of attention through behaviours such as gaze following, imitative learning, and gestural communication (Carpenter et al., 1998). Infants' early joint attentional skills, developed between the ages of nine and 18 months, underlie their emerging understanding of other persons as intentional agents with attentional states that can be manipulated and shared (Tomasello, 1995). That is, infants' ability to actively coordinate their attention between an adult and an object in situations of joint attention, rather than focus on one or the other, indicates that they are actively trying to decipher the adult's focus of attention. This implies that they have the understanding that adults' behaviour (and verbalizations) are goal directed or intentional. Understanding that others behave in an intentional manner is essential to language, as infants must discover what adults intend (or are

attending to) when they use novel words. Thus, children identify the appropriate referent for a novel label by determining the adult speaker's referential intent.

Joint attention can take place through the adult focusing in on what the infant is attending to, or through the infant focusing in on what the adult is attending to. However, it has been suggested that early language learning is facilitated during social interactions in which an adult follows into, rather than leads, infants' attentional focus (Dunham, Dunham, & Curwin, 1993; Tomasello & Farrar, 1986). For example, Dunham et al. (1993) conducted a study in which infants were either introduced a novel label for an object they were already focused on, or introduced a novel label when they were focused on a different object (i.e., the labeling was directed at a target object not in the infants focus of attention). On a subsequent comprehension task (e.g., "Where's the dodo, can you find the dodo?"), infants were more likely to correctly identify the "dodo" object in the condition where the adult had labeled the object already in the infants' focus of attention. While it has been demonstrated that infants learn better when adults follow their attentional focus, infants can also learn new words by actively monitoring the attentional focus of adults (Baldwin, 1995; Baldwin & Tomasello, 1998).

Once a child has the understanding that adults, through language, intend to direct their attention toward something in the shared environment, he or she must find ways of figuring out what aspect the adult is attending to, or intending to refer to in the situation. Socio-pragmatic cues are a means of achieving this goal. Researchers have recently demonstrated that infants are sensitive to a number of socio-pragmatic cues during language acquisition, and in particular, when asked to map a novel word onto an object in scenarios containing more than one nameless object. These cues include: attention or

gaze direction (e.g., Baldwin, 1993; Baldwin et al., 1996; Moore, Angelopoulos, & Bennett, 1999), affect (including facial expression; e.g., Tomasello & Barton, 1994) , and discourse novelty (e.g., Akhtar et al., 1996). Because the focus of the present studies is on the examination of socio-pragmatic cues, a discussion of previously studied cues is warranted.

Referential cues vs. temporal contiguity.

Social-pragmatic theorists argue that referential understanding underlies word learning. Therefore, it is necessary for children to learn that speakers intend for them to attend to something when they use language (Akhtar & Tomasello, in press). If language users lacked referential understanding, word learning could occur only by mechanisms of association such as temporal contiguity (Baldwin, 1993). Thus, a word would become associated with a referent only because, over numerous occasions, infants happened to hear that particular word at the same time they were focused on the correct referent. This would undoubtedly lead to a word learning path filled with errors. For example, if an infant was focused on a toy (e.g., a truck) and her mother looked out the window and said "Look at the bus.", the infant may think the word bus refers to the truck. Only after several instances of hearing the word truck while looking at a truck could the infant map the word truck to the appropriate referent. The issue of when infants begin to understand the importance of referential intent for word learning has received some empirical attention in recent years.

In one of the first studies to pit referential cues against temporal contiguity, Baldwin (1993) presented 19- to 20-month-old infants with two types of word learning conditions, a Conflict condition and a Coincide condition (Study 1). In the Conflict

condition, the experimenter lifted the lid of an opaque container and peered inside while uttering a novel label (e.g., "It's a modi", "There's a modi in here."), thereby indicating a reference to the object inside the container. Then the experimenter put that container aside and went to a second container and removed a toy (i.e., a novel object) from inside and gave it to the infant. Consequently, the first object the infant saw after hearing the label came from the second container, and not the container the experimenter was looking into when she uttered the novel label. After 10 seconds, the experimenter returned to the first container and removed a second toy (i.e., another novel object) and gave it to the infant. Thus, the infant did not see the labeled object until after the unlabeled object. The procedure in the Coincide condition was identical to that of the Conflict condition, except that after uttering the novel label, the experimenter removed the toy from the first container and let the infant play with it. Thus, the infant first saw the toy that was labeled. The infants were then presented with the two novel toys and asked for the referent of a novel label (e.g., a modi) on two trials. If the infants relied on temporal contiguity to assist them in mapping the novel word to the appropriate referent, then they should have chosen the first toy they saw in both conditions. However, if they understood and used the experimenter's referential intent to assist them in mapping words to objects, they should have chosen the second toy (i.e., from first container) in the Conflict condition. When asked for the referent of the novel label, infants in the Conflict condition chose the toy from the first container (i.e., second toy they saw) on over 67% of the trials. Infants in the Coincide condition chose the toy from the first container (i.e., first toy they saw) on 70% of the trials. In both the Conflict and the Coincide condition, children choose the object that the adult referred to at above chance levels. In the

Conflict condition, the choice of the second toy required the infants to use referential cues and ignore powerfully conflicting information from temporal contiguity. Thus, the results of this study indicate that infants will use referential cues to guide their mapping of the new label to the novel object.

Although the results of the above study indicate that infants use referential cues for word-object mapping, it is unclear whether they appreciate that signs of referential intent are critical for this task. To address this issue, Baldwin et al. (1996) conducted a study in which 18- to 20- month-old infants heard a novel label (e.g., "A modi") uttered by someone who was seated out of the infants' view (behind a sound-conducting rice-paper screen) while they were focused on a novel toy (e.g., a hand-held plastic telescope). Therefore, the new label covaried with infants' focus on a novel toy, but there was no sign of referential intent. As a basis for comparison, infants also heard a different novel label (e.g., "A dawnoo"), for a different novel toy, uttered by a speaker seated in view and engaged in joint attentional focus with the infant. Infants selected the novel toy at above chance levels when asked to extend the novel label in the second condition, but responded randomly when asked to extend the novel label in the first condition. This suggests that infants map a novel word onto a novel object *only* when the speaker is attending to the object.

Referential cues vs. salience.

One can conclude from the studies described above that children do pay attention to the referential intent of adults when acquiring new words. However, in these studies, it is unclear whether children mapped the novel word to the appropriate objects because they understood the referential intent of the adult or because the combination of context

and adult referential behaviour served to focus children's attention on the intended object. That is, it is possible that children acquired the novel word by mapping the word onto the most salient object without an understanding of the speaker's referential intention. Baldwin (1993), described above, examined this issue in a second study. Again, there was both a Coincide and a Conflict condition. In the Conflict condition, the experimenter looked at the infant while manipulating the lid of one container as she introduced the novel label (e.g., "I'll show you a modi. Want to see a modi? A modi."), instead of peering inside a container while uttering a novel label like in Study 1. This action did increase the salience of this container, as evidenced by the infants looking more at the manipulated container than the other container. Then the experimenter put that container aside and went to a second container and removed the toy (i.e., a novel object) and gave it to the infant. Consequently, the first object the infant saw after hearing the label came from the second container. The procedure in the Coincide condition was identical to that of the Conflict condition, except that after labeling, the experimenter removed the toy from the first container and gave it to the infant. In contrast to the first study, when asked for the referent of the novel word, infants did not systematically map the novel word onto the object located within the manipulated container. Thus, it was demonstrated that infants' word mapping is not simply a result of increase in salience. Nonetheless, these results are not conclusive, as the lid manipulation may have been successful in making the container itself salient, but may not have made the contents of the container (the novel object) salient.

In a recent series of studies, Moore et al. (1999) pitted referential cues directly against salience cues in a word learning task. The referential cue used in this study was a

shift in gaze direction by the experimenter, and the salience cue was the activation of a toy through illumination and rotation of the toy. Eighteen- and 24-month-old children were presented two toys in one of four conditions. In the Match condition, the novel word was introduced (e.g., "Look, there's Dodo. See Dodo. Look at Dodo.") while the adult looked toward the activated toy (referential and salience cues) and away from the non-activated toy. In the Mismatch condition, the novel word was introduced while the adult was looking toward the non-activated toy (referential cue) and away from the activated toy (salience cue). There were also two control conditions in which salience of the toys was held constant at either low (inactive) or high (active) salience, and referential cues varied, gaze being directed at only one object on each trial. In all four conditions, when asked for the referent of the novel word, 24-month-olds chose the object that had been the target of the adult's gaze while she was using the novel word. On the contrary, in none of the conditions did these children map the novel label to the object that was directed salience cues only. Only when there was no conflict between the referential cues and the salience of the toys were the 18-month-olds able to acquire the word for the toy that had been the target of the adult's gaze when the novel word was introduced. These results imply that referential cues provided in word learning situations do not simply facilitate word learning because they lead to the intended object being more likely to be salient and to be the focus of the child's attention. Additionally, the results indicate that when children are first learning words, they may not have as secure an understanding of referential cues. Moore et al. (1999) conclude that children's understanding of the referential behaviour of adults is what leads them to the interpretation of novel words.

Given that infants do appear to appreciate that signs of referential intent are critical for word-referent mapping and seem to have an understanding of this referential intent, researchers have examined the types of cues infants consider referential. This research has focused on the role of affective and behavioral cues (Akhtar & Tomasello, 1996; Tomasello & Barton, 1994), discourse novelty (Akhtar et al., 1996), and attentional cues (Graham, Adamache, Storms, & Pencer, 1999) in helping children map words onto objects.

Role of affective and behavioral cues.

Tomasello and Barton (1994) investigated the effect of referential intent, as indicated by speaker's affective and behavioral cues, on 24-month-old children's ability to map novel words onto novel objects. In one of the experimental conditions (With Search), the experimenter announced her intention to find an object "Let's find the toma" and then proceeded to pick up and nonverbally reject (by frowning) two other objects before finding and picking up the target object with a pleased facial expression and then handing it to the child. She then said, "Let's see what's in here", and proceeded to extract two nontarget objects, one at a time, in the same way as the target object had been found (i.e., with pleased facial expression) and pass the objects to the child. This was done to control for a bias toward the target object simply because of more interaction and affect from the experimenter. In another experimental condition (Without Search), the experimenter again announced her intention to find the referent of a novel label, but found the target object on the first try (again, with a pleased facial expression). She again went on to find four nontarget objects. In the subsequent comprehension task, all five objects were laid on the floor in front of the child and the child was asked to give the

experimenter the referent of the novel label (e.g., toma). In an elicited production task, children were asked to name the target object. As in Baldwin's (1993) study, if the infants were relying on temporal contiguity rather than social cues, they would choose the first (rejected) object seen after hearing the novel label (e.g., toma) as the referent of the novel label. However, if they recognized the affective and behavioural cues as signs of referential intent, and used these cues for mapping the novel word to the referent, they would be expected to chose the target object (3rd object) in the experimental condition. The researchers found that children in both the With Search and Without Search conditions mapped the new word onto the target object equally well: 11 of 15 children in the Without Search condition and 8 of 15 in the With Search condition chose the target object as the referent of the novel label (i.e., children either produced or comprehended target word correctly). Additionally, children in the With Search condition who did not choose the toma did not have systematic preferences for any of the distractor objects, and only one child mapped the novel word onto the first object touched by the experimenter. Thus, children were able to ignore temporal contiguity cues when the first object encountered was identified as one that was not intended and a later object was identified as the one intended through affective and behavioural cues. This finding indicates that affective and behavioural cues aid children in identifying the adult's referential intent and map a novel word onto a nameless object.

In a subsequent study, Akhtar and Tomasello (1996) examined two-year-olds' word learning for absent referents. The purpose of this study was to investigate whether children can use event knowledge and social-pragmatic cues to anticipate an object they were about to encounter and map a novel word onto that object. That is, can children

learn to map a novel word onto a novel object through past experience with the object in combination with socio-pragmatic cues, without requiring perceptual contiguity between the novel label and its referent. A nonverbal script of playing with novel objects in particular ways was established before the child was exposed to any language models. This nonverbal script consisted of the children playing three rounds of a finding game in which the experimenter found and showed each of four toys (one target and three non-targets) twice each round. A neutral sentence (e.g., "Let's see what's in here.") was said before finding the toys. Also, each toy was always found in the same location and in the same order on each round, in order to familiarize the child with the location of each toy. Following this, the experimenter announced her intention to find the referent of a novel word (e.g., a toma) in the experimental conditions. In the Referent condition, children saw the intended referent immediately after hearing the language model (e.g., "Now let's find the toma."). That is, the experimenter uttered the novel label and immediately removed the target toy from its location and gave it to the children. In the Absent referent condition, children experienced the same nonverbal scripts and language models, but never saw the referent object. That is, immediately after uttering the novel label, the experimenter attempted to open the toy barn where the target object had been previously located, and then told the children that the barn was "locked". The experimenter then proceeded to remove the non-target objects one at a time with neutral language. In addition, there were two control conditions, a Referent-control condition, and a Absent referent-control condition. These conditions proceeded in the same manner as the experimental conditions, however, the experimenter used neutral language ("Let's see what's in here."). In a subsequent comprehension test, when presented with the target

object as well as the non-target objects, and asked to show the experimenter the "toma", children mapped the novel label (e.g., "toma") to the target object significantly more in both the Referent and Absent referent conditions than in the control conditions. Thus, the children must have been able to recall which object was habitually located in the barn, and actively understood the speaker's referential intentions in this particular discourse context.

Role of discourse novelty.

