THE ORIGINS OF LEXICAL-CATEGORY-TO-MEANING LINKS: THE CASE OF COUNT NOUNS AND PROPER NAMES

by

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

in

THE FACULTY OF GRADUATE STUDIES

(Psychology)

THE UNIVERSITY OF BRITISH COLUMBIA

March 2006

Abstract

When and how do infants learn the distinction between count nouns (CNs) and proper names (PNs)? In a seminal study, Katz, Baker, and Macnamara (1974) found that 17-month-old girls restricted a novel PN to a labeled doll but generalized a novel CN to a second doll contrasting in colour. Recent studies have replicated the original finding using identical-looking dolls, but no younger than 20 to 23 months (e.g., Hall, Lee, & Bélanger, 2001; Bélanger & Hall, 2006). Experiments 1 and 2 sought to clarify this age discrepancy by examining 14-, 17-, 20-, and 23-month-olds' interpretations of CNs and PNs in a task involving either contrasting or identical-looking dolls. Infants heard a novel CN or PN for a doll. The labeled doll was paired with another contrasting or identical doll, and infants were asked to select a referent of the label. Results indicated that by 17 months, infants showed an understanding of the CN/PN distinction when the dolls looked different. It was only at 23 months that infants reliably mapped a PN onto an individual doll when it was paired with an identical-looking doll. What kinds of cues do infants use to learn the CN/PN distinction? In previous research, children interpreted a PN appropriately if it labeled a doll or familiar stuffed animal but not an artifact or unfamiliar animal. Yet questions remain about infants' understanding of proper-nameable things. In Experiment 3, the same task was used to teach 23-month-olds a PN for a doll, stuffed rabbit, toy airplane, or novel monster. Results indicated that 23-month-olds used animate/human properties and familiarity of a labeled object when interpreting a novel PN. They interpreted the label as a PN when the object was an animate surrogate and familiar object (doll, stuffed rabbit), but not when it was an inanimate surrogate or unfamiliar object (toy airplane, novel monster). Together, these experiments document

the emergence of infants' understanding of the CN/PN distinction and reveal some cues that infants might use to learn PNs as distinct from CNs. A discussion of how the findings constrain theorizing about the developmental origins of the CN/PN distinction is presented.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

By some estimates, children understand over 10,000 words by the time they are six years old (e.g., Anglin, 1993). Although this is an amazing fact in its own right, it is even more impressive when we consider the contexts in which children commonly face the task of learning words. Imagine a situation in which a parent is walking in the park with his child. The parent points to a nearby dog barking and says, "Dog!" If "dog" is an unfamiliar word to the child, she is faced with a number of logically possible lexical categories to assign to the word, each associated with a specific kind of meaning (e.g., Bloom, 2000; Macnamara, 1986; Pinker, 1996). For example, she could correctly interpret "dog" as a count noun referring to the category of dogs, but she could equally interpret it as a verb referring to the action of barking, an adjective referring to a property (such as the colour) of the dog, or a proper name referring to the specific dog. This example illustrates a problem that has motivated a large amount of empirical research in recent years. *When* and *how* do children learn to assign new words to their appropriate lexical categories, along with their associated meanings?

The present research addresses these questions about early word learning, specifically focusing on infants' understanding of count nouns and proper names. This introductory chapter will first review the existing literature on the origins and development of infants' knowledge of the linkage between lexical categories and their appropriate meanings. The focus of the initial section of the introduction will be the count noun/verb distinction and the count noun/adjective distinction. In the course of this review, a discussion of theoretical explanations for children's developing abilities involving the count noun/verb contrast and the count noun/adjective contrast will be

presented. Following this discussion will be a selective review of the existing literature on the learning of the distinction between count nouns and proper names. Outstanding questions concerning the origins of this contrast will be discussed and an examination of the limitations of existing theoretical accounts of how children learn the two preceding distinctions (count noun/verb and count noun/adjective) for explaining how children acquire the count noun/proper name distinction will be presented.

Chapters 2 through 4 will describe three experiments that address the questions of when and how an understanding of the count noun/proper name distinction emerges in infancy. The final chapter will contain a discussion of the importance of these experiments for the study of early word learning, the theoretical questions raised by the findings, and suggestions for future directions.

Linguistic Cues to Word Meaning

Following Brown's (1957) classic finding that preschoolers interpret novel words such as "a sib," "some sib," and "sibbing" as referring, respectively, to an object category, a substance category, and an action, there has been a large amount of research investigating young children's ability to use linguistic cues (e.g., "a ___," "some ___," and "___-ing") to learn the meaning and associated lexical categories of new words. This research has often used a procedure in which children are presented with an object or event paired with a novel word. The novel word is modeled with particular linguistic cues that are varied across conditions. At test, children are asked to choose another referent of the novel word from a set of different objects or events. The effect of linguistic information on children's inferences about the meaning of the word is typically determined by examining their object choices. Research using this general procedure

suggests that by approximately two years of age, children draw on linguistic information to distinguish, among other contrasts, between count nouns and verbs, count nouns and adjectives, and count nouns and proper names (e.g., Bélanger & Hall, 2006; Booth & Waxman, 2003; Echols, 2002; Echols & Marti, 1999; Gelman & Taylor, 1984; Hall, Lee, & Bélanger, 2001; Katz, Baker, & Macnamara, 1974; Littschwager & Markman, 1993; Waxman, 1999; Waxman & Booth, 2001; Waxman & Markow, 1998; Woodward & Aslin, 1991). Below is a selective review of research examining when and how infants come to use linguistic information to assign meanings appropriately to count nouns and verbs as well as count nouns and adjectives, followed by a review of the research focusing on when and how infants learn to assign appropriate meanings to count nouns and proper names.

Linguistic Cues in Learning Count Nouns and Verbs

One line of research has investigated the origins and basis of young children's use of linguistic cues to determine whether a novel word is a count noun, naming an object category, as opposed to a verb, naming an action.

The Emergence of the Count Noun/Verb Distinction

Echols and Marti (1999) examined the emergence of an understanding of the connections between count nouns and verbs and their associated meanings. They tested 13- and 18-month-olds in a preferential-looking paradigm. This paradigm is similar to the forced-choice procedure used with older children in which participants are asked to choose manually between two or more objects as the referent of a label. However, it is sometimes difficult for younger infants to perform an action such as physically choosing

between a pair of objects. Therefore, the preferential looking paradigm uses looking behaviour as a dependent measure instead of reaching behaviour.

In Echols and Marti's (1999) experiment, infants were shown an event involving a novel object (e.g., an anteater) performing a novel action (e.g., an opening/closing action with a lid on a cup) on a video monitor. The event was labeled with either a word presented linguistically as a count noun (e.g., "It's a GEP"), or one presented linguistically as a verb (e.g., "It's GEPPING"). In a no word control condition, the event was not labeled. The authors included a no word condition to determine whether the simple presence of speech might have some general attention-facilitating effect favouring objects or actions. At test, infants were shown two events on separate video monitors: One displayed the familiar object performing a novel action, and the other showed a novel object performing the now familiar action. Infants in the count noun condition were then asked to "Look at a GEP," whereas infants in the verb condition were asked to "Look at GEPPING." Infants in the no word condition were simply asked to "Look."

The looking behaviour displayed by the 18-month-olds suggested an appropriate understanding of the count noun/verb distinction: Infants in the count noun condition looked longer at the screen involving the familiar object; infants in the verb condition looked longer at the screen displaying the familiar action; and infants in the no word condition showed no preference for either screen. The looking behaviour displayed by the 13-month-old infants followed a similar general pattern; however, the authors found that infants in the no word condition showed a preference for looking at the familiar object, and that this preference was reduced in the verb condition where infants showed no preference for looking at either screen. In contrast, in the count noun condition, 13-

month-olds showed a strong preference for looking at the familiar object. The authors concluded that 18-month-old infants used linguistic information to distinguish appropriately between novel count nouns and verbs, and that even 13-month-olds were aware of some meaning difference between words from these two types of lexical category (Echols & Marti, 1999).

Thirteen-month-olds' preference for looking at the object (especially in the no word condition) and their lack of preference for looking at the action in the verb condition (Echols & Marti, 1999) motivated Echols (2002) to conduct a further study to help understand this performance. Echols was interested in determining whether words direct attention to objects at a younger age. Nine-month-olds were tested on a novelty preference procedure to investigate whether labeling would direct their attention to objects or to any consistent element (either object or action) across labeled events. In a typical novelty preference task, an infant is presented with stimuli during a habituation phase (e.g., several objects sharing a property such as the colour blue). The infant's looking behaviour towards the stimuli is recorded. After repeated presentations of the stimuli, the infant's attention to the display decreases (perhaps because of boredom), as measured by a substantial decrease in her looking time. At test, the infant is shown a pair of stimuli side by side, one representing the now-familiar aspect of the habituation event (e.g., another blue object) and one representing a novel aspect (e.g., a red object). If the infant notices that the first stimulus represents a familiar aspect (e.g., blue objects), her attention (and hence looking time) to that object should remain relatively low. However, if the infant notices that the second stimulus represents a novel aspect (e.g., red objects), her attention (and looking time) to that stimulus should return to pre-habituation levels,

and thus be relatively high (perhaps because this stimulus is new and hence more interesting). In other words, the infant should show a preference for the novel test stimulus over the familiar test stimulus.

In Echols (2002), infants were assigned either to a consistent-object condition (C-O), or to a consistent-motion condition (C-M). In the C-O condition, infants saw a novel object undergoing three different (novel) motions, whereas in the C-M condition, infants saw three different novel objects undergoing the same novel motion. Infants were also assigned either to a labeled condition or to an unlabeled condition. During the familiarization trials, infants in the labeled condition heard novel labels framed syntactically as count nouns accompanying the visual stimuli. (The authors did not include a condition where the labels were framed syntactically as verbs.) In the unlabeled condition, no label was used during the familiarization trials. At test, infants saw a novel object in a now-familiar motion and a now-familiar object in a novel motion.