Another type of socio-pragmatic cue that children might use to assist them in determining the referent of a novel label is discourse novelty. Discourse novelty involves a situation in which one element is novel in the discourse context. Akhtar et al. (1996) examined the role of discourse novelty, from the perspective of the child and the adult, in word mapping tasks. In Study 1, two-year-old children first played with three novel, nameless objects with two experimenters and a parent. After playing with these objects, while the infant was distracted, one of the experimenters placed the three objects along with a fourth novel object, in random positions in a clear plastic box. Thus, the fourth novel object was novel to the discourse context for both the child, his or her parent, and one of the experimenters. The experimenter (who had never seen the fourth object) then grabbed the box and said in an exited tone, "Look, I see a modi!" (Labeling condition). Children in a control group (No Labeling condition) heard "Look, look at that!". When the experimenter asked the children to show/give her the "modi" in a comprehension test, children chose the target object (novel object) in the Labeling condition but not in the No labeling condition. Therefore, children used novelty in the discourse context as a cue in learning a novel word.

In Study 2, the children and adults again played with three novel, nameless objects. One experimenter and parent then left the room while the child and the other experimenter played with a fourth object (the target). The experimenter then put all four toys in a row in random order. The adults then returned, and the returning experimenter looked at the group of objects and said "Look, I see a gazzer! A gazzer!" in the Labeling condition or "Look, I see a toy! A toy!" in the No labeling condition. Again, children were then asked to show/give the experimenter the "gazzer". The researchers found that children learned the word for the target object in the Labeling condition, but selected randomly in the No labeling condition. This finding indicates that children were able to monitor what was novel for adult, ignoring that the object was not novel for themselves. Additionally, the children knew that adults tend to get excited about, and thus only use new language to talk about, things that are new to the discourse context.

Attentional cues.

Graham, Adamache, Storms, & Pencer (1999) investigated three-year-olds' reliance on attentional cues to disambiguate the reference of a novel word when presented with two novel objects. In Experiment 1, the children were presented with two unnamed objects, one object at a time. The experimenter labelled a property of one of the objects (e.g., "You can squeeze this one."), while simply directing general attention to the other (e.g., "Look at this one."). When asked for the referent of a novel label, children chose randomly between the two objects. This suggests that general versus specific attention did not help children disambiguate the reference of the novel word. In Experiment 2, children were presented with two nameless objects simultaneously. One of the nameless objects was given a property while the other one was ignored by the

experimenter. When children were asked for the referent of a novel word, they chose the object which did not receive attention. There are two possible explanations for this finding. First, children may treat the property as a way to describe or label the novel object, and they used this information to help them discern the referential intent of the speaker . Alternatively, the relative novelty of the novel object may have guided the children's word object mappings. In Experiment 3, again children were presented with two nameless objects simultaneously. The experimenter directed the child's attention to one of the objects (e.g., "Look at this one.") but directed no attention to the other object. When asked for the referent of a novel label, children chose randomly.

In sum, when presented with an object that was given a property and one that was not attended to, children mapped the novel label onto the object that was initially ignored. However, when presented with an object that was attended to in a general way and one that was not attended to, children did not systematically map the novel labels to any of the objects. This suggests that children do use the property as a way of labeling the object, and that providing general attention does not seem to provide a cue to referential intent.

Taken together, these studies indicate that a number of socio-pragmatic cues can help children make appropriate mappings between words and their referents. Many referential cues, including gaze, attention, affect, and other behavioural cues, have been found to override simple associative mechanisms such as temporal contiguity cues. As well, researchers have found that discourse novelty can assist children in making a correct mapping. Most importantly, these studies indicate that infants can read adults'

referential intent in order to map a word to an appropriate referent even in referentially ambiguous situations.

The Present Studies

The present studies were designed to examine whether different types of attentional cues directed towards novel objects by a speaker would help young children in mapping novel words to novel objects. In previous research, socio-pragmatic cues have been studied in isolation or in combination with one another. That is, researchers have examined how children use one or more socio-pragmatic cues at one time to understand the speaker's referential intent. No study to date, however, has examined children's word-object mapping when different cues are contrasted or, in other words, pitted against one another. In natural word learning situations, children most likely encounter situations where they receive different cues from adults regarding their referential intent, and these cues may even conflict. Therefore, the present studies were designed to examine whether children can use attentional cues to identify adults' referential intent when learning novel words, and whether they can do this when the cues are directly contrasted. Additionally, the studies can help answer the question of whether any kind of attention towards objects helps in mapping novel words to objects or whether children show a discrimination between different types of attention.

The present thesis consists of three studies in which different types of attentional cues were directly contrasted. The complete design of the present studies is presented in Table 1. Three types of attentional cues were examined: general orienting attention, attention to a property of an object, and affective attention. These types of attentional

Table 1

Experimental Design for Studies 1 through 3

| | Label | No Label |
|---|---|---|
| Study 1 | Affective vs. Orienting Attention | Affective vs. Orienting Attention |
| Study 2 | Property vs. Orienting Attention | Property vs. Orienting Attention |
| Study 3 | Affective vs. Property Attention | Affective vs. Property Attention |

cues differ from previously studied cues (e.g., eye gaze and affect/behaviour towards objects), and were chosen because they were thought to range in specificity and intentionality. When directing orienting attention to an object, the experimenter held the object in front of the child and told him or her to look at it (e.g., "See, look at this one."). This cue can be considered a more general attentional cue from the experimenter as the child's attention is simply oriented toward the object. When directing attention to a property of an object, the experimenter held the object in front of the child and demonstrated a specific property of an object (e.g., "See, you can squeeze it."). This cue was considered to be a more specific type of attention than orienting attention. Attention to a property was thought to be a more specific cue than orienting attention, because it involves directing the child to a more specific aspect of the object rather than simply drawing attention to the whole object. Additionally, when the speaker directs attention to a property of an object, it indicates that the speaker has specific knowledge about the particular object, which children may consider when interpreting the experimenter's referential intent. When directing affective attention to an object, the experimenter held the object close to her (as if hugging it) and indicated that she liked it (e.g., "See, I like this one."). This type of attentional cue was used because it was considered to be more personal to the speaker. That is, children may interpret the speaker's behaviour as indicating that the object has personal meaning for her. Because this type of attentional cue is more personal to the speaker, children may regard this cue as more indicative of what the speaker is intending to refer to than either orienting attention or attention to a property.

In each study, children were presented with the objects in either a Label or a No Label condition. In the Label condition, the experimenter then asked the children for the referent of a novel noun. In the No Label condition, the experimenter used neutral language and asked children to simply give her one. Thus, in the Label condition, the experimenter began by announcing the novel word (e.g., "Let's find a fep."). In the No Label condition, the experimenter began by announcing "Let's find one.". After the procedure was complete, and the children had been shown both objects directed the different types of attention, the experimenter asked the children to show her one of the objects. In the Label condition the children were asked for the referent of a novel word (e.g., "Show me the fep.") and in the No Label condition they were asked for "one" (i.e., "Show me one."). Children's choices of objects in the Label condition indicated whether or not they used the different attentional cues to map novel words onto novel objects, and which type of attentional cues helped children determine the experimenter's referential intent. The No Label condition was used as a control condition. As it was not a word learning situation, this condition was used to control for children's choice of objects based on nonlinguistic factors. In particular, a comparison of children's performance in the two conditions would indicate whether children were choosing objects based on salience cues alone in both conditions, or whether they were using the attentional cues to help them determine the experimenter's referential intent in the Label condition.

In Study 1, affective attention was directly contrasted with orienting attention. That is, children were presented with two nameless objects, and the experimenter directed affective attention to one object and orienting attention to the other. In the Label condition, it was predicted that children would map a novel label to the object directed

affective attention significantly above chance levels, as they would consider this type of attention as a stronger indicator of referential intent than orienting attention because it is more personal to the speaker and does more than simply orient the children toward an object. In the No Label condition, it was predicted that children would choose randomly between the objects, as they would not be looking for evidence of referential intent. In Study 2, attention directed to a property versus orienting attention was examined. In the Label condition, it was predicted that children would choose the object given a property as the referent of a novel label significantly more than chance because this type of attentional cue indicates that the speaker knows something about the object, thus indicating a stronger sign of referential intent than orientation toward an object. However, as in Study 1, children were predicted to choose between objects randomly in the No Label condition. Finally, in Study 3, affective attention versus attention directed to a property was examined. It was predicted that children would map the novel label to the object directed affective attention significantly above chance levels because this type of attention is more personal to the speaker and may therefore be more indicative of what the speaker is intending to attend to in the situation. Additionally, it was again predicted that children in the No Label condition would choose randomly between the objects. Furthermore, in all three studies, it was predicted that children in the Label condition would be consistent in choosing objects directed one type of attention, indicating that they chose a strategy in determining the speaker's referential intent, while children in the No Label condition would choose randomly between the types of attention.

Children's productive vocabulary size was also examined in the present studies. A number of studies, including those described above (e.g., Akhtar & Tomasello, 1996;

Baldwin, 1993; Tomasello & Barton, 1994), have indicated that children's understanding of referential intent is critical to word learning. Moreover, older children, who are presumably better word learners, have a better understanding of the meaning of speakers referential cues (e.g., Baldwin, 1991; Moore et al., 1999). Therefore, it is possible, because children's ability to understand referential intent is so critical to language acquisition, children who have higher vocabularies may be more attuned to adults' referential intent. That is, children with higher vocabulary sizes may be better able to exploit referential cues for word learning. Furthermore, children's ability to use other sources of guidance in word learning, such as the mutual exclusivity principle, have been found to be related to productive vocabulary size (e.g., Graham et al., 1998). Therefore, children's productive vocabulary size may be related to their use of socio-pragmatic cues.

In the present studies, it was predicted that productive vocabulary size would be positively related to children's ability to use attentional cues to map novel words onto novel objects. In addition, if affective attention is, in fact, the most intentional cue, then children with higher vocabularies should be more likely to use affective attention to help them in disambiguating the referent of a novel word. Furthermore, even if overall productive vocabulary is not related to children's ability to map novel words onto objects, the kinds of words children are focused on learning at the time may be relevant. Previous research has demonstrated that whereas some children are focused on learning mostly nouns, other children are attempting to learn a broader range of word classes (Goldfield & Reznick, 1990). Children with a higher percentage of nouns in their vocabulary, who are therefore more focused on learning nouns, may be oriented towards using word

learning cues that focus on objects. Thus, because the attentional cues used in this study focus on objects, children with a higher percentage of nouns in their vocabulary may be more oriented towards using these cues for word-object mappings than children with a lower percentage of nouns. Therefore, children's vocabulary composition, as measured by the percentage of nouns they have in their vocabulary was also examined.

## Study 1

### Method

#### Participants

Participants were 40 two-year-olds randomly assigned to one of two conditions. There were 20 participants in the Label condition (mean age = 24.83 months, SD = .90, range = 23.49 to 26.75 months, 10 males, 10 females), and 20 participants in the No Label condition (mean age = 24.29 months, SD = 1.11, range = 21.96 to 26.20 months, 9 males, 11 females). Children were tested individually in either the lab (n = 37) or their daycare (n = 3). Parents of the children were recruited through brochures given out at health clinics and through daycare centers throughout the city of Calgary. All parents gave informed consent and participants were treated in accordance with the University of Calgary Ethical Guidelines and the Ethical Standards of the Canadian Psychological Association. Four additional children were tested but were excluded from the sample for the following reasons: did not complete procedure due to fussiness (n = 2), and experimenter error (n = 2).

#### Materials

Stimuli. Eight familiar toy objects were used in practice trials: a bottle, a spoon, a horse, a bear, a ball, keys, a bowl, and a shoe. Eight different household utensils that

have been verified as unnamable by five -year-olds were used as unfamiliar objects: a turkey baster, a sink plunger, a garlic press, a honey dipper, a clothesline pulley, an apple corer, a corkscrew, and a bottle top (Graham & Storms, 1997). These objects were grouped into four sets in order to counterbalance the type of attention that the objects received (i.e., *orienting* attention or *affective* attention) and the placement of the objects (i.e., left side or right side; See Table 2). For example, for one child the experimenter directed *orienting* attention to the sink plunger, which was placed on the right, and the experimenter directed *affective* attention to the turkey baster, which was placed on the left. For another child, the experimenter directed *affective* attention to the sink plunger, which was placed on the left, and directed *orienting* attention to the turkey baster, which was placed on the right (See Table 2). The experimenter used a hand puppet as a "helper" in order to help keep the children interested in participating in the procedure.

Equipment. A videocamera and a videocassette recorder equipped with frame by frame replay provided a visual record of children's choice of object, which was used for reliability coding. Both the videocamera and the videocassette recorder were placed behind a one-way mirror. A hidden microphone was placed on a shelf in the testing room, providing a continuous audiotaped record. The coder examined the video replays on a 27-inch television monitor. The experimenter used a small stopwatch to time the 5- and 10-second intervals in which the stimuli were given to the children to manipulate.

Procedure

Children were tested individually in either a room in a laboratory on the University of Calgary Campus, or in a quiet area at a Daycare in the city of Calgary. Before beginning the study, the experimenter briefly played with the child to allow him

Table 2

Unfamiliar Object Property Descriptions and Novel Label Requested

| Object Pairs | Property | Novel Label Requested |
|---|---|---|
| Pair 1: | | |
| Turkey Baster | Squeeze it | fep |
| Sink Plunger | Squish it | |
| Pair 2: | | |
| Garlic Press | Open it | wug |
| Honey Dipper | Tap it | |
| Pair 3: | | |
| Clothesline Pulley | Roll it | blick |
| Apple Corer | Twirl it | |
| Pair 4: | | |
| Bottle Top | Twist it | zav |
| Corkscrew | Spin it | |

or her to become more comfortable in the situation. The child and either a parent/guardian or a day-care worker were then seated across from two experimenters at a table and the procedure was explained to them. Parents and caregivers were asked to refrain from giving their child any information about the objects or new labels, and not to point to any of the objects. Throughout the study, the primary experimenter remained constant, and a secondary experimenter was responsible for timing trials and placing appropriate objects in front of the child.

Each child was first given a practice task in which they were presented with pairs of familiar objects and asked by the experimenter to choose the referent of one of the familiar labels. The purpose of the practice task was to familiarize the child with the task of choosing objects on the right and on the left, and picking out the referents of labels. On one trial, the child was shown a bowl and a shoe and asked to show the experimenter the bowl. This was repeated with three more pairs of objects for a total of four trials. The familiar objects were always presented in the same pairs (e.g., bowl with shoe, bottle with spoon), in a random order, with left/right presentation counterbalanced. The experimenter always asked for the same referent within each pair in order to maintain consistency across participants. The child received positive feedback if he or she chose the correct referent (e.g., "Good") and corrective feedback if they chose the incorrect referent. Only two children needed to receive corrective feedback on one trial. Following successful practice trials, the experimenter began the test procedure.

In the Label condition, the experimenter began by announcing the novel word (e.g., "Let's find a dax."). In the No Label condition, the experimenter began by announcing "Let's find one.". The child was then presented with a pair of novel objects

(e.g., the garlic press and the honey dipper) and was allowed to manipulate these objects for approximately ten seconds. The experimenter then retrieved the objects and placed them out of the child's reach. The experimenter then directed *affective* attention to one object and *orienting* attention to the other object, one at a time. For affective attention, the experimenter picked up an object and announced "See this one, I like this one. Look, I like this, I like this one. Yes, I like this one. Here you go". While uttering these phrases, the experimenter brought the object up to her chest and slightly swung it back and forth as if she were hugging the object. She then allowed the child to play with the object for approximately five seconds. The experimenter then directed orienting attention to the other novel object (e.g., "See this one, look at this one. Look, look at this, look at this one. Yes, look at this one. Here you go."). While uttering these phrases, the experimenter held the object up in front of the child and slightly swung it back and forth. The order of presentation of attention type was counterbalanced within and across participants.

Next, the objects were again placed out of the child's reach, and the child was asked for the referent of a novel word (e.g., "Show me the dax.") in the Label condition and asked for "one" in the No Label condition (i.e., "Show me one."). The objects were then pushed back to the child so that he or she could show/give the experimenter an object. The request was repeated, if necessary, until the child distinctly chose an object (e.g., by pointing to it or giving it to the experimenter). While making this request, the experimenter was careful to look only at the child's face to avoid biasing the child's selection through nonverbal cues. Once the child chose an object, the experimenter said "Okay, let's try another one" and proceeded to the next trial. Note that no corrective

feedback was given during the testing procedure. This was repeated for a total of 4 trials, using a different pair of objects on each trial, with the order of presentation randomized across children. The objects were always presented in the same pairs (e.g., turkey baster and sink plunger) and the same novel label was requested with each pair (see Table 2). The experimenter recorded the child's choices after each test trial. A parent or guardian was then asked to complete the MacArthur Communicative Development Inventory (MCDI; Fenson et al., 1991), as a measure of the child's productive vocabulary. After the study was completed, the child was thanked and given a certificate and a prize (e.g., a toy).

Reliability Coding

In order to establish inter-rater reliability, 20% of the data (n=8) was coded a second time from the videotapes. The coder was blind to the hypotheses of the experiment, and all coding was done with the volume on the monitor turned off so that she didn't know if the child was in the Label or the No Label condition. The coder recorded which object the child picked on each of the four trials. Kappa was used to establish the level of agreement between the experimenter and the coder. Kappa is based on percent agreement (i.e., whether the experimenter and the coder both rated one participant as choosing the same object), with an additional correction for chance (Sattler, 1992). Thus, Kappa takes into consideration the probability of the raters agreeing purely by chance. The two raters were found to be in almost perfect agreement, with Kappas ranging from .5 (a disagreement on one trial out of four) to 1.0 with a mean of .94.

## Results

T-tests were conducted to compare age, productive vocabulary size, and percentage of nouns in total vocabulary (number of nouns/number of words in vocabulary x 100) of children in the Label and No Label conditions. This was done in order to establish whether the groups were similar, and thus allow the assumption that findings were not due to group differences on these factors. Children in the Label and No Label conditions did not differ significantly in age, $t(38) = 1.67$, $p > .10$; productive vocabulary size, $t(38) = .74$, $p > .10$; or, percentage of nouns in total vocabulary, $t(38) = -1.98$, $p > .05$ (See Table 3 for means). Thus, comparisons between conditions were considered acceptable.

### Object Choice Analyses

The aim of the first set of analyses was to examine whether infants were using affective attention or orienting attention to help them map the novel words onto the novel objects. It was hypothesized that children would be more likely to map the novel words onto the objects directed affective attention than the objects directed orienting attention because affective attention would be considered a more specific indicator of the experimenter's referential intent. The percentage of trials on which children chose the object that was directed affective attention and the object that was directed orienting attention was calculated for children in the Label and the No Label conditions. The mean percentage of choices of the objects that were directed affective attention was then compared to the level expected by chance alone (50%) using one-sample directional t-tests, in each condition. Children in the Label condition ($M = 48.75\%$, $SD = 29.77$) did not choose the object that received affective attention significantly more than would be

Table 3

Mean Age, Vocabulary Size, and Percentage of Nouns of Children in Label and No Label Conditions of Each Study

| | Label Condition | No Label condition |
|---|---|---|
| Study 1 | | |
| Age | 24.83 (.90) | 24.29 (1.11) |
| Vocabulary size | 341.20 (216.53) | 294.35 (184.46) |
| Percentage of Nouns | 59.96 (7.3) | 66.41 (12.61) |
| Study 2 | | |
| Age | 24.82 (.98) | 24.48 (1.23) |
| Vocabulary size | 346.00 (210.39) | 338.55 (229.64) |
| Percentage of Nouns | 61.61 (8.34) | 57.61 (9.5) |
| Study 3 | | |
| Age | 25.17 (.84) | 24.21 (1.02) |
| Vocabulary size | 284.35 (200.40) | 349.40 (137.12) |
| Percentage of Nouns | 59.15 (11.81) | 62.98 (9.74) |

Note. The standard deviations are in parentheses.

expected by chance, $t$ (19) = -.19, $p$ > .05. Similarly, children in the No Label condition ($M$ = 56.25%, $SD$ = 24.16) did not choose the object that received affective attention significantly more than would be expected by chance, $t$ (19) = 1.16, $p$ > .05. In addition, children in the Label and No Label conditions did not significantly differ in their mean percentage of choice of objects directed affective attention, $t$ (38) = -.87, $p$ > .10. These analyses indicate that children were not mapping the novel label to the object that was directed affective attention, contrary to my predictions. However, children in the No Label condition responded at chance levels as predicted.

Given that the experimenter announced her intention to find an object (i.e., using either a novel word or "one") and then directed attention to both objects, one at a time, children may have relied on temporal contiguity and simply chosen the object that the experimenter attended to or touched first. To rule out this possibility, a one-sample directional t-test was conducted comparing the number of objects chosen by the children that the experimenter first directed attention towards to chance levels (2). In the Label condition, the number of objects chosen by the children that the experimenter first directed attention towards ($M$ = 2.10, $SD$ = .85) did not differ from chance, $t$ (19) = .52, $p$ > .10. Thus, children did not simply map the novel word to the first novel object that that the experimenter attended to or touched. Similarly, in the No Label condition, the number of objects that the experimenter directed attention towards first, chosen by the children ($M$ = 2.0, $SD$ = .73) was at chance levels, $t$ (19) = .00, $p$ = 1.00. These results indicated that children were not simply using the strategy of always picking the first object the experimenter attended to or touched.

Strategy Analyses

In previous studies the experimenter has directed one type of socio-pragmatic cue at one novel object at one time and did not direct any socio-pragmatic cues towards the other objects (e.g., Akhtar et al., 1996; Baldwin, 1993; Tomasello & Barton, 1994). In contrast, in the present study, the experimenter directed a different cue to each of two novel objects. It is possible that children considered either cue as indicating the speaker's referential intent and thus may have used one cue or the other to map words onto objects. Therefore, in the next set of analyses, I examined children's consistency in using a particular type of attention to choose objects across trials in each condition. In particular, I examined whether children were making forced choice selections of objects based on a strategy (i.e., using the affective attention or orienting attention to determine the experimenter's intentionality) or choosing randomly between objects directed each type of attention. Children were classified according to their object choices: children who chose three or four of the four objects that were directed affective attention were classified as Affective Attention Choosers and those who chose three or four of the four objects that were directed orienting attention were classified as Orienting Attention Choosers. Children who did not meet these criteria were considered Random Choosers. See Table 4 for number of children classified as each type of Chooser in the Label and No Label conditions. First, using the binomial theorem, it was determined that the probability of any child being classified as an Affective Attention Chooser was 0.312, the probability of any child being classified as a Orienting Attention Chooser was 0.312, and the probability of being classified as a Random Chooser was .375. A 2 (Label, No Label) x 3 (Affective Attention Chooser, Orienting Attention Chooser and Random Chooser)

Table 4

Number of Each Type of Chooser in the Label and No Label Conditions in Each Study

| | Type of Strategy | Label Condition (n=20 per study) | No Label condition (n=20 per study) |
|---|---|---|---|
| Study 1 | Affective Attention | 8 | 6 |
| | Orienting Attention | 7 | 4 |
| | Random | 5 | 10 |
| Study 2 | Attention to Property | 8 | 5 |
| | Orienting Attention | 6 | 7 |
| | Random | 6 | 8 |
| Study 3 | Affective Attention | 5 | 9 |
| | Attention to Property | 7 | 5 |
| | Random | 8 | 6 |

cross-tabs analysis indicated that chooser type did not vary by condition, $\chi^2$ (2, N = 40) = 2.81 , p > .10. Thus, similar numbers of children were Affective Attention Choosers, Orienting Attention Choosers, and Random Choosers in the Label and No Label conditions, indicating that children were no more likely to use a strategy in choosing an object when in a word learning situation than when simply asked to choose an object.

The two types of Strategic Choosers were collapsed to explore whether Strategic choosers and Random choosers differed in productive vocabulary size, percentage of nouns in their vocabulary, or age, and independent t-tests were conducted. In the Label condition, children who were Strategic Choosers (M = 347.27, SD = 218.26) and Random Choosers (M = 323.00, SD = 235.41) did not differ significantly in productive vocabulary size, t (18) = -.21, p > .10. Similarly, children who were Strategic Choosers (M = 59.06, SD =7.22) and Random Choosers (M = 62.64, SD = 7.68), did not differ significantly in percentage of nouns in their vocabulary, t (18) = .94, p > .10. Furthermore, the Strategic Choosers (M = 24.61, SD = .82) and Random Choosers (M = 25.46, SD = .93), did not differ significantly in age, t (18) = 1.95, p >.05. The results were similar for the No Label condition. Children who were classified as Strategic Choosers (M = 258.00, SD = 155.99) did not differ on productive vocabulary size from children classified as Random Choosers (M = 330.70, SD = 211.10), t (18) = .88, p >.10. In addition, the mean age of Strategic Choosers (M = 24.26, SD = .77) and Random Choosers (M = 24.33, SD = 1.42), did not differ significantly, t (13.88) = .14, p >.10. Thus, in both the Label and No Label conditions, Strategic and Random Choosers do not differ on age or productive vocabulary. However, in the No Label condition Strategic

Choosers ($M$ = 72.48, $SD$ = 13.08) had a significantly higher percentage of nouns than Random Choosers ($M$ = 60.34, $SD$ = 9.08), $t$ (18) = -2.41, $p$ <.05.

A series of Oneway Analysis of Variance (ANOVA) were conducted to examine whether children who used the strategy of choosing mostly objects that were directed affective attention differed from children who used the strategy of choosing objects that were directed orienting attention or who were choosing randomly on age, productive vocabulary size, or percentage of nouns in vocabulary. No main effect of age was found in the Label Condition, $F$ (2, 17) = 1.81, $p$ > .10 (See means in Table 5). Similarly, no main effect of productive vocabulary size, $F$ (2, 17) = .86, $p$ > .10, or percentage of nouns in vocabulary, $F$ (2, 17) = .45, $p$ > .10, was found. In addition, there was no main effect of age in the No Label Condition, $F$ (2, 17) = .31, $p$ > .10 (See means in Table 5). There was also no main effect of productive vocabulary size, $F$ (2, 17) = .36, $p$ > .10, or percentage of nouns in vocabulary, $F$ (2, 17) = 3.08, $p$ > .05. Thus, age, productive vocabulary, and percentage of nouns in vocabulary did not affect which strategy children used.

Correlational Analyses

In the next set of analyses, I examined whether a child's age, percentage of nouns, or productive vocabulary size, might have influenced his or her use of either affective or orienting attention in choosing an object, using zero-order correlations (See Table 6). In the Label and the No Label conditions, the correlations between age and percentage of trials on which children chose the object that was directed affective attention were not significant. This finding indicates that there is no relation between age and children's decision to chose an object that has been directed affective or orienting attention.