Echols (2002) found evidence that labeling directs infants' attention to objects (rather than simply to any consistent element in an event): After hearing a label, infants focused on the object in the C-O condition, attending more (according to their looking time) to the object during familiarization, and to the change of object at test. Therefore, Echols (2002) concluded that labeling (with a count noun) directed infants' attention to objects, but only when the object was consistent across labeling situations. This finding indicates that objects may in fact be privileged as a target of infants' attention during labeling at nine months, a result that may explain why 13-month-old infants appeared to have a general interest in objects in Echols and Marti (1999). It is only by 18 months of

age, however, that infants are able to overcome this preference for objects when hearing novel verbs, as demonstrated by the results reported by Echols and Marti.

How do Infants Learn the Count Noun/Verb Distinction?

Although Echols and Marti (Echols, 2002; Echols & Marti, 1999; Echols & Marti, 2004) did not offer an explicit account of the origins and development of infants' understanding of count nouns and verbs, it is possible to infer one from the conclusions they drew from their studies. First, findings from Echols (2002) led the authors to suggest that infants begin the task of word learning with initial biases or general expectations leading them to consider objects as cohesive and stable entities (Echols & Marti, 2004). Specifically, the authors suggested that count nouns are learned earlier than verbs in part because their referents (objects) are perceived as being more stable over time and more cohesive in contrast to the referents of verbs (actions), which may be perceived as being more transient and as changing across different occurrences. In other words, it is possible that the stability and cohesion of objects across different contexts (in comparison with actions) facilitates the task of identifying the referents for novel count nouns and allows an earlier mapping of count noun labels to objects. These early mappings of count nouns to objects can then provide infants with opportunities to notice the particular linguistic cues that are correlated with count noun labels.

In support of this count noun primacy, recall the results from Echols (2002) showing that when a series of scenes is labeled, young infants are sensitive to whether the scenes contain an object that is consistent. Echols and Marti (2004) suggested that more time is required before infants begin to attend to information conveyed by linguistic cues associated with other lexical categories. Infants' ability to identify the referents of these

other lexical categories (e.g., actions as referents for verbs) may be hindered by the fact that these referents are more transient across different contexts than the referents of count nouns (i.e., objects). Their findings suggest that a growing language-specific knowledge helps infants by 13 months to begin to show an appreciation of the lexical-category-to-meaning links involving words from other lexical categories (e.g., verbs) and, by 18 months, to show a clearer understanding of these links.

Linguistic Cues in Learning Count Nouns and Adjectives

A second line of research has explored the origins and acquisition of lexical category to meaning connections for count nouns and adjectives. In particular, Waxman and her colleagues (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001; Waxman & Booth, 2003; Waxman & Markow, 1995, 1998) have investigated the origins and basis of the linkage between count nouns and object categories in contrast to that between adjectives and properties of objects.

The Emergence of the Count Noun/Adjective Distinction

In four sets of studies, Waxman and her colleagues (Waxman, 1999; Waxman & Booth, 2001, 2003; Waxman & Markow, 1995) demonstrated an early understanding of a semantic distinction between words presented linguistically as count nouns and those presented as adjectives. In most of these experiments, the authors used an adapted version of the standard novelty preference procedure described earlier, but they relied on infants' manipulation of the test objects as a dependent measure instead of infants' looking behaviour.

Using the adapted version of the standard novelty preference procedure, Waxman and Markow (1995) examined the influence of novel words on 12-month-old (ranging

from 11.0 and 13.7 months) infants' object categorization. More specifically, the authors investigated the effect of a novel count noun, a novel adjective, and no label on infants' categorizations. Infants were presented with four objects of the same category (e.g., four animals) and heard either a count noun (e.g., "This is a PLUSHY"), an adjective (e.g., "This is a PLUSHY one"), or no label applied to each object in succession. At test, they were given two objects: one from the familiar category and one from a novel category (e.g., an airplane and a horse). The dependent measure was the amount of time that the infants looked at and/or actively manipulated each object.

Based on infants' scores on a vocabulary checklist, the authors divided the participants into two groups: a high vocabulary group (production vocabulary of more than two words) and a low vocabulary group (production vocabulary of two words or fewer). This division based on vocabulary size was carried out to investigate whether lexical advances are associated with sensitivities to word-to-meaning links. Findings from this experiment suggested that 12-month-old infants used "words as invitations to form categories," irrespective of the words' lexical category: Infants in the high vocabulary group showed a novelty preference after hearing either a count noun or an adjective. On the other hand, infants in the low vocabulary group were not influenced by the use of novel count nouns or adjectives. Therefore, Waxman and Markow (1995) concluded that lexical advances (measured by vocabulary production) are associated with greater sensitivity to the word-to-object-category linkage, and that at 12 months, both count nouns and adjectives are interpreted as highlighting category-based commonalities among objects.

In another set of studies using a similar novelty preference task, Waxman (1999) reported evidence that 13-month-olds (mean age of 13.5, ranging from 12.7 to 14.6 months) interpret adjectives (but not count nouns) as highlighting property-based commonalities. Infants were presented with four objects that shared a property (e.g., four purple objects), and heard either a novel count noun, a novel adjective, or no label applied to each object. At test, infants saw a new object from the same category with the same property (e.g., a purple horse) and an object (also from the same category) with a contrasting property (e.g., a blue horse). Infants' preference was measured by the amount of time spent looking at and manipulating each object.

Results showed that infants who heard an adjective revealed a reliable novelty preference for the object with the contrasting property, whereas infants who heard a count noun or who did not hear a label did not. Waxman (1999) interpreted these results as suggesting that infants with a mean age of 13 months can use linguistic information to interpret novel adjectives (but not novel count nouns) as highlighting property-based commonalities among objects. In a more recent study, Waxman and Booth (2003) found that by 11.7 months on average, infants (ranging in age between 11.1 and 12.3 months) do not yet distinguish between novel words presented linguistically as count nouns and those presented as adjectives and that they interpret both types of words as highlighting both category-based and property-based commonalities. Therefore, results from the previous two studies suggest that by an average of 13 months of age (but not 11 months), infants interpret count nouns appropriately, that is, as highlighting category-based commonalities among objects, but interpret adjectives as highlighting both category-based and property-based commonalities among objects.

Recently, Booth and Waxman (2003) modified their procedure to include only a word-extension measure. With this new task, they were able to demonstrate an understanding of adjectives as referring specifically to object properties (rather than object categories) in infants as young as 14 months on average (13.6 months to 14.6 months), but only when the property used was colour (not when it was texture) and only when the objects were taken from the same superordinate-level category, such as *animal* (not when they were taken from the same basic-level category, such as *dog*). Based on these findings, the authors concluded that by an average of 14 months, infants' expectation for novel adjectives is not yet robust because they are in transition between their earlier understanding of adjectives as highlighting both property-based and category-based commonalities to a more mature understanding of adjectives as highlighting property-based commonalities exclusively.

The findings from these studies (Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001, 2003) suggest that between 13 and 14 months of age on average (but not 11 months of age), infants have started to distinguish between novel words presented linguistically as count nouns and those presented as adjectives. For these infants novel labels presented syntactically as count nouns tend to highlight category-based (but not property-based) commonalities among objects. On the other hand, novel words presented linguistically as adjectives tend to highlight both category-based and property-based commonalities among objects, which suggests that these infants have not yet acquired the appropriate lexical-category-to-meaning link involving adjectives, and are not yet able to map them exclusively to object properties.

Waxman and Markow (1998) reported an appropriate understanding of count nouns and adjectives at an average age of 21.3 months (ranging from 20.2 and 22.7 months). Infants were presented with a familiar object labeled with a novel word presented linguistically either as a count noun or as an adjective. Infants were then asked to choose another referent for the label between two objects, only one of which displayed the same property as the original. Infants chose the property-match more often when they heard an adjective than when they heard a count noun.[1] These results suggest that by an average of 21 months, infants extend novel adjectives (but not count nouns) specifically to object properties (see also Waxman & Booth, in preparation, cited in Waxman & Booth 2001, for evidence that count nouns highlight category-based commonalities and that adjectives highlight specifically property-based commonalities for 24-month-olds).

In sum, results reported by Waxman and her colleagues (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, in preparation, cited in Waxman & Booth 2001; Waxman & Booth, 2001; Waxman & Booth, 2003; Waxman & Markow, 1995; Waxman & Markow, 1998) suggest three main conclusions. First, by an average of 11 months, infants do not distinguish between words presented linguistically as count nouns and adjectives. At this age, neither type of linkage is appropriately established, and infants interpret both count nouns and adjectives as highlighting both category-based and property-based commonalities. Second, by 13 to 14 months of age on average, infants have begun to understand the distinction between words from these lexical categories. More specifically, they extend count nouns to other objects of the same category, while they extend adjectives to other objects of the same category or to other objects with the

[1] The same results emerged when the property used was colour or texture.

same properties (with the exception of one experiment in which 14-month-olds succeeded in associating adjectives exclusively with colour-based but not texture-based commonalities). Third, infants with a mean age of 21 to 24 months have forged the appropriate adult-like link between count nouns and adjectives and their respective meanings. In other words, they interpret count nouns as highlighting category-based commonalities, whereas they interpret adjectives as highlighting specifically property-based commonalities.

How do Infants Learn the Count Noun/Adjective Distinction?

Addressing the question of how infants come to form lexical-category-to-meaning links, Waxman (e.g., Waxman 1998, 2004) has argued that an initial mechanism, present at the onset of word learning, leads infants to attend to commonalities among labeled objects. First, by about 11 months of age, novel words presented linguistically either as count nouns or as adjectives highlight various types of commonalities (e.g., category-based or property-based) among labeled objects (e.g., Waxman and Booth, 2003). With experience, infants begin to notice the distinctive grammatical properties of some of these words, and at the same time start to notice correlations between certain sets of words and certain types of commonality among objects. The first lexical-category-to-meaning link to be appropriately formed is the one involving count nouns and object categories by 13 months of age on average (e.g., Waxman, 1999; Waxman & Booth, 2001; Waxman & Markow, 1995). Waxman suggests that this may be because, on the one hand, count nouns are especially salient in the linguistic input, and on the other hand, object categories are particularly salient in the world (e.g., Waxman, 2004). Once the lexical-category-to-meaning link involving count nouns is formed, infants start to recognize

(between 13 to 14 months and 21 to 24 months of age) the correlation between other types of words and their referents, for example, between adjectives and property-based commonalities (e.g., Booth & Waxman, 2003; Waxman & Markow, 1998).