Table 5

Mean Age, Vocabulary Size, and Percentage of Nouns of Children in Label and No Label Conditions of Study 1 Who Strategically Chose Objects Directed Affective Attention or Orienting Attention, or Chose Randomly

| | Age | Vocabulary Size | Percentage of Nouns |
|---|---|---|---|
| Label Condition | | | |
| Affective Attention (n=8) | 24.65 (.69) | 415.25 (210.73) | 58.63 (4.45) |
| Orienting Attention (n=7) | 24.56 (.99) | 269.57 (214.81) | 59.56 (9.89) |
| Random (n=5) | 25.46 (.93) | 323.00 (235.41) | 62.63 (7.68) |
| No Label Condition | | | |
| Affective Attention (n=6) | 24.49 (.55) | 258.33 (173.62) | 74.57 (16.74) |
| Orienting Attention (n=4) | 23.91 (.99) | 257.50 (150.86) | 69.35 (4.94) |
| Random (n=10) | 24.33 (1.41) | 330.70 (211.10) | 60.34 (9.08) |

Note. The standard deviations are in parentheses.

Table 6

Correlations Between the Percentage of Trials on Which Children Chose the Object that was Directed Affective Attention (Studies 1 and 3) or Attention to a Property (Study 2) and Age, Productive Vocabulary, and Percentage of Nouns in the Label and No Label Conditions

| | Label Condition | No Label Condition |
|---|---|---|
| Study 1 | | |
| Age | .01 | .16 |
| Vocabulary size | .02 | .20 |
| Percentage of Nouns | -.04 | .25 |
| Study 2 | | |
| Age | .03 | .00 |
| Vocabulary size | -.04 | .32 |
| Percentage of Nouns | -.07 | -.04 |
| Study 3 | | |
| Age | .25 | .13 |
| Vocabulary size | .17 | .03 |
| Percentage of Nouns | .40 | .03 |

Note. All p's > .05.

Additionally, the correlations between productive vocabulary and percentage of trials on which the children chose the object directed affective attention, and between percentage of nouns in vocabulary and percentage of trials on which the children chose the object directed affective attention were also not significant in the Label and No Label conditions. Thus, total productive vocabulary, and the composition of children's vocabularies, as measured by the percentage of nouns in total vocabulary does not seem to influence children's decision to chose an object that has been directed either affective or orienting attention.

First Trial Analyses

Recently, it has been argued that the first trial on language and cognitive tasks is the most sensitive and "pure" measure of children's responses (Diesendruck & Markson, 2000; Evey & Merriman, 1998). That is, children may have a fragile commitment to a rule or strategy and decision making on future trials may be mostly influenced by performance factors (e.g., experimenter's ambiguous acceptance of their answer on the first trial). In order to assess children's choices on the first trial, the number of children that chose objects that had been directed affective attention on the first trial was compared to the number of children who chose objects that were directed orienting attention on the first trial. In both the Label and No Label conditions of the present study, nine children chose the object that had been directed affective attention, and 11 children chose the object that had been directed orienting attention, $\chi^2$ (1, N = 40) = .00, $p > .10$. Thus, children were found to be using both types of attention as a strategy in mapping novel words to novel objects on the first trial.

Gender Analyses

Possible gender differences were also examined in the present studies. While some studies have suggested that females have an advantage over males in early language abilities (e.g., Fenson et al., 1994), previous research has not found any gender differences in children's ability to use socio-pragmatic cues to learn language (e.g., Akhtar et al., 1996). A number of analyses were conducted to rule out the possibility of any influence of gender in the present study. Independent t-tests were conducted to examine possible gender differences in: the percentage of trials on which children chose the object directed affective attention, productive vocabulary size, and composition of vocabulary as measured by the percentage of nouns in total vocabulary. In the Label condition, males ($M$ = 52.50, $SD$ = 29.93) and females ($M$ = 45.00, $SD$ = 30.73) did not differ significantly on the percentage of trials on which children chose the object directed affective attention, $t$ (18) = .55, $p$ >.10. Likewise, males ($M$ = 61.11, $SD$ = 28.26) and females ($M$ = 52.27, $SD$ = 20.78) in the No Label condition did not differ on the percentage of trials on which children chose the object directed affective attention, $t$ (18) = .81, $p$ >.10. In the Label condition, males' productive vocabulary ($M$ = 305.00, $SD$ = 210.74) and females' productive vocabulary ($M$ = 377.40, $SD$ = 227.29) were not significantly different, $t$ (18) = -.74, $p$ > .10. Likewise, in the No Label condition, males' productive vocabulary ($M$ = 274.67, $SD$ = 205.57) and females' productive vocabulary ($M$ = 310.45, $SD$ = 173.81) did not differ significantly, $t$ (18) = -.42, $p$ >.10. Additionally, in the Label condition, males' percentage of nouns in vocabulary ($M$ = 59.69, $SD$ = 9.01) and females' percentage of nouns in vocabulary ($M$ = 60.23, $SD$ = 5.60) were not significantly different, $t$ (18) = -.16, $p$ > .10. Furthermore, in the No Label

condition, males' percentage of nouns in vocabulary (M = 69.26, SD = 16.78) and females' percentage of nouns in vocabulary (M = 64.08, SD = 7.96) were not significantly different, $t$ (18) = .91, $p > .10$. Thus, as predicted, no gender differences were found in children's use of attentional cues to choose objects, or productive vocabulary size or composition. In an additional analysis, it was found that in the Label condition, a similar number of males (N = 7) and females (N = 8) were Strategic Choosers, $\chi^2$ (1, N = 20) = .27, $p > .10$. In the No Label condition, there was also a similar number of males (N = 6) and females (N = 4) that were Strategic Choosers, $\chi^2$ (1, N = 20) = 1.84, $p > .10$. These results suggest that there are no gender differences in children's use of a strategy in mapping words to objects and in choosing objects.

## Discussion

The purpose of Study 1 was to examine whether children would use attentional cues, specifically affective attention and/or orienting attention, as a cue to an adult speaker's referential intent. Novel objects were presented to children in one of two between-subjects conditions. In the Label condition, children heard a novel label announced at the beginning of the procedure (e.g. "Let's find a zav.") and were later asked for the referent of that novel label. In the No Label condition, no novel label was used throughout the procedure and instead children were asked for "one" of the objects. Four pairs of novel objects were presented to the children; the experimenter directed affective attention to one object of each pair and orienting attention to the other. The object choice of the children in each trial was examined.

Contrary to what was predicted, the mean percentage of choices of objects that were directed each of the attentional cues did not differ across conditions. Furthermore,

children did not choose the object directed affective attention or the object directed orienting attention at above chance levels when asked for the referent of a novel word. This finding suggests that children cannot use these attentional cues to understand the referential intent of a speaker in a word learning task. However, children were not simply relying on temporal contiguity cues to map words onto objects either, as they did not use the strategy of always picking the first object the experimenter directed attention towards.

Further examination of the data indicated that direct comparisons of percentage of choices of objects that were directed each type of attentional cue did not adequately reflect whether children can use these cues to map novel words to novel objects. In the present study, the experimenter directed two different attentional cues at two novel objects. Thus, it is possible that these two cues are equally useful to children in determining referential intent, and were competing against one other. Therefore, it is a possibility that children recognized these types of attention as cues to referential intent, and chose one or the other to help them identify the referent of a novel word. If some children were choosing the object directed affective attention as the referent, and others were choosing the object directed orienting attention, then when each type of attention is looked at separately, it would appear that children as a group were not choosing either at above chance levels. Thus, I examined whether children were mapping novel words to novel objects systematically, using either type of attention by classifying children based on their object choices across the four trials.

These analyses suggested that a similar number of children systematically chose objects that were directed affective and orienting attention and chose randomly between

objects in the Label condition and the No Label condition. These findings suggest that some children may use affective attention and others may use orienting attention strategically when choosing objects. However, it is difficult to establish whether children were using a strategy or a bias given their similar performance in the Label and No Label conditions.

A number of comparisons between children who used a strategy in choosing objects and those who chose randomly, indicated that these groups of children were similar in age, productive vocabulary size, and percentage of nouns in their vocabulary. Therefore, it appears that children's ability to use a strategy in choosing objects and mapping words to objects was not a function of age, productive vocabulary, or percentage of nouns in their vocabulary. However, in the No Label condition, children who consistently chose objects directed either affective or orienting attention had a higher percentage of nouns in their vocabulary than children who chose randomly between objects. It is possible that children with more nouns are object focused in their word learning strategies (as evidenced by a larger number of object words in vocabulary), and because the task is also object focused they apply a strategy to choose objects.

Another interesting question was whether children's age, productive vocabulary size, or composition of vocabulary, as measured by the percentage of nouns, influenced children's decision to choose an object that had been directed either affective or orienting attention. It was found that none of these factors influenced children's object choices. This finding indicates that children of different ages, with different sizes of productive vocabulary, or percentage of nouns in their vocabulary do not have an increased or decreased chance of choosing objects directed affective or orienting attention.

Researchers have previously suggested that children's behaviour on the first trial of a language task is an important measure of their responses (Diesendruck & Markson, 2000; Evey & Merriman, 1998). In the present study, children chose a similar number of objects that were directed orienting attention and that were directed affective attention on the first trial. This result is consistent with the findings that children used both orienting and affective attention when choosing objects and when mapping novel words onto novel objects.

While previous research has suggested that females have an advantage over males in early language abilities (e.g., Fenson et al., 1994), the gender differences found have been quite small, and variables between sex have been found to account for more of the variability (e.g., age). Additionally, previous research has not found any gender differences in children's ability to use socio-pragmatic cues to learn language (e.g., Akhtar et al., 1996). Consistent with previous research (e.g., Akhtar et al., 1996; Fenson et al., 1994), no gender differences were found in the percentage of trials on which children chose objects directed affective attention, productive vocabulary size, or percentage of nouns in total vocabulary. Additionally, an equal number of males and females were found to use a strategy in choosing objects.

To summarize, the results of Study 1 provide preliminary evidence that children can use both affective and orienting attention cues to help them map words onto objects. In addition, the results indicate that children may choose to focus on either affective attention or orienting attention as a strategy for understanding the speaker's referential intent. Furthermore, children's ability to be strategic in choosing objects was not a function of age, productive vocabulary size, or percentage of nouns in their total

vocabulary. Study 2 was conducted to examine if children map words to objects in a similar manner to Study 1, when objects are directed attention to a property in contrast to when objects are directed orienting attention.

## Study 2

The goal of Study 2 was to examine whether children would use attention to a property or orienting attention to map novel words onto novel objects when these two types of attention were pitted against one another. As in Study 1, there was a Label condition, and a No Label control condition. It was predicted that children in the Label condition would map the novel label onto the object given a property because they would use this more specific attention as a stronger sign of referential intent. Children in the No Label condition were expected to respond randomly when choosing between the objects, as they would not be looking for a speaker's referential intent.

### Method

#### Participants

Participants were 40 two-year-olds randomly assigned to one of two conditions. There were 20 participants in the Label condition (mean age = 24.82 months, SD= .98, range = 23.10 to 26.13 months, 10 males, 10 females), and 20 participants in the No Label condition (mean age = 24.48 months, SD= 1.23, range = 22.26 to 26.76 months, 9 males, 11 females). Children were tested individually in either the lab (n =38) or their daycare (n = 2). Parents of the children were recruited as in Study 1. Three additional children were tested but were excluded from the sample for the following reasons: did not complete procedure due to fussiness (n=2), and experimenter error (n=1).

Materials

Stimuli. These were identical to those used in Study 1.

Equipment. This was identical to that used in Study 1.

Procedure

The procedure for the practice trials was identical to that used in Study 1. In this study, only four children needed corrective feedback on one trial. The procedure for the word-mapping task was identical to that in Study 1 with one exception: the experimenter directed attention to the *property* of one object and *orienting* attention to the other object, one at a time. While demonstrating a property of an object, the experimenter described the property verbally (e.g., See this one, you can roll this one. Look, you can roll this, you can roll this one. Yes, you can roll this one. Here you go"). Property descriptions for each of the unfamiliar objects are presented in Table 2. While describing the property verbally, the experimenter held the object in front of the child and demonstrated the property.

Reliability Coding

In order to establish inter-rater reliability, approximately 20% of the data (n=7) was coded a second time by a coder blind to the experimental hypotheses. The coding was conducted as in Study 1. Inter-rater reliability was calculated using Kappa as in Study 1. The experimenter and coder were found to be in perfect agreement, with all Kappas equal to 1.00.

## Results

Age, productive vocabulary size, and percentage of nouns in total vocabulary of children were compared across conditions in order to establish whether the groups were

similar, and thus allow the assumption that findings were not due simply to group differences on these variables. Children in the Label and No Label conditions did not differ significantly in age, $t$ (38) = .98, $p$ >.10; productive vocabulary, $t$ (38) = .11, $p$ > .10; and, percentage of nouns, $t$ (38) = 1.42, $p$ > .10 (See Table 3 for means). Thus, comparisons between conditions were considered acceptable.

Object Choice Analyses

The aim of the first set of analyses was to examine whether children were using attention to a property or orienting attention to help them map novel words to the novel objects. It was hypothesized that children would map the novel words onto the objects that had been directed attention to a property because a property is more specific to the object and may consequently indicate a stronger referential intent. The percentage of trials on which children chose the object directed attention to the property of the object and the object directed orienting attention was calculated for both the Label condition and the No Label condition. The mean percentage of choice of objects directed attention to a property was then compared to the level expected by chance alone (50%) using one-sample directional t-tests, in each condition. Children in the Label condition ($M$ = 50%, $SD$ = 29.25) did not choose the object that received attention to a property significantly more than would be expected by chance (no statistic computed). Similarly, children in the No Label condition ($M$ = 47.5%, $SD$ = 19.70) did not choose the object that received attention to a property significantly more than would be expected by chance, $t$ (19) = -.57, $p$ > .05. Additionally, children in the Label and the No Label conditions did not significantly differ in their percentage of choice of objects that were directed attention to a property, $t$ (38) = .32, $p$ > .10. Thus, children did not appear to be choosing the object

that was directed attention to a property more than would be expected by chance regardless of condition. Thus, the hypothesis that children in the Label condition would map the novel label to the object that was directed attention to a property at above chance levels was not confirmed. However, children in the No Label condition responded at chance levels as predicted.