Comparing Accounts of How Infants Learn the Count Noun/Verb and the Count Noun/Adjective Distinctions

Results reported by Waxman and her colleagues about the origins of the count noun/adjective distinction (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001; Waxman & Booth, 2003; Waxman & Markow, 1995) are generally consistent with Echols and Marti's (2004) findings concerning the average age at which infants first form the links between count nouns and verbs and their appropriate meanings (see Table 1.1).

Lexical Categories	*No Distinction*	*Some Distinction*	*Appropriate Distinction*
Count Noun/Verb	--	13 months	18 months
Count Noun/Adjective	11 months	13-14 months	21-24 months

Table 1.1: Summary of the mean ages reported with no distinction, some distinction, and an appropriate distinction of the lexical-category-to-meaning links involving count nouns and verbs, and count nouns and adjectives.

Recall that results from Echols (2002) suggest that infants as young as 9 months can map a novel word presented linguistically as a count noun to an object category (when the labeled object is consistent across labeling situations), and results from Echols and Marti (1999) suggest that by an average of 13 months, infants can use linguistic information to distinguish between the meanings of novel count nouns and novel verbs, though their understanding of novel verbs is not entirely adult-like. By 18 months on

average, infants demonstrate an understanding of the appropriate links involving both count nouns and verbs.

This time frame is roughly in line with the one suggested by Waxman and her colleagues concerning infants' understanding of count nouns and adjectives (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001; Waxman & Booth, 2003). According to these authors, at a mean age of 11 months, infants have not yet begun to distinguish between count nouns and adjectives. By about 13 to 14 months, infants show an appreciation of a distinction between these lexical categories, and although their understanding of count nouns is appropriate, their understanding of adjectives is not yet adult-like. Finally, by an average of 21 to 24 months, Waxman and her colleagues have found clear evidence that infants demonstrate an appropriate understanding of the distinction between count nouns and adjectives. This mature understanding of the count noun/adjective distinction appears to be reached approximately three months later than the understanding of the count noun/verb distinction reported by Echols and Marti (1999).

Addressing the question of how infants come to form links between lexical categories and their meanings, both Waxman (2004) and Echols and Marti (2004) propose that infants begin word learning with a predisposition to attend to objects and object categories, which allows them to map count nouns onto object categories early in development. Waxman further suggests that a mechanism present at the onset of word learning leads infants to extract commonalities (e.g., category-based or property-based) among labeled objects. Findings reported by Echols (2002) are consistent with the proposal that infants are sensitive to commonalities among labeled events (at least when

the commonality is a consistent object). Both authors agree that infants only later become more sensitive to the specific linguistic properties of particular lexical categories (e.g., verbs and adjectives).

Although Echols and Marti (2004) are not explicit about the process by which this increased sensitivity occurs, Waxman and her colleagues propose that infants notice the correlations between words from different lexical categories and the different types of commonalities among objects (e.g., category-based and property-based) that those words describe. This process of correlation-detection allows infants to form appropriate lexical-category-to-meaning links (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman, 2004; Waxman & Booth, 2001). Therefore, with experience, infants use their growing knowledge of linguistic information to form links from other lexical categories such as adjectives and verbs to their appropriate meanings.

How does the existing research on the learning of contrasts involving *other* lexical categories bear on the preceding findings concerning the count noun/verb and count noun/adjective contrasts? One lexical category contrast that can help us better understand infants' acquisition of lexical-category-to-meaning links in general is the contrast between count nouns and proper names. The following section will examine the existing research on young infants' understanding of this lexical category distinction.

Linguistic Cues in Learning Proper Names and Count Nouns

Many researchers have used procedures similar to those described in the previous sections to determine whether young children understand the linguistic information that differentiates count nouns and proper names, and whether they can use this information to learn the appropriate meanings of these words. In one such procedure, children hear a

novel word for one of two familiar stuffed dolls or animals of the same category. If children know that count nouns refer to object categories, they should interpret a novel word presented linguistically as a count noun (e.g., "a DAXY") as marking the object as a category member and extend it to either object randomly. If they know that proper names refer to individual objects, then they should interpret a novel word presented linguistically as a proper name (e.g., "DAXY") as referring to the labeled object as an individual and not extend it to the other object.

Several researchers have used this type of methodology to examine young children's use of linguistic cues to distinguish between count nouns and proper names. In a seminal study, Katz et al. (1974; with additional data from Macnamara, 1982) tested children on a forced-choice task after teaching them a novel count noun or a novel proper name for a doll or a block.

In one experiment (Katz et al., 1974, Experiment 2), children were presented with a pair of dolls differing in hair and dress colour or a pair of blocks, also differing in colour. Children were randomly assigned either to a count noun condition or to a proper name condition. Two groups of girls (one with an average age of 17 months and one with an average age of 22 months) were taught a count noun label or a proper name label for a doll, and a third group of girls (with an average age of 22 months) was taught a proper name label for a block. Children heard the experimenter label one object with the novel word at least five times. In the count noun condition, the word was presented linguistically as a count noun (e.g., "This is a ZAV"), whereas in the proper name condition, it was presented linguistically as a proper name (e.g., "This is ZAV"). The other object of the pair was not labeled. At test, children were asked to choose a referent

for the novel word by performing specified actions with an object. For example, in the count noun condition, the experimenter asked, "Can you feed a ZAV?" and in the proper name condition, the experimenter asked, "Can you feed ZAV?" The results showed that both 17- and 22-month-old girls were more likely to choose the labeled doll in the proper name condition than in the count noun condition. When the objects used were blocks, the 22-month-old girls selected either object at chance. These results were not replicated with boys averaging 24 months of age (Katz et al., Experiment 1).

In a subsequent experiment, Macnamara (1982, Experiment 3 with boys) tested three groups of boys with a mean age of 28 months on a similar task (two groups were tested with dolls and one group was tested with blocks), with one modification: during the teaching phase, boys were asked once to name the labeled object in an attempt to focus their attention better on the task. Boys who heard a proper name for a doll selected the labeled doll at above-chance levels when asked for a referent of the label, but did not do so after hearing a count noun for a doll or after hearing a proper name for a block. In sum, findings from these experiments suggest that girls as young as 17 months on average and boys with a mean age of 28 months used linguistic information (i.e., the presence or absence of the determiner, "a") to decide if the novel word was a proper name referring to the object as an individual, or a count noun picking out the object as a category member. The finding that infants restricted a novel proper name to the labeled object when the object was a doll, but not when the object was a block suggest that they used cues to animacy when distinguishing between the count nouns and proper names, an issue that will be addressed further in Chapter 4.

To clarify children's interpretations of the novel label in the preceding research, Gelman and Taylor (1984) replicated Katz et al.'s (1974) study with a slightly different methodology. They argued that while children who showed no preference for either doll in Katz et al.'s task may have correctly interpreted the novel label as a count noun (i.e., they thought that the word named a category such as doll), they may equally have been simply guessing (i.e., they did not know which object to choose, so they selected randomly).

To determine which one of these two possibilities was accurate, Gelman and Taylor (1984) replicated Katz et al.'s (1974) task with girls averaging 29 months of age and boys averaging 30 months of age, with one methodological change. Instead of being presented with two objects, children were presented with four: two stuffed animals and two blocks. One of the objects (either a stuffed animal or a block) was labeled with a novel count noun or a novel proper name. If children were interpreting the label as a count noun, they should have restricted their selection to the two stuffed animals (or the two blocks), whereas if children were simply guessing, they should have selected among the four objects at chance. If children were interpreting the novel proper name as referring to the individual object, they should have restricted their choice to the labeled object. The authors found that after hearing a count noun for a stuffed animal or a block, children (both boys and girls) chose one of the two objects of the same category most of the time, ignoring the other two toys. After hearing a proper name, children chose the labeled toy most of the time when the labeled object was a stuffed animal. However, when the labeled object was a block, children did not restrict their choice to the labeled object, but rather selected the other block or one of the stuffed animals. These results are

consistent with the hypothesis that by an average of 29 to 30 months of age, children understand that count nouns refer to objects as category members, whereas proper names refer to objects as individuals (if the object is an animate surrogate).

It is important to note, however, an important interpretative problem with the preceding findings. The dolls or animals used in the tasks were always perceptually different from each other (e.g., their dress or hair colour differed). As a result, when children restricted a novel word to the labeled object, it is difficult to determine whether it was because they thought the word named the individual object (appropriate for a proper name) or because they thought the word named one of the object's properties (like its hair or dress colour, appropriate for an adjective). To address this interpretative problem, several researchers have modified the task (e.g., Bélanger & Hall, 2006; Hall et al. 2001; Liittschwager & Markman, 1993; Sorrentino, 2000, 2001). For example, Hall et al. (2001) designed a task similar to Katz et al.'s (1974) task, but they used pairs of identical-looking stuffed animals. In a series of six experiments, children ranging in average age between 20 to 37 months heard a novel count noun or proper name (between five and nine times) for a doll or stuffed animal. The object was then moved to a new location, and a second identical object was placed at the original object's location. At test, children were asked to select one of the two objects as a referent for the novel label. At 20 months of age on average (ranging from 18 and 22 months), children showed no evidence of an understanding of the count noun/proper name distinction. Neither boys nor girls were more likely to choose the labeled object after hearing a proper name than after hearing a count noun (Hall et al., Experiment 1).