A possible strategy that children may have chosen, given that attention was directed to both objects, was to pick the object that the experimenter first attended to or touched. To examine this possibility, a one-sample directional t-test was conducted comparing the number of objects chosen by the children that the experimenter first directed attention towards against chance levels (2). In the Label condition, children chose objects that the experimenter directed attention towards first ($M = 2.20$, $SD = .95$) at chance levels, $t\ (19) = .94$, $p > .10$. Similarly, in the No Label condition, the number of objects that the experimenter directed attention towards first, chosen by the children ($M = 2.0$, $SD = 1.03$) did not differ from chance, $t\ (19) = .00$, $p = 1.00$. Thus, children did not simply map the novel word to the first novel object that that the experimenter directed attention towards or always choose the first novel object attended to by the experimenter.

Strategy Analyses

In the next set of analyses, I examined children's consistency in choosing particular objects across trials in each condition. Specifically, I examined whether children were making forced choice selections of objects based on a strategy (i.e., using attention to property or orienting attention to determine the experimenter's intentionality) or choosing objects randomly. Children were classified according to their object choices: children who chose three or four of the four objects that were directed attention to a

property were classified as Property Choosers and those who chose three or four of the four objects that were directed orienting attention were classified as Orienting Attention Choosers. Children who did not meet this criteria were considered Random Choosers. See Table 4 for number of children classified as each type of Chooser in the Label and No Label conditions. A 2x3 crosstabs analysis (as in Study 1) indicated that there was a similar number of Property, Orienting Attention, and Random Choosers, $\chi^2$ (2, N = 40) = 1.06 , $p > .10$ in both the Label and No Label conditions. Thus, while some children may be using a strategy to choose between objects, the same number of children are choosing randomly and there is no difference across conditions.

In additional analyses, independent t-tests were conducted examining whether children classified as Strategic Choosers (collapsed across types) or as Random Choosers differed on productive vocabulary size, age, and percentage of nouns. In the Label condition, the productive vocabulary size of children classified as Strategic Choosers ($M$ = 366.57, $SD$ = 218.95) did not differ significantly from that of the Random Choosers ($M$ = 298.00, $SD$ = 199.04), $t$ (18) = -.66, $p > .10$. Additionally, the age of children classified as Strategic Choosers ($M$ = 24.93, $SD$ = 1.05) was not significantly different from the age of Random Choosers ($M$ = 24.57, $SD$ = .82), $t$ (18) = -.76, $p > .10$. Furthermore, the percentage of nouns in vocabulary for Strategic Choosers ($M$ = 60.84, $SD$ = 4.89) was not significantly different from the percentage of nouns of Random Choosers ($M$ = 63.42, $SD$ = 14.02), $t$ (5.53) = .44, $p > .10$. In the No Label condition, children classified as Strategic Choosers ($M$ = 444.00, $SD$ = 207.90) had a significantly higher mean productive vocabulary size than Random Choosers ($M$ = 180.38, $SD$ = 166.00), $t$ (18) = -3.00, $p < .01$. Additionally, children classified as Strategic Choosers ($M$ = 24.99, $SD$ =

.79) had a significantly higher mean age than Random Choosers ($M$ = 23.71, $SD$ = 1.41), $t$ (18) = -2.61, $p$ < .05. However, the percentage of nouns in vocabulary of Strategic Choosers ($M$ = 57.06, $SD$ = 9.24) was not significantly different from the percentage of nouns of Random Choosers ($M$ = 58.43, $SD$ = 10.47), $t$ (18) = .31, $p$ > .10.

A series of Oneway Analysis of Variance (ANOVA) was also conducted to examine whether children who used the strategy of choosing mostly objects that were directed attention to a property differed from children who used the strategy of choosing objects that were directed orienting attention or who were choosing randomly on age, productive vocabulary, or percentage of nouns in vocabulary (See means in Table 7). No main effect of age was found in the Label condition, $F$ (2, 17) = .39, $p$ > .10. There was also no main effect of productive vocabulary size, $F$ (2, 17) = .34, $p$ > .10. Finally, there was no main effect of percentage of nouns in vocabulary, $F$ (2, 17) = .18, $p$ > .10. Thus, age, productive vocabulary, and percentage of nouns in vocabulary did not effect which strategy children used in mapping novel words to objects. In addition, there were no main effects of age, $F$ (2, 17) = 3.27, $p$ > .05, or percentage of nouns in vocabulary $F$ (2, 17) = .07, $p$ > .10, in the No Label condition. However, there was a main effect of productive vocabulary in the No Label condition, $F$ (2, 17) = 7.88, $p$ < .01. A priori contrasts were conducted to determine where the difference lay. The productive vocabulary of children who strategically chose the object that was directed attention to a property was significantly higher than both children who chose the object directed orienting attention and children who chose randomly, $t$ (17) = 2.20, $p$ < .05, and $t$ (17) = 3.96, $p$ < .005, respectively. Therefore, it appears that children who have a higher

Table 7

Mean Age, Vocabulary Size, and Percentage of Nouns of Children in Label and No Label Conditions of Study 2 Who Strategically Chose Objects Directed Attention to a Property or Orienting Attention, or Chose Randomly

| | Age | Vocabulary Size | Percentage of Nouns |
|---|---|---|---|
| Label Condition | | | |
| Attention to a Property (n=8) | 25.04 (1.14) | 340.75 (218.66) | 60.83 (5.51) |
| Orienting Attention (n=6) | 24.79 (.99) | 401.00 (234.98) | 60.85 (4.44) |
| Random (n=6) | 24.57 (.82) | 298.00 (199.04) | 63.42 (14.02) |
| No Label Condition | | | |
| Attention to a Property (n=5) | 25.09 (.62) | 575.60 (118.79) | 56.38 (7.34) |
| Orienting Attention (n=7) | 24.92 (.94) | 350.00 (212.35) | 57.54 (10.94) |
| Random (n=8) | 23.71 (1.41) | 180.38 (166.00) | 58.43 (10.47) |

Note. The standard deviations are in parentheses.

productive vocabulary are more likely to use the strategy of choosing objects that were directed attention to a property.

Correlational Analyses

In the next set of analyses, a number of zero-order correlations examining the influence of age, productive vocabulary size, and percentage of nouns in vocabulary on choice of object that was directed either attention to a property or orienting attention were conducted (See Table 6 for correlations). In the Label condition and the No Label condition, the correlations between percentage of trials on which children chose the object directed attention to the property and age, productive vocabulary size, and percentage of nouns in vocabulary were not significant. Therefore, it appears that age, productive vocabulary, and percentage of nouns do not influence children's choice of object in either condition.

First Trial Analyses

Children's responses on the first trial were examined, as the first trial has been said to be a more sensitive measure of children's ability to use rules or strategies on language and cognitive tasks (Evey & Merriman, 1998). In the Label condition, eight children chose the object that had been directed attention to a property, and 12 children chose the object that had been directed orienting attention. Similarly, in the No Label condition, nine children chose the object that had been directed attention to a property, and 11 children chose the object that had been directed orienting attention. A chi-square analysis indicated that children were not using one type of attention over the other to choose objects on the first trial, $\chi^2$ (1, N = 40) = .10, $p > .10$. Thus, children used both types of attention as a strategy to choose objects on the first trial.

Gender Analyses

In the final set of analyses, a number of independent t-tests were conducted to examine possible gender differences on a number of factors, including the percentage of trials on which children chose the object directed attention to a property, productive vocabulary size, and vocabulary composition, as measured by the percentage of nouns in total vocabulary. Based on previous research (e.g., Fenson et al., 1994), it was predicted that there would be a small or no female advantage. This prediction was confirmed. In the Label condition, males ($M$ = 47.50, $SD$ = 29.93) and females ($M$ = 52.50, $SD$ =2 9.93) did not differ on the percentage of trials on which children chose the object that was directed attention to a property, $t$ (18) = -.37, $p$ > .10. Similarly, in the No Label condition, males ($M$ = 41.67, $SD$ = 21.65) and females ($M$ = 52.27, $SD$ = 17.52) did not differ on the percentage of trials on which children chose the object directed attention to a property, $t$ (18) = -1.21, $p$ > .10. In the Label condition, males' productive vocabulary ($M$ = 270.00, $SD$ = 223.63) and females' productive vocabulary ($M$ = 422.00, $SD$ = 174.94) were not significantly different, $t$ (18) = -.1.69, $p$ > .10. Likewise, in the No Label condition, males' productive vocabulary ($M$ = 364.89, $SD$ = 275.39) and females' productive vocabulary ($M$ = 317.00, $SD$ = 195.92) were not significantly different, $t$ (18) = .45, $p$ > .10. Additionally, in the Label condition, males' percentage of nouns ($M$ = 61.92, $SD$ = 5.65) and females' percentage of nouns in vocabulary ($M$ = 61.31, $SD$ = 10.71) were not significantly different, $t$ (18) = .16, $p$ > .10. Furthermore, in the No Label condition, males' percentage of nouns in vocabulary ($M$ = 53.68, $SD$ = 10.38) and females' percentage of nouns in vocabulary ($M$ = 60.82, $SD$ = 7.75) were not significantly different, $t$ (18) = -1.76, $p$ > .05. These results indicate that there are no

gender differences in percentage of trials on which children chose the object directed attention to a property, and productive vocabulary size and composition. In an additional analysis, it was found that in the Label condition, an equal number of males (N = 7) and females (N = 7) were Strategic Choosers, $\chi^2$ (1, N = 20) = .00, p > .10. In the No Label condition, a similar number of males (N = 7) and females (N = 5) were Strategic Choosers, $\chi^2$ (1, N = 20) = 2.22, p > .10. Again, these results suggest that males and females do not differ in their use of a strategy in mapping words to objects and in choosing objects.

## Discussion

The goal of Study 2 was to examine whether children would use attention directed to a property of an object and/or orienting attention to help them map novel words to novel objects. As in Study 1, there were two between-subjects conditions: Label and No Label. In each condition, four pairs of novel objects were presented to the children and one object in each pair was directed attention to a property while the other object was directed orienting attention.

The hypothesis that children would use attention to a property as a cue in mapping words onto objects was not confirmed. In fact, children did not choose objects directed attention to a property or orienting attention at above chance levels when asked for the referent of a novel word. Similarly, children did not choose objects directed these types of attention at above chance levels in the No Label condition. Therefore, it appears that children cannot use these types of attention to help them understand adult's referential intent. The children, however, were not relying on simple associative cues such as

temporal contiguity either, as children were not simply choosing the first object that the experimenter directed attention towards.

As in Study 1, it is possible that these results did not adequately reflect children's ability to use attentional cues to map novel words to novel objects. Again, the experimenter directed two different types of attentional cues to two novel objects and children may have seen these cues as equally referential. The children were equally likely to use attention to a property as a strategy, orienting attention as a strategy, or choose randomly.

A number of comparisons in the Label condition between children who used a strategy in choosing objects and those who chose randomly, suggested that these two groups of children were similar in age, productive vocabulary size, and percentage of nouns in their vocabulary. This finding indicates that children's ability to use a strategy when mapping words onto objects was not a function of these factors. However, in the No Label condition, children who strategically chose objects directed either attention to a property or orienting attention had a higher productive vocabulary size and were older than children who chose randomly between objects. Additionally, children who were using the strategy of choosing objects that were directed attention to a property had higher productive vocabularies than children who either chose objects that were directed orienting attention or those who chose randomly. Perhaps, in this condition, children who had more experience with language learning found it easier to use these attentional cues, and in particular attention to a property, to help them choose objects. In addition, findings indicated that as children get older, they are more likely to be using a strategy in choosing objects.

Also interesting, is whether children's age, productive vocabulary size, or composition of vocabulary, as measured by their percentage of nouns, can have an influence on children's decision to chose an object that has been directed either attention to a property or orienting attention. In the present study, none of these factors had an influence on children's object choices.

Consistent with Study 1, no gender differences were found in the percentage of trials on which children chose objects directed attention to a property, productive vocabulary size, or percentage of nouns in total vocabulary, or in the number of male and female Strategic Choosers. Again, this finding is not surprising given that the advantage for girls typically accounts for only 1 to 2% of the variance in language (Fenson et al, 1994).

To summarize, the results of Study 2 indicated that children performed similarly in the Label and No Label conditions, suggesting that children did not use attention to a property and orienting attention cues to help them map words onto objects. However, some children chose to focus on either attention to a property or orienting attention when choosing objects. Thus, some children may have been using a strategy or had some bias or preference for a certain type of attentional cue. Study 3 was conducted to examine if children map words to objects in a similar manner when objects are directed attention to a property in contrast to when objects are directed affective attention.

## Study 3

The goal of Study 3 was to examine whether children would use attention to a property or affecitve attention to map novel words onto novel objects when these two types of attention were contrasted with one another. As in Studies 1 and 2, there was a

Label condition, and a No Label control condition. It was predicted that children in the Label condition would map the novel label onto the object that was directed affective attention because they would consider this type of attention as more personal to the experimenter and therefore as a stronger sign of referential intent. Children in the No Label condition were expected to respond randomly when choosing between the objects, as they would not be looking for a speaker's referential intent.