A second experiment showed that by an average age of 24 months (ranging from 22 and 27 months), girls (but not boys) selected the labeled object significantly more often in the proper name condition than in the count noun condition. It was only at a mean age of 37 months (ranging from 33 to 43 months) that boys demonstrated success on the same task (Hall et al., 2001, Experiment 3). Findings from these first four experiments thus revealed a significant gender difference, with girls showing an appropriate differentiation of count nouns from proper names about one year before boys. This gender difference is similar to the one reported by Macnamara and colleagues (e.g., Katz et al.; Macnamara, 1982).

To examine the possibility that this gender difference was due to the fact that boys were less attentive than girls during the task and that, as a result, their understanding of the count noun/proper name distinction was harder to demonstrate than in girls, Hall et al. conducted a fifth experiment with boys averaging 23 months of age (ranging from 22 to 26 months). These boys were provided with a more elaborate and interactive context during the introduction of the novel labels. The novel label was presented in several distinct sentence frames to make its lexical category easier to detect. Also, children were asked to repeat the label and were invited to interact with the object while the label was taught. Results from this experiment showed that with increased exposure to the novel labels and a more socially interactive setting, boys successfully differentiated count nouns from proper names by selecting the labeled object more often in the proper name condition than in the count noun condition. However, even with an increased exposure to the novel labels, girls with a mean age of 20 months (ranging from 18 to 22 months) failed to do so (Hall et al., Experiment 6). In sum, the experiments reported in Hall et al.

showed that by an average age of 24 months, both boys and girls restricted a novel proper name to an individual object, but were willing to extend a novel count noun to a second identical-looking object.

Although the results from these more recent studies offer more clear-cut evidence than results from earlier studies regarding children's understanding of the lexical-category-to-meaning links involving count nouns and proper names, the youngest age at which children showed sensitivity to these connections on the newer tasks is about two years of age (Hall et al., 2001). In fact, children with a mean age of 20 months failed to show an understanding of these links in two separate experiments (Hall et al., Experiments 1 and 6). These results suggest that it is not until children's second birthday that they can use linguistic cues to distinguish appropriately between novel words presented as count nouns and those presented as proper names. Yet how can the results from these more recent studies be reconciled with the findings from Macnamara (e.g., Katz et al., 1974; Macnamara, 1982) that girls with a mean age of 17 months understand this distinction?

Bélanger and Hall (2006) tested the possibility that the failure of 20-month-old children to show an appropriate differentiation of count nouns and proper names in Hall et al. (2001) was due to the methodology used in that research. The hypothesis was that a task requiring children to actively choose an object was too difficult for younger participants to perform. Bélanger and Hall therefore used looking behaviour as a dependent measure to reduce the demands of the task.

In a series of four experiments, infants with a mean age of 16 and 20 months (ranging from 14 to 18 months and from 18 to 22 months) were presented with pairs of

identical-looking stuffed animals on a puppet stage. One animal (e.g., a duck) was presented on one end of the stage and labeled either with a count noun (e.g., "He's called a DAXY") or with a proper name (e.g., "He's called DAXY"). In a third condition, no label was used. The animal was then slowly moved to the other side of the stage and another identical-looking stuffed animal was placed in the first object's original position. In Experiments 1 (with infants averaging 20 months of age) and 2 (with infants averaging 16 months of age), infants were then asked either to look at "a DAXY" (in the count noun condition), to look at "DAXY" (in the proper name condition), or to look at "one" (in the no word condition). Infants' looking behaviour was examined and two measures were taken: the proportion of looking time to the labeled object (looking time measure) and the first object gazed-at immediately following the test prompt (first look measure). There was no difference in the looking time measure between the conditions, but the first look measure indicated that 20-month-olds (but not 16-month-olds) looked first more often at the labeled object in the proper name condition than in the count noun or no word conditions. However, based on a comparison of the first look measure to chance, infants in the proper name condition did not show a preference for looking at either animal, whereas in the count noun and no word conditions, they showed a preference for looking at the unlabeled animal (the more novel object in the scene).

Experiments 3 (with infants averaging 20 months of age) and 4 (with infants averaging 16 months of age) were conducted in an attempt to reduce this preference for novelty and to examine whether infants could demonstrate an actual preference for looking at the labeled object in the proper name condition. Immediately before making the test prompts, the experimenter briefly presented a distracter card halfway between the

two animals to attract the infants' eye gaze to the centre of the display and to reduce their tendency to look at the novel animal. In this modified task, 20-month-olds (but not 16-month-olds) who heard a proper name for a stuffed animal showed a preference for looking at the labeled animal on the first look measure. Infants who heard a count noun or no label did not show a preference for looking at either animal at test. These findings suggest that when identical objects are used, infants with a mean age of 20 months were able to use linguistic information (i.e., the presence or absence of the determiner) to determine whether the novel word referred to the individual object or to the category of objects.

The Emergence of the Count Noun/Proper Name Distinction

Previous research leaves us with a fundamental question requiring clarification: What is the earliest age at which infants can use lexical category information to distinguish between count nouns and proper names?

On the one hand, Macnamara (e.g., Katz et al., 1974; Macnamara, 1982) found that girls with an average age of 17 months can do it. In addition, there are reports based on young children's productive vocabulary that suggest an early understanding of proper names. For example, Nelson (1973) conducted a longitudinal study investigating the development of 18 children's vocabulary and found that 12% of her participants' first 50 words (achieved between the ages of 15 and 24 months) referred to specific people. Moreover, among her participants' first 10 words (achieved on average between 13 and 19 months), 24% were words for specific individuals such as *mommy* and *daddy*. Consistent with these reports, lexical norms compiled for the MacArthur Communicative Development Inventories (MCDI), a standardized parent reporting system used to assess

English-speaking children's lexical growth, indicated that between 53% and 56% of 12-month-olds were reported to produce a word to refer to their own mother or father and that by 16 months, these percentages reached 76% to 80%. Reports on infants' comprehension of words such as *mommy* and *daddy* were even more compelling. On average, 91% of 9-month-old infants were reported by their parents to understand *mommy* or *daddy*, percentages that reached 94% to 96% by 16 months of age (Dale & Fenson, 1996).

On the other hand, recent investigations have failed to uncover an understanding of the count noun/proper name distinction in infants who were younger than 23 to 24 months on average with reaching behaviour as a dependent measure (e.g., Hall et al., 2001) or in infants younger than 20 months of age on average with looking behaviour as a dependent measure (Bélanger & Hall, 2006).

Experiments 1 and 2 of this dissertation were designed to clarify the discrepancy observed in previous research. First, recall that a key difference between the method used by Katz et al. (1974) and the method used in later studies (e.g., Bélanger & Hall, 2006; Hall et al., 2001; Liittschwager & Markman, 1993) is that in the original method, there were perceptual differences between the stimuli, whereas in the revised method, the stimuli looked identical. As mentioned earlier, the use of identical objects was meant to deal with an important interpretive problem raised by the use of perceptually different objects. With the original method, Katz et al. reported that girls with a mean age of 17 months succeeded. With the revised method, however, Bélanger and Hall found that infants averaging 16 months of age failed and infants averaging 20 months of age succeeded on a task involving a looking measure; and Hall et al. reported that infants

with a mean age of 20 months failed and those with a mean age of 23 to 24 months succeed on a task involving a reaching measure. To address this discrepancy, infants in each of the experiments described in this dissertation took part in a task that included some trials involving perceptually different objects and other trials involving perceptually identical objects.

Second, in order to obtain a clear picture of the development of an understanding of the count noun/proper name distinction within a single study, infants were recruited to span the age groups (from 14- to 23-months) at which some understanding of lexical category-to-meanings links has previously been reported (e.g., Bélanger & Hall, 2006; Booth & Waxman, 2003; Echols, 2002; Echols & Marti, 1999; Echols & Marti, 2004; Hall et al., 2001; Katz et al., 1974; Macnamara, 1982; Waxman, 1999; Waxman & Booth, 2001, 2003; Waxman & Markow, 1995; Waxman & Markow, 1998). Using a fixed method for all age groups allowed for direct comparisons between the different groups.

Third, another important methodological difference between Katz et al.'s (1974) original study and Hall et al's (2001) and Bélanger and Hall's (2006) experiments was the social setting of the experiments. In Katz et al., the experiment was conducted in a social and interactive manner, in which the child was asked to interact actively with the experimenter and the stimuli. In contrast, in Bélanger and Hall, the experimenter was hidden behind a curtain during the labeling, and the child was never asked to manipulate the objects presented. In this case, infants could not rely on any social-pragmatic cues to help them in the task, providing a possible reason why the younger infants did not display an understanding of the distinction between proper names and count nouns (e.g., see Baldwin 1991, 1993a; 1993b; Baldwin, Bill, & Ontai, 1997; Baldwin et al. 1996; Hollich,

Hirsh-Pasek, & Golinkoff, 2000, for evidence that infants use social-pragmatic information when interpreting novel labels). In Hall et al. (2001, Experiments 1 to 4), although infants saw the experimenter at all times, they were mere observers and were never given the opportunity to interact with the experimenter and the objects. In Experiments 5 and 6 (which yielded success with boys who were 23 months of age on average and failure with girls who were 20 months of age on average), children were given the opportunity to interact with the labeled object twice, but not to the same extent as in Katz et al, where children were asked to interact with the object five times. Therefore the task used in Experiments 1 and 2 was designed to be highly interactive in nature, with the experimenter remaining in full view of the infants and inviting infants to participate actively and to manipulate the stimuli while learning the novel label.

A final possible reason for the discrepancy in findings in previous research is related to the way the novel label was taught to the infants. In Bélanger and Hall (2006), infants heard the novel label a total of five times before the testing phase. It is possible that younger infants needed a richer linguistic context including more repetitions of the label embedded in several distinct sentence frames. One piece of evidence that points to this possibility can be found in results reported in Hall et al. (2001). In their Experiment 2, boys with a mean age of 24 months were not able to distinguish appropriately between novel labels presented linguistically as count nouns and proper names after hearing the label a total of five times in the same linguistic context. In their Experiment 5, however, a group of boys with a mean age of 23 months succeeded at the task when presented with a richer and more elaborate linguistic (the label was repeated nine times in different sentences frames). Therefore, it is possible that the richer and more elaborate linguistic

context allowed the younger boys to demonstrate an understanding of the count noun/proper name distinction. Therefore, to facilitate the learning of the novel label in Experiments 1 and 2 of this dissertation, the task was designed with an extended teaching phase including many repetitions of the novel label (i.e., infants heard the label 18 times) in a more diverse set of linguistic contexts than in previous studies.

In sum, Experiment 1 explored infants' understanding of count nouns and proper names an at an average age of 17, 20, and 23 months by including several repetitions of the novel word in several sentence frames and by providing an interactive setting involving both perceptually contrasting and identical dolls. Experiment 2 investigated the same issues with infants with a mean age of 14 months.

How do Infants Learn the Count Noun/Proper Name Distinction?

Another fundamental question left unanswered by the existing research concerns the mechanism of acquisition, that is, *how* the word-to-meaning links involving count nouns and proper names and their respective meanings are formed. As discussed earlier, Echols and Marti (2004) and Waxman and her colleagues (e.g., Booth & Waxman, 2003; Waxman, 1998, 1999, 2004; Waxman & Booth, 2001) have suggested that because of the perceptual salience of objects and object categories, the first lexical-category-to-meaning link to be established is the count-noun-to-object-category link. In addition, Waxman and her colleagues have proposed that a mechanism leading infants to attend to commonalities among objects (or, in the case of Echols, 2002, commonalities among events) is in place early in development. With experience, infants become more sensitive to the correlations between specific linguistic properties of the different lexical categories such as count nouns, verbs, and adjectives and specific types of commonalities among

object or events, which allows them to then start mapping these types of words onto their appropriate meanings.

How well can such an account explain how infants acquire the link between proper names and individual objects? A different kind of mechanism must be proposed since a different ability is involved in establishing the proper-name-to-individual-object link, one that does not only involve extracting commonalities across objects (or events). In particular, when infants learn proper names, they do not need to determine when a word names a common object category or object property shared by different objects or a common action in which different objects engage. Rather, they need cues to detect when a word names an individual object per se. If infants cannot use their ability to extract commonalities among objects (or events) to learn proper names as they do for count nouns, adjectives, and perhaps verbs, how do they learn to interpret proper names appropriately?

Since infants cannot initially rely on linguistic cues to distinguish between count nouns and proper names (or between words from other lexical categories), they must start out by using non-linguistic information to help identify these two word categories. Researchers have proposed that toddlers and preschoolers use several types of non-linguistic information to help them identify proper names as distinct from words from other lexical categories (e.g., Bloom, 1994, 2000; Hall, 1991, 1994, 1996, 1999; Hall & Bélanger, 2005; Hall, Veltkamp, & Turkel, 2004; Macnamara, 1982, 1986; Pinker, 1996). The following sections will describe four types of information that have received empirical attention with young children and preschoolers, namely, information about whether the labeled object already has a proper name, information about the range of

reference of the label, information about the labeled object's properties (such as animacy and cues to personhood), and information about the familiarity of the labeled object. In a word learning situation involving a novel proper name, young children and infants may use these cues to help restrict the possible referents of the word and determine which object is being singled out as an individual and thus help them learn the proper-name-to-individual-object link.

An individual object is referred to by a single proper name. One type of information that has been argued to help children determine whether a novel word applied to an object is a proper name concerns whether the object already has a known proper name (e.g., Hall, 1999). Although individuals can be labeled with more than one proper name (for example, my friend Rebecca is sometimes referred to with the nickname Punky), these different labels usually differ pragmatically or in the contexts in which they are used (for example, in the level of formality of the conversation). This fact suggests that if two proper names are used in the same discourse context, there should be a strong bias towards inferring that they do not refer to the same individual object (e.g., see Bloom, 2000).

Hall and Graham (1999) reported evidence for a bias leading children to believe that an individual object gets only one proper name. In their study, 4-year-olds (ranging in age from 48 months to 65 months) were first taught a novel label presented linguistically as an adjective or as a proper name for a stuffed animal. They were then asked for the referent of a novel proper name, given a choice between the original labeled stuffed animal and another stuffed animal. Children resisted mapping the proper name onto the same stuffed animal if they were first explicitly taught a proper name for it, and

instead mapped it onto the other stuffed animal. However, 4-year-olds had no problem mapping the proper name onto the original stuffed animal if they first heard that animal labeled with a novel adjective. Therefore, it seems that preschoolers can use information about whether an object already has a known proper name to interpret subsequent novel labels used to refer to the same object. It remains to be investigated whether such a cue is used by younger children and infants when interpreting novel proper names. Note that however useful this cue may be, infants cannot rely on it when first learning the proper-name-to-individual-object link, since it requires that children have already learned other proper names beforehand. Therefore, infants first learning the association between individual objects and proper names must be sensitive to other non-linguistic information.

Range of reference of the label: A proper name refers to a single object. As mentioned earlier, one critical difference between proper names and words like count nouns, adjectives, or verbs is that proper names refer to unique entities, whereas words from the other lexical categories can be used to describe multiple entities or events. Therefore, a child who is aware of this fact could use a word's range of reference, or the number of objects to which it is extended, to guide interpretation. More specifically, a child should be more likely to interpret a novel label as a proper name referring to an individual object if it is used to refer to one object than if it used to refer to two or more objects.

Empirical evidence shows that, when a novel word is presented with no clear lexical class information, children do, in fact, use the word's range of reference as a cue to its meaning. Children as young as 3 years of age are more likely to interpret a novel word as a proper name if it is used to label only one object than if it is used to label two

different objects (Hall, 1996; Hall & Bélanger, 2005). For example, Hall and Bélanger (2005) presented children who were on average 37 months old with a pair of identical-looking stuffed animals and labeled one or both of the animals with the same novel word. When the novel word was presented with clear lexical class information, indicating that it was a proper name or an adjective (e.g., "His name is DAXY" or "He is very DAXY"), children interpreted the word appropriately regardless of whether one or both animals were labeled. At test, when asked for a referent for the new word, they restricted the label to the individual object if it was a proper name, but generalized the label to a third identical-looking animal if the word was an adjective. When the novel word was presented with no clear lexical class information (e.g., "DAXY"), children used the range of reference of the label when assigning it a meaning. They made a proper name interpretation of the label if the word was applied to one of the two animals (i.e., they restricted the label to the individual animal). However, if the word was applied to both animals, children interpreted it as an adjective or as a count noun (i.e., they generalized it to a third identical-looking animal). Therefore, early in the process of word learning, children may exploit range-of-reference information to guide their interpretation of novel words in the absence of clear linguistic information. It remains to be investigated whether this cue is used by younger children and infants when interpreting novel proper names.

When considering range-of-reference information, children use direct cues about the number of objects labeled with the same word. In the case of count nouns and adjectives, the range of reference may include many objects, whereas for proper names, the range of reference is restricted to one object. However, indirect information about which objects are *not* being labeled with the word may also be relevant to proper name

learning. Markman and Jaswal (2004) argued that the fact that some objects are not being labeled is a strong cue to determining that the word is a proper name. The authors started with the assumption that young children expect all novel labels to generalize to other objects of the same category (according to a "taxonomic bias") and that they are sensitive to a speaker's intent to refer to a given object, but notice failures to use the expected label with certain objects. For example, if a speaker labels a dog "Fido," a child may first be biased to think that "Fido" should generalize to other dogs (thus following the taxonomic bias). When speakers then refer to other dogs without using the label "Fido," the child may revise his or her guess and infer that the label therefore does not refer to a category like "dog," but rather to the previously labeled individual dog. Markman and Jaswal propose that in the case of learning proper names, this sensitivity to the non-occurrence of labels is an important mechanism at work. Empirical evidence is still needed to support this proposal.

In sum, it has been established that young children use a novel word's range of reference as a cue in helping in its interpretation, and more precisely, that young children can use this information to help them learn proper names as distinct from count nouns and adjectives. It is also possible that children use indirect cues such as the non-occurrence of labels when learning proper names. We now turn to two further cues that are the focus of the third experiment of this dissertation: young children's knowledge about the properties of objects, namely animacy and familiarity, which indicate they are being singled out as individuals rather than as category members. These cues may help infants to identify which words they hear are likely to be proper names.

Animate/human properties of the labeled object. Certain kinds of objects may be better candidates than others for being labeled by proper names. Macnamara (1982, 1986) argued that children are sensitive to the fact that proper names should be used to label objects that they consider to be important as individuals. In contrast, objects considered to be somewhat interchangeable with other members of the same kind should be less likely to be labeled with proper names. Which objects are considered to be important enough to deserve a proper name? Research suggests that both children and adults tend to include living entities and their surrogates in this category, although adults also include some kinds of artifacts and other kind of things (such as boats, places, and hurricanes) to the list (e.g., Hall, et al., 2004). Therefore, it is possible that young infants may find animate objects (such as people and pets) or animate surrogates (such as dolls and stuffed animals) to be better candidates for receiving proper name labels than inanimate objects (such as cups or shoes) when first learning the proper-name-to-individual-object link.