## Method

### Participants

Participants were 40 two-year-olds randomly assigned to one of two conditions. There were 20 participants in the Label condition (mean age = 25.17 months, SD= .84, range = 22.90 to 26.36 months, 10 males, 10 females), and 20 participants in the No Label condition (mean age = 24.21 months, SD= 1.02, range = 22.50 to 25.96 months, 9 males, 11 females). Children were tested individually in either the lab (n =38) or their daycare (n= 2). Parents of the children were recruited as mentioned above in Study 1. Four additional children were tested but were excluded from the sample for the following reasons: experimenter error (n=3), and missing MCDI (n=1).

### Materials.

Stimuli. These were identical to those used in Study 1.

Equipment. This was identical to that used in Study 1.

### Procedure

The procedure of the practice task was identical to Study 1, and two children needed to receive corrective feedback on one trial. The procedure of the word-mapping task was identical to that in Study 1 with one exception: the experimenter directed

attention to the *property* of one object and *affective* attention to the other object, one at a time.

Reliability Coding

In order to establish inter-rater reliability, approximately 20% of the data (n=9) was coded a second time by a coder blind to the experimental hypotheses. The coding was conducted as in Study 1. Inter-rater reliability was calculated using Kappa as in Study 1. The experimenter and coder were found to be in perfect agreement, with all Kappas equal to 1.00.

## Results

T-tests were conducted to compare age, productive vocabulary size, and percentage of nouns in total vocabulary (number of nouns/number of words in vocabulary x 100) of the children in the Label and No Label conditions to establish that the groups were similar and thus findings could not be attributed to a difference in group composition. Children in the Label and No Label conditions did not differ significantly in productive vocabulary size, $t$ (33.59) = -1.20, $p > .10$; and, percentage of nouns, $t$ (38) = -1.12, $p > .10$ (See Table 3 for means). There was a statistically significant difference in the children's age, $t$ (38) = 3.26, $p < .01$ (See Table 3 for means). However, this difference was not considered substantial because the difference between the means was only one month of age, and the standard deviations were quite small. Thus, comparisons between conditions were considered acceptable.

Object Choice Analyses

The aim of the first set of analyses was to examine whether infants were using attention to a property or affective attention to help them map novel words to the novel

objects. The percentage of trials on which children chose the object directed affective attention and the object directed attention to a property of the object was calculated for both the Label condition and the No Label condition. The mean percentage of choice of objects directed affective attention was then compared to the level expected by chance alone (50%) using one-sample directional t-tests, in each condition. Children in the Label condition ($M$ = 46.25%, $SD$ = 26.00) did not choose the object that received affective attention significantly more than would be expected by chance, $t$ (19) = -.645, $p$ > .05. Similarly, children in the No Label condition ($M$ = 56.25%, $SD$ = 22.76) did not choose the object that received affective attention significantly more than would be expected by chance, $t$ (19) = 1.157, $p$ > .05. In addition, children in the Label and No Label conditions did not significantly differ in the percentage of choice of objects that were directed affective attention, $t$ (38) = -1.29, $p$ > .10. Thus, it seems as though children are not choosing the object directed affective attention more than would be expected by chance regardless of condition. The present results indicate that children in the Label condition, as a group, did not map the novel label to the object directed affective attention at above chance levels, as hypothesized. However, the prediction that children in the No Label condition would respond at chance levels was confirmed.

As in the previous studies, children may have used the strategy of picking the object that the experimenter first attended to or touched. Thus, a one-sample directional t-test was conducted comparing the number of objects chosen by the children that the experimenter first directed attention towards against chance levels. In the Label condition, children chose the object that the experimenter first directed attention towards ($M$ = 2.40, $SD$ = .94) at chance levels, $t$ (19) = 1.90, $p$ > .05. However, in the No Label

condition, the number of objects that the experimenter directed attention towards first, chosen by the children ($M = 2.55$, $SD = 1.00$) was greater than chance levels, $t(19) = 2.47$, $p < .05$. Thus, children in this condition were more likely to use the strategy of picking the first object that the experimenter first directed attention towards.

Strategy Analyses

In the next set of analyses, children's consistency in choosing particular objects across trials in each condition was examined. Specifically, I examined whether children were making forced choice selections of objects based on a strategy (i.e., using attention to property or affective attention to determine the experimenter's intentionality) or choosing between objects randomly. Children were classified according to their object choices: children who chose three or four of the four objects that were directed affective attention were classified as Affective Attention Choosers, and those who chose attention to a property were classified as Property Choosers. The remaining children were classified as Random Choosers. See Table 4 for number of children classified as each type of chooser in the Label and No Label conditions. A 2x3 cross-tabs analysis (similar to Studies 1 and2) indicated that there was a similar number of Affective Attention, Property, and Random Choosers in both conditions, $\chi^2(2, N = 40) = 1.76$, $p > .10$. These findings suggest, that some children may be using a strategy to choose between objects and to map the novel words onto the novel objects, however, the same number of children are choosing randomly, and there is no difference across conditions.

As in Study 1 and 2, independent t-tests were conducted examining whether Strategic Choosers (collapsed across types) and Random Choosers differed on productive vocabulary size, age, and percentage of nouns in vocabulary. In the Label condition,

Strategic Choosers (M = 284.50, SD = 214.42) and Random Choosers (M = 284.13, SD = 191.74), did not significantly differ on productive vocabulary size, t (18) =0 , p > .10. Additionally, children classified as Strategic Choosers (M = 25.30, SD = .80) did not differ in age from children classified as Random Choosers (M = 24.98, SD = .91), t (18) = -.83, p > .10. Furthermore, Strategic Choosers (M = 56.67, SD = 13.39) and Random Choosers (M = 62.88, SD=8.39), did not differ significantly on percentage of nouns in vocabulary, t (18) = 1.16, p >.10. Similarly, for the No Label condition, Strategic Choosers (M = 369.71, SD = 121.11) and Random Choosers (M = 302.00, SD = 171.65) did not differ on productive vocabulary size, t (18) = -1.01, p > .10. Also, the age of Strategic Choosers (M = 24.35, SD = .96) was not significantly different from the age of Random Choosers (M = 23.87, SD = 1.16), t (18) = -.98, p > .10. In addition, the percentage of nouns in vocabulary of Strategic Choosers (M = 64.23, SD = 10.16) and Random Choosers (M = 60.05, SD = 8.80), did not differ significantly, t (18) = -.88, p > .10. Thus, in both the Label and No Label conditions, Strategic and Random Choosers do not differ on age, productive vocabulary, or percentage of nouns.

To examine whether children who used the strategy of choosing mostly objects that were directed affective attention differed from children who used the strategy of choosing objects that were directed attention to a property or who were choosing randomly on age, productive vocabulary, or percentage of nouns in vocabulary, a series of Oneway Analysis of Variance (ANOVA) was conducted (See means in Table 8). There was no main effect of age in the Label Condition, F (2, 17) = .98, p > .10. Similarly, there was no main effect of productive vocabulary size, F (2, 17) = .01, p > .10, or percentage of nouns in vocabulary, F (2, 17) = 1.31, p > .10. In addition, in the

Table 8

Mean Age, Vocabulary Size, and Percentage of Nouns of Children in Label and No Label Conditions of Study 3 Who Strategically Chose Objects Directed Attention to a Property or Affective Attention, or Chose Randomly

| | Age | Vocabulary Size | Percentage of Nouns |
|---|---|---|---|
| Label Condition | | | |
| Attention to a Property (n=7) | 25.07 (.62) | 289.57 (212.16) | 53.51 (14.06) |
| Affective Attention (n=5) | 25.62 (.98) | 277.40 (242.51) | 61.10 (12.43) |
| Random (n=8) | 24.98 (.91) | 284.13 (191.74) | 62.87 (8.39) |
| No Label Condition | | | |
| Attention to a Property (n=5) | 24.21 (1.29) | 360.40 (144.20) | 65.13 (14.37) |
| Affective Attention (n=9) | 24.43 (.81) | 374.89 (115.56) | 63.73 (7.98) |
| Random (n=6) | 23.87 (1.16) | 302.00 (171.65) | 60.05 (8.80) |

Note. The standard deviations are in parentheses.

No Label Condition, there was no main effect of age, $F(2, 17) = .53$, $p > .10$, productive vocabulary size, $F(2, 17) = .50$, $p > .10$, or percentage of nouns in vocabulary, $F(2, 17) = .40$, $p > .10$. Thus, age, productive vocabulary, and percentage of nouns in vocabulary did not affect which strategy children used in choosing objects.

Correlational Analyses

Next, a number of zero-order correlations were conducted, as in the previous studies, to examine the influence of age, productive vocabulary size, and percentage of nouns on choice of objects. In the Label condition and the No Label condition, the correlations between the percentage of trials on which children chose the object that was directed affective attention and age were not significant. Likewise, the correlations between the percentage of trials on which the children chose the object that was directed affective attention and productive vocabulary were also not significant for both the Label and No Label condition. Therefore, as in the previous studies age and productive vocabulary did not influence children's choice of object. However, in the Label condition, the correlation between percentage of nouns in total vocabulary and percentage of trials on which children chose the object that was directed affective attention was marginally significant ($p = .08$). Thus, as children's percentage of nouns increased, they were more likely to choose the object that was directed affective attention. In the No Label condition, the correlation between percentage of trials on which children chose the object that was directed affective attention and percentage of nouns in vocabulary was not significant. These findings indicate that the percentage of nouns children have may influence their choice of object when it has been directed affective attention and they are asked to map novel labels to novel objects.

First Trial Analyses

As in the previous studies, children's responses on the first trial were analyzed to obtain a more sensitive examination of children's use of attentional cues. In the Label condition, 9 children chose the object that had been directed attention to a property, and 11 children chose the object that had been directed affective attention. Similarly, in the No Label condition, eight children chose the object that had been directed attention to a property, and 12 children chose the object that had been directed affective attention. A chi-square analysis indicated that children were not using one type of attention over the other to choose objects on the first trial, $\chi^2$ (1, N = 40) = .10, $p > .10$. Thus, children again used both types of attention as a strategy to choose objects on the first trial.

Gender Analyses

Similar to the previous studies, a number of independent t-tests were conducted to examine possible gender differences in language ability. A number of factors were examined including: the percentage of trials on which children chose the object directed affective attention, productive vocabulary size, and composition of vocabulary as measured by the percentage of nouns in total vocabulary. The prediction that there would be small or no gender differences was confirmed. In the Label condition, males ($M$ = 52.50, $SD$ = 29.93) and females ($M$ = 40.00, $SD$ = 21.08) did not differ on the percentage of trials on which children chose the object directed affective attention, $t$ (18) = 1.08, $p > .10$. Similarly, males ($M$ = 52.78, $SD$ = 23.20) and females ($M$ = 59.09, $SD$ = 23.11) in the No Label condition did not differ on the percentage of trials on which children chose the object directed affective attention, $t$ (18) = -.61, $p > .10$. In the Label condition, males' productive vocabulary ($M$ = 309.50, $SD$ = 208.63) and females' productive

vocabulary (M = 259.20, SD = 199.63) were not significantly different, $t$ (18) = .55, $p$ > .10. Likewise, in the No Label condition, males' productive vocabulary (M = 404.78, SD = 147.80) and females' productive vocabulary (M = 304.09, SD = 115.03) were not significantly different, $t$ (18) = 1.72, $p$ > .10. Additionally, in the Label condition, males' percentage of nouns in vocabulary (M = 56.09, SD = 12.96) and females' percentage of nouns in vocabulary (M = 62.21, SD = 10.27) were not significantly different, $t$ (18) = -1.17, $p$ > .10. Furthermore, in the No Label condition, males' percentage of nouns in vocabulary (M = 59.83, SD = 6.21) and females' percentage of nouns in vocabulary (M = 65.55, SD = 11.54) were not significantly different, $t$ (18) = -1.33, $p$ > .10. These results indicate that there are no gender differences in percentage of trials on which children chose the object that was directed affective attention, and productive vocabulary size and composition. In an additional analysis, it was found that in the Label condition, a similar number of males (N = 7) and females (N = 5) were Strategic Choosers, $\chi^2$ (1, N = 20) = .84, p > .10. Similarly, in the No Label condition, a similar number of males (N = 7) and females (N = 7) were Strategic Choosers, $\chi^2$ (1, N = 20) = .48, p > .10. These results, again, suggest that there are no gender differences in children's use of a strategy in mapping words to objects and in choosing objects.

## Discussion

The purpose of Study 3 was to examine whether children would use affective attention and/or attention to a property to help them map novel words to novel objects. As in Studies 1 and 2, there was a Label and a No Label condition. Four pairs of novel objects were presented to the children, and one object of each pair was directed affective

attention, while the other object was directed attention to a property. The children's object choice in each trial was examined.

Unexpectedly, children did not choose the object directed affective attention at above chance levels when asked for the referent of a novel word. Therefore, it appears that children cannot use these attentional cues to help them understand the speaker's referential intent in a word learning task. While children in the Label condition did not appear to rely on temporal contiguity in choosing objects, children in the No Label condition were choosing objects that the experimenter first directed attention towards. Additionally, as in Studies 1 and 2, these results do not adequately reflect children's ability to use these cues in mapping novel words to novel objects. Like the previous studies, this study directed two different attentional cues at two different novel objects and thus put these cues in competition with one another. It is possible that the children saw both of these cues as indicators of referential intent and chose one or the other to help them map the novel word to an object. The important question is whether children used one type of attention consistently.

As in the previous studies, children were divided into three groups: a group of those who consistently used attention to a property as a strategy to choose objects, those who consistently used affective attention as a strategy to choose objects and, a group of children who chose randomly between the objects. The findings indicated that a similar number of children were strategically choosing objects that were directed either attention to a property or affective attention and choosing randomly in both the Label and No Label conditions. Additionally, children's performance on the first trial of the task indicated that children were using both types of attentional cues to chose objects.

Because a similar number of children were using a strategy or choosing randomly, and because children performed similarly in both the Label condition and the No Label control, it cannot be concluded that children were able to identify the experimenter's referential intent. However, some children may have had a preference for certain cues, or regarded a certain type of cue as more salient than the other.

Comparisons between children who consistently chose objects directed either attention to a property or affective attention and children who chose randomly indicated that these children were similar in age, productive vocabulary size, and percentage of nouns in their vocabulary. Therefore, children's ability to use a strategy in choosing objects and mapping words to objects could not have been a function of these factors. Similarly, children's age and productive vocabulary size did not have an influence on children's decision to chose an object that had been directed either attention to a property or affective attention. However, in the Label condition, as children's percentage of nouns in their vocabulary increased the greater the percentage of objects directed affective attention that were chosen. Perhaps, as children obtain a greater percentage of nouns in their vocabulary, the more they see affective attention as implying more intentionality than attention to a property. This in turn may cause children to chose the object directed affective attention as the referent of a novel label.

Like Studies 1 and 2, no gender differences were found in the percentage of trials on which children chose objects directed affective attention, productive vocabulary size, or percentage of nouns in total vocabulary. Again, this finding is consistent with previous research (Fenson et al, 1994).

To summarize, the results of Study 3 indicate that the children in this study use attentional cues similarly in the Label and No Label conditions. Thus, these children may not be able to use these cues to identify the speaker's referential intent, and instead may choose objects based on increased salience. However, some children consistently choose either attention to a property or orienting attention as a strategy for choosing objects, indicating that they either considered one type of attention more salient, or continued with one strategy because the experimenter had not indicated that they were wrong on the first trial.

Cross-Study Analyses

Because the stimuli, procedure, and experimenter were the same across all three studies, and children were drawn from the same population, a number of analyses were conducted across the studies. Analyses across studies, increased the number of subjects per analysis, and thus increased the power of the analyses. Thus, children's abilities to use attentional cues in mapping novel words to novel objects could be examined on a larger scale. With all three studies considered together, comparisons revealed that children in the Label and No Label conditions did not differ significantly in productive vocabulary size ($M$ = 323.85, $SD$ = 207.57, $M$ =3 27.43, $SD$ = 185.93, respectively), $t$ (118) = -.10, $p > .10$, and percentage of nouns ($M$ = 60.24, $SD$ = 9.25, $M$ = 62.33, $SD$ = 11.14, respectively), $t$ (118) = -1.12, $p > .10$ across the studies. The children's mean age ($M$ = 24.94, $SD$ = .91, $M$ = 24.33, $SD$ = 1.11, respectively) was statistically different, $t$ (118) = 3.32, $p < .005$, however the difference was not considered substantial, as the difference was not even one month of age and the standard deviations were quite low.

Therefore, the two groups were considered similar and comparisons across conditions were considered acceptable.

Object Choice Analyses.

Given that children were presented with objects that were directed affective attention in Studies 1 and 3, attention to a property in Studies 2 and 3, and orienting attention in Studies 1 and 2, analyses were conducted to examine if children used these types of attention in a similar manner to choose objects, regardless of the type of attention they were pitted against. The percentage of trials on which children chose the object directed affective attention was calculated separately for Study 1 and Study 3, for both the Label condition and the No Label condition. The percentage of trials on which children chose the object directed attention toward a property was calculated separately for Study 2 and Study 3, for both the Label and the No Label condition. Finally, the percentage of trials on which children chose the object directed orienting attention was calculated separately for Study 1 and Study 2, for both the Label and the No Label condition. The mean percentage of choice of objects directed affective attention in Study 1 was then compared to the mean percentage of choice of objects directed affective attention in Study 3 using independent t-tests, in each condition (See Table 9 for means). For the Label condition, it was found that the percentage of choice of objects directed affective attention for Study 1 did not differ significantly from the percentage of choice of objects in Study 3, $t(38) = .28$, $p > .10$. Similarly for the No Label condition, it was also found that the percentage of choice of objects directed affective attention for Study 1 did not differ significantly from the percentage of choice of objects in Study 3, $t(38) = 0$, $p > .10$. The mean percentage of choice of objects directed attention to a property in

Study 2 was then compared to the mean percentage of choice of objects directed attention to a property in Study 3 (See Table 9 for means). For the mean percentage of choice of objects directed attention to a property there was also no difference in the Label or No Label conditions between Study 2 and Study 3, $t$ (38) = -.43, $p$ > .10, $t$ (38) = .56, $p$ > .10, respectively. Finally, the mean percentage of choice of objects directed orienting attention in Study 1 was compared to the mean percentage of choice of objects directed orienting attention Study 2 (See Table 9 for means). For the mean percentage of choice of objects directed orienting attention there was also no difference in the Label condition or No label condition between Study 1 and Study 2, $t$ (38) = .13, $p$ > .10, $t$ (38) = -1.26, $p$ > .10, respectively. Thus, it appears that children are choosing objects that were directed the different types of attention presented on a given trial at similar rates regardless of study.

Correlational Analyses.

The next set of analyses were conducted to examine if age, percentage of nouns, or productive vocabulary size influenced children's choice of objects within the Label and No Label conditions across studies. First, the percentage of trials on which children chose the object directed affective attention was calculated across Study 1 and Study 3, for both the Label condition and the No Label condition. The percentage of trials on which children chose the object directed attention toward a property was calculated across Study 2 and Study 3, for both the Label and the No Label condition. Finally, the percentage of trials on which children chose the object directed orienting attention was calculated across Study 1 and Study 2, for both the Label and the No Label condition.

Table 9

Means of Percentage of Objects Chosen by Children that were Directed the Different Types of Attention in Each Study.

| | Label Condition | | | No Label Condition | | |
|---|---|---|---|---|---|---|
| | Study 1 | Study 2 | Study 3 | Study 1 | Study 2 | Study 3 |
| Affective Attention | 48.75 | | 46.25 | 56.25 | | 56.25 |
| Attention to Property | | 50.00 | 53.75 | | 47.5 | 43.75 |
| Orienting Attention | 51.25 | 50.00 | | 43.75 | 52.5 | |

Next, a number of zero-order correlations were conducted (See Table 10). In the Label condition and the No Label condition, the correlations between age and percentage of trials on which children chose the object that was directed affective attention, orienting attention, and attention to a property were not significant. Therefore, age does not appear to have an influence on children's choice of object. Similarly, in the Label condition and the No Label condition, the correlations between percentage of nouns and percentage of trials on which children chose the object that was directed affective attention, orienting attention, and attention to a property were not significant. Therefore, percentage of nouns does not appear to have an influence on children's choice of object. In addition, the correlations between productive vocabulary and percentage of trials on which the children chose the object that was directed affective attention, orienting attention, and attention to a property were also not significant for both the Label and No Label condition.

However, it appeared from the plot of productive vocabulary size and percentage of trials on which the children chose the object directed affective attention, that there were two separate groups of children, those with a low vocabulary and those with a high vocabulary. When the children were split into high and low vocabulary groups according to the median split for the Label condition (across the three studies), some of the correlations in the Label condition approached significance. For the high vocabulary group (vocabulary size greater than 309.5) and the low vocabulary group (vocabulary size less than or equal to 309.5) there was a marginally significant positive correlation between productive vocabulary and the percentage of trials on which the children chose the object that was directed affective attention, $r = .44$, $p = .053$, $r = .37$, $p = .11$,

Table 10

Correlations Across Studies Between the Percentage of Trials on Which Children Chose the Object that was Directed Affective Attention, Orienting Attention, or Attention to a Property and Age, Productive Vocabulary, and Percentage of Nouns in the Label and No Label Conditions

| | Label Condition | No Label Condition |
|---|---|---|
| Affective Attention | | |
| Age | .10 | .15 |
| Vocabulary size | .19 | .02 |
| Percentage of Nouns | .21 | .16 |
| Orienting Attention | | |
| Age | -.02 | -.06 |
| Vocabulary size | -.08 | -.14 |
| Percentage of Nouns | .05 | .20 |
| Attention to a Property | | |
| Age | -.08 | -.05 |
| Vocabulary size | -.11 | .17 |
| Percentage of Nouns | -.25 | -.06 |

Note. All p's > .05.

respectively. Additionally, for both the high vocabulary group and the low vocabulary group there was a marginally significant negative correlation between productive vocabulary and the percentage of trials on which the children chose the object that was directed orienting attention, $r = -.36$, $p = .11$, $r = -.44$, $p = .06$, respectively. Thus, it appears that the children in the word learning context, are responding similarly in the high and low vocabulary groups. Both groups of children seem to be more likely to choose an object directed affective attention and less likely to choose an object directed orienting attention as the referent of a novel label, as their productive vocabulary size increases. These correlations were not significant in the No Label condition. For the high vocabulary group (vocabulary size greater than 324, again using the median split for the No Label condition across the three studies) and the low vocabulary group (vocabulary less than or equal to 324) there was no significant correlation between productive vocabulary and the percentage of trials on which children chose the object that was directed affective attention, $r = .00$, $p > .10$, $r = .12$, $p > .1$, respectively. Likewise, for the high and low vocabulary groups, there was no significant correlation between productive vocabulary size and the percentage of trials on which children chose the object that was directed orienting attention, $r = -.02$, $p < .10$, $r = .18$, $p > .10$, respectively. These results suggest that productive vocabulary size may influence choice of object in word learning situations only.

Gender Analyses.

Finally, similar to the analyses conducted for each study, a number of independent t-tests were conducted to examine possible gender differences in language skills. Factors that were examined included: the percentage of trials on which children chose the object

that was directed affective attention, orienting attention, and attention to a property; productive vocabulary size; and, percentage of nouns. Males ($M$ = 52.50, $SD$ = 29.13) and females ($M$ = 42.50, $SD$ = 25.78) in the Label condition did not differ on the percentage of trials on which children chose the object that was directed affective attention, $t$ (38) = 1.15, $p$ > .10. Similarly, in the No Label condition, males ($M$ = 56.94, $SD$ = 25.45) and females ($M$ = 55.68, $SD$ = 21.73) did not differ on the percentage of trials on which they chose the object that was directed affective attention, $t$ (38) = .17, $p$ > .10. In the Label condition, the percentage of trials on which males ($M$ = 50.00, $SD$ = 29.25) chose the object that was directed orienting attention did not differ significantly from the percentage of trials on which females ($M$ = 51.25, $SD$ = 29.77) chose the object that was directed orienting attention, $t$ (38) = -.13, $p$ > .10. Similarly, in the No Label condition, males ($M$ = 48.61, $SD$ = 26.39) and females ($M$ = 47.73, $SD$ = 18.76) did not differ on the percentage of trials on which children chose the object that was directed orienting attention, $t$ (38) = .12, $p$ > .10. Furthermore, in the Label condition, males ($M$ = 47.50, $SD$ = 29.13) and females ($M$ = 56.25, $SD$ = 25.49) did not differ on the percentage of trials on which children chose the object that was directed attention to a property, $t$ (38) = -1.01, $p$ >.10. Likewise, in the No Label condition, the percentage of trials on which males ($M$ = 44.44, $SD$ = 21.96) chose the object that was directed attention to a property did not differ significantly from the percentage of trials on which females ($M$ = 46.59, $SD$ = 20.85) chose the object that was directed attention to a property, $t$ (38) = -.32, $p$ > .10. In the Label condition, males' productive vocabulary ($M$ = 294.83, $SD$ = 207.69) and females' productive vocabulary ($M$ = 352.87, $SD$ = 206.83) were not significantly different, $t$ (58) = -1.08, $p$ > .10. Likewise, in the No Label condition,

males' productive vocabulary (M = 348.11, SD = 214.79) and females' productive vocabulary (M = 310.52, SD = 160.00) were not significantly different, $t$ (58) = .78, $p$ > .10. Additionally, in the Label condition, males' percentage of nouns (M = 59.23, SD = 9.65) and females' percentage of nouns (M = 61.25, SD = 8.87) were not significantly different, $t$ (58) = -.84, $p$ > .10. Furthermore, in the No Label condition, males' percentage of nouns (M = 60.92, SD = 13.20) and females' percentage of nouns (M = 63.48, SD = 9.18) were not significantly different, $t$ (58) = -.88, $p$ > .10. Thus, there no gender differences were found in percentage of trials on which children chose the object directed the different types of attention, productive vocabulary size, and percentage of nouns.

Additionally, a chi-square analysis indicated that in the Label condition, a similar number of males (N = 21) and females (N = 20) were Strategic Choosers, $\chi^2$ (1, N = 60) = .08, $p$ > .10. This suggests that there are no gender differences in children's use of a strategy in mapping novel words to novel objects. However, in the No Label condition, there was significantly more males (N = 20) than females (N = 16) that were Strategic Choosers, $\chi^2$ (1, N = 60) = 4.14, $p$ < .05. Thus, males were more likely to use a strategy in choosing objects.

## General Discussion

The purpose of the present studies was to examine the types of attentional cues that children can use to map novel words to novel objects. Previous studies have examined children's word learning when they are presented with socio-pragmatic cues that consist of either a complex of behaviours indicating a speaker's referential intent (e.g., happy facial expression, eye contact, and presentation of an object), or only a single

cue (e.g., eye-gaze direction). The present studies were designed to extend these previous studies, examining specifically the types of cues children can use to understand referential intent. In particular, the specific goal of these studies was to investigate whether children can use affective attention, attention to a property, or orienting attention to map novel words onto novel objects when each of these attentional cues are in competition.