Consistent with the data reported by Hall et al. (2004), many studies have shown that young children use the animacy cues associated with a labeled object when interpreting a novel label. In fact, 2-year-old children have been reported to be more likely to acquire proper names for dolls, human-like creatures, and stuffed animals (including bears, cats, dogs, dolphins, monkeys, penguins, rabbits, seals, squirrels, and mosquito-like creatures) than for artifacts (including bottles, balls, balloons, blocks, boats, cars, cups, hats, honey dippers, kaleidoscopes, plastic plumbing objects, ships, shoes, spoons, shuttlecock, trains, vegetable peelers, and wands) (e.g., Gelman & Taylor, 1984; Hall, 1991, 1994, 1996; Hall & Graham, 1999; Hall et al., 2001; Imai & Haryu, 2001; Jaswal & Markman, 2001; Katz et al., 1974; Liittschwager & Markman, 1993;

Sorrentino, 2001). Recall that in Katz et al., children were taught a novel word modelled linguistically as a proper name for either one of two dolls or one of two blocks. When asked to select an object for the referent of the word, girls who were on average 22 months of age and boys who were on average 28 months of age were more likely to choose the labeled object after hearing it applied to a doll than after hearing it applied to a block. Recall also that Gelman and Taylor (1984) found converging results with children with an average age of 30 months. Children were shown four objects (two stuffed animals and two blocks) and taught a novel proper name for one of the stuffed animals or one of the blocks. At test, children were asked to perform actions with the referent of the label. After hearing a count noun, children generalized the label to the other object of the same category as the labeled object. After hearing a proper name, children were more likely to restrict their choice to the labeled object if it was a stuffed animal than if it was a block, suggesting that they used the animacy cues when interpreting novel words.[2]

Sorrentino (1999) has proposed that it may not be animacy per se that is important for children when determining which objects deserve to be labeled with proper names, but rather whether the object is capable of having mental states. In one study, she presented 30-month-olds with an artifact and either described it as having "likes" and "wants" or described some physical qualities of the object. In both cases, the object was labeled with a novel proper name. Children were more likely to interpret the label as a

[2] Recall that in both studies (Katz et al. 1974; Gelman & Taylor, 1984), the two objects of the same category were contrasting in some properties such as colour, leaving the possibility that children were not interpreting the novel word as a proper name referring to the individual object, but as an adjective or a count noun, referring to a property or a restricted category.

proper name, referring to the individual object, if it was described as having "likes" and "wants" than if some physical qualities were described.

It is also possible that infants consider humans or human surrogates to be particularly likely to be singled out as individuals and, therefore, to deserve to be labeled with proper names. Tincoff and Jusczyk (1999) tested 6-month-old infants on a preferential-looking procedure and reported an early understanding of an association between "mommy" and "daddy" and visual displays of their parents. In one experiment, infants were presented with videos of their own father and mother, accompanied by audio presentation of the word "daddy" or "mommy." Infants looked more at the named than at the unnamed parent. In a second experiment, infants were presented with videos of a male stranger and a female stranger along with audio presentation of the words "daddy" or "mommy." Results indicated that 6-month-olds showed no preference for looking at either video in either case. The authors argued that comprehension of labels referring to salient animate figures such as one's parents may begin earlier than comprehension of labels for other familiar objects. Note that although this experiment does not provide evidence of an understanding of the proper-name-to-individual-object link at this age (or perhaps even of a word-object link), it does point to the possibility that the saliency of certain objects such as important animate figures (like people) may make them more likely to be considered as particularly important to track through time and space and, eventually, to be labeled with proper names.

Nelson (1973) also reported that the words "mommy" and "daddy" were often cited among children's first words (see also Dale & Fenson, 1996). Thus, it is possible that early in development, infants consider humans (or human surrogates) as the most

likely recipients of proper names. The roles of animacy cues and cues to personhood were examined in Experiment 3 by comparing infants' likelihood of learning a novel proper name for a human surrogate or an animal surrogate, as opposed to an inanimate object.

Familiar object can be labeled with proper names. A final non-linguistic cue that has been shown to be used by children to help learn proper names is the object's familiarity. Several studies have found that if 2-year-olds are familiar with a labeled object (i.e., if they know a count noun label for it), they will be more likely to learn a proper name for it than if they are unfamiliar with the object (e.g., Hall, 1991; Imai & Haryu, 2001).

For example, Hall (1991) presented children with a mean age of 32 months with either an unfamiliar or a familiar object and labeled it with a novel proper name. In the unfamiliar condition, children heard a label for an unfamiliar monster (e.g., "See this? This is ZAV"). In the familiar condition, a familiar stuffed animal was similarly labeled (e.g., "See this? This is ZAV"). Finally, in the familiar-explicit condition, the same stuffed animal was labeled with a known count noun and the novel proper name (e.g., "See this cat? This is ZAV"). This last condition was included to investigate whether the explicit use of a known category term would affect children's performance. At test, children were presented with the labeled object, along with three other objects and asked to choose a referent for the label. In the unfamiliar condition, the other objects included another monster-like creature (identical to the labeled object except for the clothes it was wearing) and two distracter creatures (one familiar stuffed animal and a different monster-like creature). In the familiar and familiar-explicit conditions, the other objects

were another familiar stuffed animal (identical-looking except for the clothes it was wearing), and the same two distracter creatures as in the unfamiliar condition.

The results indicated that children were more likely to select the named object in the familiar and familiar-explicit conditions than in the unfamiliar condition. Note that by choosing the named object, it remains possible that children interpreted the word as an adjective labeling a property or as a count noun referring to a restricted category because the second object of the same category was not identical to the labeled object. Thus, the findings demonstrated that at an average age of 32 months, children have a tendency to make an object category interpretation when a proper name is used to refer to an unfamiliar object, but not when a proper name is used to refer to a familiar object (see also Imai & Haryu, 2001 for a recent replication of these findings).

The effect of an object's familiarity on word learning may be explained by the proposal that initial biases or constraints guide children's interpretation of novel words. The "object-kind bias" (or "taxonomic" and "whole object" constraints) has been suggested to help explain children's tendency to interpret a novel label applied to an unfamiliar object (an object for which the child has no count noun label) as referring to the object's category, regardless of the syntactic information accompanying the word (e.g., Markman, 1989, 1994; Markman & Hutchinson, 1984; Markman & Wachtel, 1988; Woodward & Markman, 1998).

However, not all words refer to objects as category members, and objects can be labeled with more than one word (e.g., we can refer to a dog using the words "dog", "Fido", or "spotted"). The "mutual exclusivity bias" proposes that children assume that objects have only one object category label (e.g., Markman, 1994). This bias leads infants

to be reluctant to accept a second label for the object category. Therefore, when children already have a count noun for an object (i.e., when the object is familiar), they are more likely to interpret another label as referring to something other than the category, such as the individual object itself. Similarly, the "contrast principle" proposed by Clark states that different words will contrast in meaning (e.g., Clark, 1987, 1988). Therefore, if a child knows the label "dog" and hears someone refer to a dog as "Fido," she might assume that "Fido" does not refer to the object's category, but rather to the individual object. The combination of these word learning biases can account for the familiarity effect shown in toddler's learning of novel words for familiar and unfamiliar objects. Until now, it has been unclear whether infants younger than 32 months on average use familiarity as a cue when learning the proper-name-to-individual-object link. This issue was addressed in Experiment 3 by examining 23-month-olds' interpretation of a novel word presented linguistically as a proper name for both a familiar object (such as a doll or a familiar stuffed rabbit) and an unfamiliar object (such as a smiling monster-like stuffed toy).

To summarize, the purpose of Experiment 3 was to investigate the basis of infants' learning of the proper-name-to-individual-object link by examining their sensitivity to certain object properties (such as animate/human properties, as well as familiarity) argued to be important for interpreting a novel object word as a label for an individual object. A novel contribution of Experiment 3 lies in the fact that the only previous study that has investigated the use of non-linguistic cues such as animacy by infants younger than 30 months of age tested girls (not boys) averaging 22 months of age, and used perceptually contrasting object but did not include identical objects (Katz et al.,

1974). As mentioned previously, an interpretative problem stems from the use of contrasting objects: Children selecting the labeled object as a referent for the novel proper name could be interpreting the label as a proper name, but could also be interpreting it as an adjective or as a count noun. Therefore, children in Experiment 3 were tested on some trials involving perceptually contrasting objects and on other trials involving perceptually identical objects. In addition, this study is the first to compare human surrogates to animal surrogates directly.

As a whole, the present investigation of infants' understanding of the count noun/proper name distinction addressed the questions of *when* and *how* infants acquire the knowledge of lexical-category-to-meaning links involving count nouns and proper names. Experiments 1 and 2 addressed an important discrepancy observed in previous research regarding the emergence of these links. Studies using contrasting objects and a manual search method have found that girls averaging 17 months of age show an understanding of the distinction between count nouns and proper names (e.g., Katz et al., 1974), whereas studies using identical objects with a similar procedure have found success only at an average age of 23 to 24 months (e.g., Hall et al., 2001), and studies using identical objects with a looking behaviour measure reported success at an average age of 20 months of age (Bélanger & Hall, 2006). To determine whether this age disparity was due to methodological differences between studies unrelated to the use of contrasting and identical objects, infants with a mean age of 14 to 23 months were tested with the *same* reaching procedure, including some trials involving perceptually contrasting objects and other trials involving identical objects. The teaching phase of the task was designed to maximize the learning of the label by its interactive nature and by

ensuring that the infants heard the label multiple times and in multiple linguistic contexts. In Experiment 3, the basis of this understanding of proper names in children with a mean age of 23 months of age was explored by manipulating the animate/human properties of the object and the familiarity of the object and examining the effect of these manipulations on infants' interpretation of novel proper name labels. The findings from the three experiments presented in this dissertation help to specify the time-course of the acquisition of an understanding of lexical category-to-meaning connections in the lexicon, and to shed light on the mechanisms by which an appreciation of these connections is mastered.

Chapter 2: Learning Count Nouns and Proper Names: Evidence from 17-, 20-, and 23-Month-Olds

Recall the discrepancy in findings reported in the previous literature regarding the question of when infants first use lexical category information to distinguish between count nouns and proper names. Katz et al. (1974) reported evidence that girls who were on average 17 months of age have an understanding of the links between these two lexical categories and their meanings with a task using perceptually contrasting objects. However, subsequent investigations using a task with perceptually identical objects have failed to replicate this finding with boys and girls younger than 23 months of age on average with reaching behaviour as a dependent measure (e.g., Hall et al. 2001) and with boys and girls younger than 20 months of age on average with looking behaviour as a dependent measure (Bélanger & Hall, 2006). The main goal of this experiment was to clarify this discrepancy by investigating whether the differences in findings were due to task differences unrelated to the use of contrasting or identical objects or whether they reflected the fact that an understanding of the count noun/proper name distinction appears earlier when the labeled object contrasts in its properties with other objects of the same kind.