Taken together, the results of Studies 1, 2, and 3 yielded three main findings. First, these 24-month-olds, as a group, unexpectedly, relied on affective attention, attention to a property, and orienting attention to similar extents in both the Label condition and the No Label condition. Second, the children, as a group, did not consistently show a preference for using any one type of attention to choose objects. Third, the children's ability to use attentional cues may be tied to vocabulary development. Each of these main findings will be discussed in turn, followed by an examination of their connection to previous research on socio-pragmatic cues and word learning, as well as their implications for future research in this area.

An unexpected finding was that children in the Label and No Label conditions behaved similarly when choosing novel objects. It was predicted that children would choose objects based on attentional cues only in a word learning context. That is, it was not expected that children would choose the same percentage of objects that were directed each type of attentional cue in both the Label and No Label conditions. Additionally, it was surprising that a similar number of children in the No Label condition were using a strategy in choosing objects because they were not looking for evidence of referential intent of the speaker. Because children behaved similarly in the

experimental and control conditions, they do not appear to have the ability to identify the speaker's referential intent using affective attention, attention to a property, and orienting attention. Instead, these attentional cues may have served only to enhance the salience of the objects. However, because some children were found to be using strategies in both conditions, they must have either formed preferences for the different attentional cues, or have thought one type of cue was more salient than another. That is, in order for children to consistently choose objects that were directed one type of attention, they must have developed a preference for that attentional cue, perhaps because it was more salient for them. Nonetheless, it is inconclusive whether children in the present studies can use these attentional cues to map words onto objects.

There are a number of reasons why children may have behaved similarly in the Label and No Label conditions. First, the objects in both conditions received the same kind and amount of attention, and therefore, the salience of the objects was equivalent in the Label and No Label conditions. If children were in fact choosing objects based on the salience of the objects, they would thus choose objects in a similar manner in both conditions. Second, children may have found it confusing to try and interpret the speaker's referential intent in the Label condition when presented with two types of attentional cues at one time. That is, if children in the present studies considered all attentional cues as indicating the speaker's intentions, then being presented with two at once and having to choose may have been confusing to them. Thus, while children's performance may be similar in both conditions, the reasons underlying their performance may be different. Finally, the present findings may have been due to the small sample sizes and thus a lack of statistical power.

The finding that children performed similarly in the Label and No Label conditions is inconsistent with previous research. In studies in which neutral language accompanies a socio-pragmatic cue rather than novel words, children do not consistently choose the objects that had been directed the neutral language when later asked for the referent of a novel word (e.g., Akhtar et al., 1996; Akhtar & Tomasello, 1996). For example, in the control condition in Akhtar et al. (1996), the experimenter said "Look! Look at that! Look at that in there!" while looking in a box containing three previously viewed objects, and one object novel to the discourse context. In a subsequent comprehension task, children did not map a novel label to the object new to the discourse, in contrast to the Label condition. However, in these studies, children in the control conditions were asked for the referent of a novel word in the subsequent comprehension test; in the present studies, children in the No Label condition were asked for "one". Additionally, in previous studies, the experimenters do not give the exact same type of attention to the control or non-target objects (e.g., Akhtar et al., 1996; Akhtar & Tomasello, 1996; Tomasello & Barton, 1994). That is, while the experimenters were careful to direct the same amount of attention to target and non-target objects, the wording directed towards the non-target objects was not exactly the same as the wording directed towards the target objects without the novel label. For example, in Akhtar and Tomasello's (1996) study, in the experimental condition, the finding of the target object was preceded by the experimenter saying "Now let's find the toma. Where's the toma? Let's find the toma.", while the finding of non-target objects was preceded by the experimenter saying "Let's see what's in here.". Thus, the findings in the present studies may, in part, be due to the language directed at the objects in the control condition being

exactly the same as the language directed at the objects in the experimental conditions with only one word difference. Consequently, the control condition of the present studies can be considered more conservative than the control conditions of previous studies. Perhaps a less conservative control for the present studies would be for the experimenter to say "Let's look at some things." instead of "Let's find one.", or to ask for the referent of a novel word instead of "one". Thus, methodological differences between previous studies and the present studies may account for the inconsistent findings. On the other hand, children in the present studies may simply not have been able to use attentional cues to understand the speaker's referential intent.

A number of findings indicated that children, as a group, used each of the attentional cues when choosing objects, rather than consistently using one type of attentional cue. This finding was not expected, as it was predicted that children would use affective attention over attention to a property, and attention to a property over orienting attention to map words onto objects. However, a number of findings indicate that this is not so. First, children chose objects directed each type of attention at chance levels. Thus, children, as a group, did not show a preference for using only one type of attention per study to help them choose objects. It could be proposed, that children did not see the different types of attention as differing in intentionality or salience. Second, children chose objects directed affective attention at the same rate in Studies 1 and 3, chose objects directed attention to a property at the same rate in Studies 2 and 3, and chose objects directed orienting attention at the same rate in both Study 1 and Study 2. Therefore, it is possible that each of these attentional cues was seen as either salient or intentional regardless of which other attention type is presented with it. For example,

attention to a property was not seen as more salient in Study 2 where it was contrasted with orienting attention than in Study 3 where it was contrasted with affective attention.

There is one major methodological difference between previous studies and the present studies that can possibly account for the finding that children do not show a preference for using one type of attention over another. In the present studies, two socio-pragmatic cues were pitted against one another, with children being presented with two novel objects, both of which receive a type of attention. Previous research has focused on either one socio-pragmatic cue at one time, or directed these cues at only one novel object. For example, Moore et al. (1999) presented children with two novel objects at once but, only one object was directed referential behaviour (gaze direction) at a time. Thus, in order to make a more reasonable comparison, in the present studies, children's use of either cue to help them map words to objects was examined. Children were divided into those who consistently used one type of attention when choosing objects and mapping novel words to objects, and those who randomly used the different types of attention. While children as group did not use only one type of attentional cue (e.g., did not all use affective attention as a cue for word learning), many picked one type of attentional cue to use consistently. That is, some children used affective attention to help them decide which objects to choose, some children used attention to a property, and others used orienting attention. However, the distribution of children choosing objects consistently versus randomly was not different from chance alone. Additionally, as mentioned above, it is inconclusive whether children are able to use these strategies to understand adults' referential intent, or if they have a preference for one type of attention, or see one type of attention as being more salient.

An additional important finding, was that most children in the present studies were not simply relying on associative cues to map novel words onto objects or to choose objects. If children relied solely on temporal contiguity, then they would have consistently chosen the first object that the experimenter had directed attention towards. However, this was not the case for most of the children in the present studies. This finding is consistent with previous studies that have found that children can override temporal contiguity to use other socio-pragmatic cues (e.g., Baldwin, 1993; Tomasello & Barton, 1994). For example, Baldwin (1993) found that infants could map a novel word onto the second object they were exposed to when it was marked as the one intended by the speaker, and the first object was not. Also, Tomasello and Barton (1994) demonstrated that children would not map a label onto an object that the experimenter directed negative affect towards (indicating disappointment) even though it was the first object seen after the announcement of the novel label.

In the present studies, there was also preliminary evidence that children's ability to use affective cues to map words onto objects was tied to vocabulary development. With the three studies combined, in the Label condition only, there was a positive relationship between children's use of affective attention to map words to objects and productive vocabulary size, and a negative relationship between children's use of orienting attention and productive vocabulary size in both a high and low vocabulary size group. Thus, as children's productive vocabulary size increased, they were more likely to map words onto objects that had received affective attention, and less likely to map words onto objects that had received orienting attention. Thus, there is a possibility that as children become more adept word learners, they begin to make a finer distinction

among attentional cues, and begin to see affective attention as the most intentional cue, and orienting attention as the least intentional. This possibility fits with the notion that more advanced language learners are better at understanding referential intent and in using socio-pragmatic cues (Moore et al., 1999). Another possibility is that as children become better at using socio-pragmatic cues, it is easier for them to learn vocabulary and therefore their vocabulary size increases.

The findings of the present studies demonstrated that children's use of attentional cues to map novel words onto novel objects is not tied to age. However, this conclusion might not be warranted given the restricted age range of children in the studies (22 to 26 months of age). Moore et al. (1999) demonstrated that younger children may have a less secure grasp of socio-pragmatic cues. However, these children were only 18-months-old. Moore et al. conclude that by 24-months of age, children have a strong understanding of adults' referential behaviour using both words and non-linguistic behaviour. Therefore, because the children in the present studies were all around 24-months-old, they should have been similar in their understanding of adult referential behaviour.

It is often reported that females have an advantage in early language skills. However, the magnitude of this advantage is often quite small, with gender usually accounting for only 1-2% of the variance in verbal performance, and girls being on average only one to two months ahead of boys on most measures (Fenson et al., 1994; Hyde, 1981). Additionally, the obtained gender differences are usually small compared with the far larger individual differences found in different aspects of language (Fenson et al., 1994). In the present study, females did not appear to have any advantage in language skills. Males and females were similar in the percentage of trials on which they

chose objects and mapped words onto objects directed attentional cues. Thus, females did not seem more adept at understanding adults' referential intent. This is consistent with previous studies which found that there were no gender differences in children's abilities to use socio-pragmatic cues to learn words (e.g., Akhtar et al., 1996). Additionally, males and females had similar productive vocabulary sizes. Furthermore, males and females were similar in the composition of their vocabulary as indicated by their percentage of nouns. These results are consistent with Fenson et al. (1994) who found that while females had a larger productive vocabulary size, gender only accounted for approximately 2% of the variance in productive vocabulary size.

There are some limitations to the present studies that must be considered along with the findings. First, due to the methodology of presenting the children with two types of attentional cues on each trial, it is difficult to establish whether or not these children can use either type of cue as indicating the speaker's referential intent. That is, some children who appeared to be choosing randomly between objects may in fact have seen both types of attentional cue as indicating the speaker's referential intent. However, this possibility cannot be examined using the present methodology. Second, the present studies followed strict experimental procedures which may not have been representative of naturalistic settings. For example, the children were presented with only one attentional cue at a time, controlling for any other pragmatic cues. However, in naturalistic settings, children may receive a number of pragmatic and other cues at one time. Third, given the restricted age range of the present studies it is difficult to examine the developmental nature of children's ability to use attentional cues in mapping words to

objects. Finally, in relation to the previous points, it is difficult to generalize the findings of the present studies to the behaviour of children in general.

Given the limitations of the present studies, this area still needs to be more fully investigated. In future research, it will be important to investigate a number of issues. First, an interesting issue concerns what children would do in situations where they were presented with two novel objects, but only one attentional cue was presented at a time. This would help establish whether children as a group see each type of attentional cue as indicating a speaker's referential intent. That is, because it is possible that some of the results were due to the children in the present studies finding the task too hard, by simplifying the task and separating the attentional cues, the usefulness of each cue could be studied separately. There are a number of things one could do with the second object. One option is for the second novel object could be ignored completely (Graham et al., 1999). Another option would be to present the child with the second novel object in a manner similar to the first object, but accompany this presentation with nonreferential neutral language (e.g., "I like Winne the Pooh, do you like Winne the Pooh.").

Another future direction is to examine younger children's and older children's ability to use attentional cues to map novel words onto novel objects. It is important to establish at what age children can start to use these cues. This information is important to uncover so that we understand when children are able to use this type of information to learn new words. However, the task may need to be simplified for younger children, as they have been found to be less able to understand referential intent (Baldwin, 1991; Moore et al., 1999).

In conclusion, the present studies have advanced our understanding of children's abilities to use socio-pragmatic cues, and in particular attentional cues, to disambiguate the referent of novel words. It was demonstrated that some of the 24-month-olds in these studies could use affective attention, attention to a property, and orienting attention systematically in choosing objects. Additionally, productive vocabulary size was found to be directly related to the children's use of affective attention and orienting attention to map novel words onto novel objects. However, it cannot be said conclusively whether attentional cues can help children determine the referential intent of adults in word learning situations.

Thus, the results of the present studies indicate that children may have difficulty using attentional cues in word learning. This finding is in accord with previous studies that indicate that children's ability to use socio-pragmatic cues is quite fragile. For example, Akhtar et al. (1996) found that only eight out of 16 children in the experimental condition mapped the novel word to the novel object in the comprehension test, and only 10 out of 16 demonstrated any signs of word learning at all. Therefore, while some researchers and theorists (e.g., Tomasello, in press) would suggest that socio-pragmatic cues are sufficient for early vocabulary acquisition, the implication is that they are not. It is more probable that children use multiple sources of information to help them in mapping new words onto new objects. In particular, given the abundance of previous research on lexical constraints, it is likely that in addition to socio-pragmatic cues, children also possess default assumptions or constraints that help them in learning new words (Baldwin & Tomasello, 1998; Woodward & Markman,1998). Thus, rather than children using either socio-pragmatic cues or lexical constraints in language acquisition,

it is most likely that children use both of these types of information along with other sources of guidance when learning new words. In fact, it may even be that to adequately describe lexical acquisition, both socio-pragmatic theories and lexical constraint theories are needed (Golinkoff et al., 1999). That is, lexical constraint theories are needed to explain how children decide, for example, that a word labels a whole object, or that words apply to categories. Socio-pragmatic theories are needed to explain how children decide which of the many unnamed objects around them the speaker intends to be labelled. Thus, these two theories should not be seen as mutually exclusive, and instead should be seen as working together.

The implication of the above discussion is that socio-pragmatic cues are one essential aspect of children's word learning. The findings of the present studies are important for a number of reasons. First, previous studies have not investigated what children will do if socio-pragmatic cues are in constrast with one another. Second, previous studies have not examined children's ability to use this fine tuned distinction in cues in determining speakers' referential intent. Future research examining the robustness of these and other socio-pragmatic cues will provide important insights into the manner in which children can learn words when surrounded by unfamiliar objects.

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