In this experiment, infants were presented with some trials involving perceptually contrasting objects, and with other trials involving identical objects. This methodological manipulation was carried out to help determine whether infants distinguish count nouns from proper names at an earlier age when the objects involved in the task are perceptually contrasting than when they are identical.

In addition, to help uncover when infants first understand the count noun/proper name distinction, a fixed method was used to test infants from three age groups (averaging 17, 20, and 23 months), thereby allowing for direct comparisons between the different groups.

Recall that another methodological difference that could account for the discrepancy between the findings reported in Katz et al.'s (1974) original study and Hall et al.'s task and Bélanger and Hall's (2006) experiments was the social setting of the experiments. Infants tested in the original Katz et al. task could rely on social-pragmatic cues because of the more social and interactive setting, whereas infants in the Bélanger and Hall task could not use these types of cues since the experimenter was hidden behind a curtain during the procedure. In Hall et al. (2001, Experiments 1 to 4), although infants saw the experimenter at all times, they were mere observers and were never given the opportunity to interact with the experimenter and the objects. In Experiments 5 and 6 (which yielded success with boys who were 23 months on average and failure with girls who were 20 months on average), children were given the opportunity to interact with the labeled object twice, which is less than in Katz et al., where children interacted with the object five times. The task used in this experiment was thus designed to be similar to the one used by Katz and colleagues and was therefore highly interactive in nature, with the experimenter being in full view of the infant, and with the infant participating actively by manipulating the stimuli while learning the novel label.

Finally, a further reason for the discrepancy in findings outlined above may be related to the richness of the linguistic context provided during the teaching of the novel label. Recall that in results reported in Hall et al. (2001, Experiment 5), boys with a mean

age of 23 months succeeded in distinguishing between count nouns and proper names only when presented with nine repetitions of the label (compared to five in the previous experiments), in a richer and more elaborate linguistic context where the label was used in a multitude of sentence frames (compared to one in previous experiments). Therefore, it is possible that an even richer and more elaborate linguistic context would allow younger infants to demonstrate an understanding of the count noun/proper name distinction. Therefore, in this experiment, to facilitate the learning of the novel label, the task was designed with an extended teaching phase and included 18 repetitions of the novel label in as many different linguistic contexts.

We used human surrogates (i.e., dolls) as stimuli in order to maximize the possible non-linguistic cues that may promote the interpretation of a novel label applied to an object as referring to the object as an individual in its own right. In fact, dolls have two important properties (animate/human properties and familiarity) that have been shown to be used by young children when learning proper names (see Chapter 1).

Method

Participants

A total of 96 infants participated in this experiment. There were 32 infants in the 17-month age group (16 males; 16 females, with a mean age of 17.13 months and a range of 16.00 to 18.98 months), 32 infants in the 20-month age group (16 males; 16 females, with a mean age of 20.58 months and a range of 19.00 to 21.98) and 32 infants in the 23-month age group (16 males; 16 females, with a mean age of 23.21 months and a range of

22.00 to 25.16).[3] Half the infants were assigned to the count noun (CN) condition, and half were assigned to the proper name (PN) condition. There were eight males and eight females in each condition. An additional 40 infants were tested but excluded from the final sample for failing to complete the task (N = 26), because of parental interference (N = 2), because the parent reported that the child was regularly exposed to another language than English (N = 3), because of distracting noises coming from outside the room (N = 1), or because of experimental or recording equipment error (N = 8). Participants were recruited through advertisements placed in local media, as well as through local community centres and public libraries. Parents visited a research centre at the university psychology department and were reimbursed for parking and/or travel expenses. Infants received a t-shirt and a certificate of appreciation at the end of their visit. All infants were exposed primarily to English and were from middle-class or upper-middle-class homes.[4]

Stimuli

Two triads of dolls were used. In each triad, there were two identical-looking dolls and one contrasting doll (in hair, skin, and clothes colour). The dolls measured approximately 30 cm high. One of the triads consisted of female dolls, and the other consisted of male dolls (see Figure 2.1). Half the participants in each condition were randomly assigned to the female dolls stimuli and half were assigned to the male dolls stimuli.[5]

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[3] The age group labels (i.e., 17-month, 20-month, and 23-month age groups) were chosen to most accurately represent the mean attained age in months by infants in each age group.

[4] Parental reports indicated that infants heard English at least 80% of the time they were exposed to language.

[5] As in Hall et al. (2001), dolls of both genders were included to control for any effects that could be due to the gender of the object.

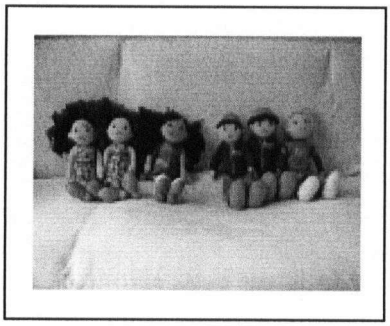

Figure 2.1: Picture of the stimuli used in Experiment 1.

To make the task more interesting for the infants, a small puppet was also used during the test trials. In addition seven prop objects were used during the teaching phase and the test trials (see Figure 2.2): A colourful box (14 cm high, 22 cm wide, and 30 cm deep), an orange truck (10 cm high and 23 cm long), a plastic spoon (13 cm long), a small plastic cup (8 cm high), a baby face cloth (10 cm x 10 cm wide), a custom-made slide with stairs (23 cm high, 16 cm wide, and 33 cm deep), and a small custom-made doll-size bed (30 cm long and 24 cm wide).

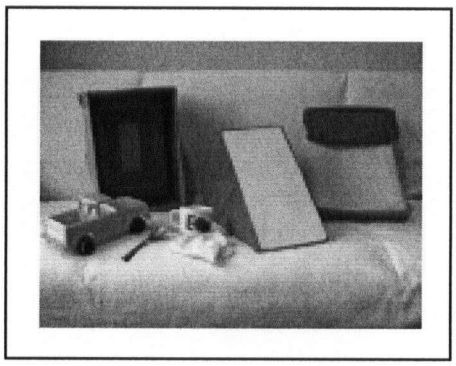

Figure 2.2: Picture of the seven prop objects used in Experiment 1 (from left to right, the truck, the box, the spoon, the cup, the cloth, the slide, and the bed).

Procedure

Before the beginning of the task, the experimenter explained the procedure to the parent and asked her to refrain from influencing the infant in any way during the testing. The parent and infant then followed the experimenter into the testing room where they were asked to sit at a table, facing the experimenter. In most cases, the infant sat on a booster seat directly across from the experimenter and the parent sat to the side. If the infant was too shy to sit on her own, she sat on her parent's lap in front of the experimenter. The table was 174 cm wide and 90 cm deep. Small pieces of transparent tape placed on the table indicated the placement of the dolls at the beginning and end of each test trial. Two of these markers were 30 apart and 24 cm from the edge of the table on the experimenter's side and two were also 30 apart, but 24 cm from the edge on the infant's side of the table.

At the beginning of the experiment, the experimenter introduced the three dolls and the puppet and let the infant play with them for approximately 30 seconds. The experimenter then removed the dolls and said that the puppet was tired and needed to go for a short nap, but that he would be back to play later.

The experiment was divided into two phases: the teaching phase and the testing phase.

Teaching phase. At the beginning of the teaching phase, the experimenter introduced one of the dolls and labeled it with a novel word. In the CN condition, the word was modeled syntactically as a count noun (e.g., "She's called a MOOPY. I'll put the MOOPY in the box"), and in the PN condition, the word was modeled syntactically as a proper name (e.g., "She's called MOOPY. I'll put MOOPY in the box") (see Figure 2.3,

Step 1). The only linguistic feature that distinguished these two conditions was the presence of determiners with the noun in the CN condition. The experimenter then followed a script during which she repeated the label 18 times in different linguistic contexts to teach the novel label to the infant (see Appendix A for full script). To make the teaching phase interactive and to familiarize the infant with the actions used during the testing phase, the experimenter performed seven actions with the doll. After demonstrating each action, the infant was asked to perform the same action. The seven actions were "put in the box," "drive the truck," "feed with the spoon," "give a drink with the cup," "clean with the cloth," "push down the slide," and "put in bed".

At the end of the teaching phase, a chair was placed on one of the markers on the experimenter's side of the table (the left/right position of the chair was counterbalanced between trials and across participants) and the experimenter sat the labeled doll on the chair (see Figure 2.3, Step 2). Another chair was placed on the second marker on the experimenter's side of the table and the experimenter placed the second doll on the chair (the identical doll was used on the identical test trials, whereas the perceptually contrasting doll was used on the contrast test trials) (see Figure 2.3, Step 3).

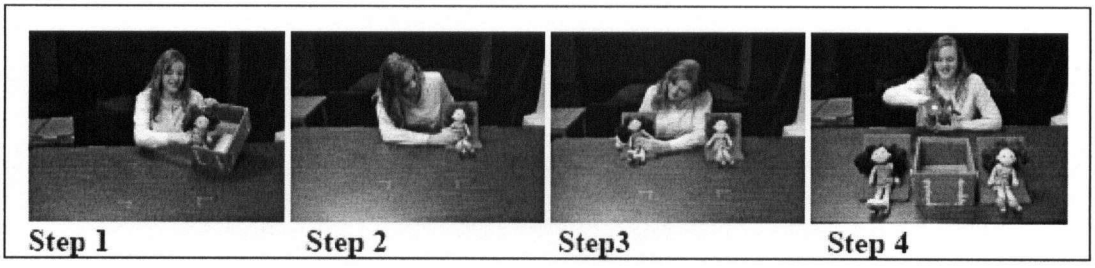

Figure 2.3: Procedure used on contrast trials in Experiment 1.

Testing phase. The experimenter then introduced the puppet and the testing phase begun. The testing phase was divided into two test trials: a contrast test trial and an

identical test trial. The order of the test trials was counterbalanced across participants such that half of the participants completed the contrast trial first and the other half completed the identical trial first. Using the puppet, the experimenter continued to follow the script, asking four test questions (e.g., "Can you put (a) MOOPY in the box?") and three filler questions (e.g., "Can you make one drive the truck?"), starting with a test question and then alternating between a test and a filler question (see Figure 2.3, Step 4).[6] After the first test trial, the experimenter removed all the objects from the table except for the labeled doll and started the second trial by re-introducing the labeled doll and naming it three more times. The experimenter then brought a chair back and placed it on the marker (if the chair had been placed on the left marker in the first trial, then it was placed on the right marker on the second trial) and sat the labeled doll on the chair. The other chair was placed on the second marker and the experimenter put the third doll (either contrasting or identical, whichever had not been used on the first trial) on the chair. The second test trial then proceeded exactly as the first trial. The session was videotaped for later coding. To be included in the final sample, children had to respond to at least two out of the four test questions for each test trial.

After the experiment, parents were asked to fill out the MacArthur Communicative Development Inventory (MCDI). The infant or toddler form was used, depending on the child's age.[7] This vocabulary checklist was used to determine whether infants in both conditions had equivalent vocabulary sizes and whether infants' performance on the task was related to their vocabulary sizes.

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[6] Filler questions were included to ensure that the infant felt that either doll could be chosen and therefore avoid the potentially awkward situation where the same doll had to be selected after each question.

At the end of the session, parents were thanked and children were given a t-shirt and a certificate of appreciation for their participation.

Coding

A trained researcher viewed the videotapes without sound and coded the infants' first object choices (the labeled object, the unlabeled object, or both objects) after each test and filler prompt. Muting the sound of the video clips ensured that the coder was blind to the condition of the participants. In order to count as a choice, the infant had to at least touch one of the objects. If the child picked both objects simultaneously, the trial was excluded from further analyses.[8] To assess inter-rater reliability, a second independent researcher, blind to condition, coded 25% of the participants in each condition, at each age group. Inter-rater reliability averaged 96%, ranging from 93% to 98% for each condition. All discrepancies were resolved through discussion.

Hypotheses

If infants have forged appropriate links between the novel label and its meaning, they should understand that when used as a count noun, the label refers to the object category and should be extended to other objects of the same category. Therefore infants should select either doll when asked for a referent of the novel label. On the other hand, they should understand that a proper name refers only to the labeled object and should not be extended to other objects of the same category. Therefore infants should select the labeled doll when asked for a referent of the novel label. In this two-object forced-choice

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[7] To allow comparisons across the two different versions of the forms, infants' percentile ranks were used instead of their raw scores.

[8] The number of trials on which infants chose both objects simultaneously was very low (less than one percent of trials in each condition). When the overall analyses were performed with these trials included, the effects were the same as when they were excluded. These trials were excluded to facilitate comparisons of infants' responses to chance levels.

task, the prediction was that, on the test trials, infants should choose the labeled doll more often in the PN condition than in the CN condition. On the filler trials, the prediction was that there should be no difference in the mean proportion of labeled-object choices in the PN and CN conditions, since infants are simply asked to choose an object.

These general predictions are mediated by expected age differences. Recall that the main goal of this experiment was to examine whether the differences in findings between Katz et al. (1974) and more recent studies (Bélanger & Hall, 2006; Hall et al., 2001) were due to task differences related to the use of perceptually contrasting and identical objects between these studies. In the current experiment, all age groups were tested on the same task, where the labeled doll was paired with a contrasting doll on half the trials (similarly to the task used in Katz et al.), and with an identical doll on the remaining trials (similarly to the task used in Hall et al.). If the age difference found in previous studies was due to methodological differences unrelated to the use of contrasting or identical objects, infants in this experiment should succeed or fail on both contrasting and identical trials at the same age since the same method was used for all age groups. On the other hand, if the discrepancy is related to the fact that contrast trials are somehow easier than identical trials, infants should succeed on contrast trials at an earlier age than on identical trials. In other words, after hearing a novel proper name, younger infants should select the labeled doll as a referent for the novel label at above-chance levels on contrasting trials only, whereas older infants should select the labeled doll at above-chance levels on both contrasting and identical trials.

Another factor that may influence infants' performance on the task is gender. Recall that Katz et al. (1974) and Macnamara (1982) reported an understanding of the

count noun/proper name distinction in girls with a mean age of 17 months, but found no evidence of such an understanding in boys before 28 months on average. Similarly, Hall et al. (2001) reported an earlier understanding of the lexical-category-to-meaning links involving count nouns and proper names in girls than in boys. In one experiment, girls with a mean age of 24 months succeeded, but boys with a mean age of 31 months failed. It was only with more exposure to the label that boys averaging 23 months of age succeeded in a separate experiment. Therefore, the current experiment will test whether girls show an earlier understanding of the count noun/proper name distinction than boys.

Finally, recall that Waxman and Markow (1995) concluded that lexical advances (measured by vocabulary production) are associated with 12-month-olds' greater sensitivity to the word-to-object-category linkage. To examine whether lexical advances would also have an effect on infants' sensitivity to the proper-name-to-individual-object linkage, their productive vocabulary scores from parental reports on the MCDI were examined. If higher productive vocabulary size is associated with an earlier understanding of this link, infants with high vocabulary scores should perform better on the task than same-age infants with lower vocabulary scores. If, on the other hand, productive vocabulary is not related to infants' understanding of the proper-name-to-individual-object link, there should be no difference between the performance of infants with high vocabulary scores and same-age infants with low vocabulary scores.

Results

An initial examination of the number of completed trials in each condition was conducted with a one-way analysis of variance (ANOVA) performed on the number of completed trials (out of a possible of eight trials) with label condition (CN and PN) as the

between-subject factor. This analysis yielded no significant difference between the number of trials completed by infants in the CN condition (M = 7.20, SD = 1.01) and in the PN condition (M = 7.50, SD = .77), $F(1, 94) = 3.30$, $p = .07$, $d = .30$, indicating that infants found the task engaging and that they completed most trials appropriately in both conditions.

A 3 × 2 × 2 × 2 mixed ANOVA was performed with age group (17-month, 20-month, and 23-month age groups), gender (male and female), and label condition (CN and PN) as between-subjects factors, and trial type (contrasting and identical) as a within-subjects factor.[9] The dependent measure was the mean proportion of completed test trials on which infants chose the labeled object.

The ANOVA yielded a significant main effect of label condition, $F(1, 84) = 36.08$, $p < .001$, $\eta_p^2 = .30$, which was mediated by a significant Label × Age Group interaction, $F(2, 84) = 3.86$, $p = .025$, $\eta_p^2 = .08$. There was also a near-significant trial type main effect, $F(1, 84) = 3.80$, $p = .055$, $\eta_p^2 = .04$, indicating that infants tended to select the labeled object more often on the contrast trials (M = .63, SD = .32) than on identical trials (M = .52, SD = .35). No other main effects or interactions were significant, including the main effect of gender, $F(1, 84) = 2.63$, $p = .11$, $\eta_p^2 = .03$, and all interactions involving gender, indicating that girls performed no differently than boys on this task.

[9] Trial type order (i.e., whether infants completed a contrast or identical trial first) was also included as a factor in an initial ANOVA, but no effect involving this factor was significant, $F(1, 72) = .38$, $p = .54$, $\eta_p^2 = .005$. The order in which the trials were presented thus did not affect infants' performances at test. As a result, the factor was dropped from the analysis.

To examine the significant Label × Age Group interaction, simple main effects were performed at each age group independently, comparing infants' performance in the CN and PN conditions. Infants in the 17-month age group showed no significant difference in their object choices in the CN (M = 0.53, SD = 0.12) and PN (M = 0.63, SD = 0.24) conditions, $F(1, 28) = 3.21$, $p = .08$, $\eta_p^2 = 0.10$. However, significant differences in object choices emerged in the 20-month age group, $F(1, 28) = 7.68$, $p = .01$, $\eta_p^2 = 0.21$, and in the 23-month age group, $F(1, 28) = 40.24$, $p < .001$, $\eta_p^2 = 0.59$. Infants in the 20-month age group chose the labeled object significantly more often in the PN condition (M = 0.69, SD = 0.17) than in the CN condition (M = 0.47, SD = 0.18). This difference was also apparent with the infants in the 23-month age group: They chose the labeled object more often in the PN condition (M = 0.75, SD = 0.14) than in the CN condition (M = 0.42, SD = .18) (see Figure 2.4).

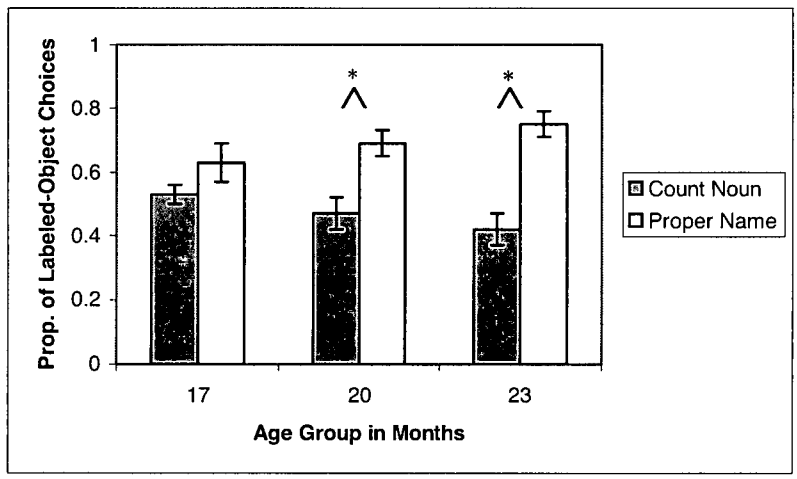

Fig. 2.4: Mean proportion of labeled-object choices on test trials in the CN and the PN conditions by infants in the 17-, 20-, and 23-month age groups (* indicates a significant difference in scores between the CN and PN conditions, $p < .05$).

A similar pattern of results emerged when we classified infants as being consistent labeled-object choosers according to whether they selected the labeled object on at least 75% of completed trials (see Table 2.1). In the 17-month age group, there were 6 consistent labeled-object choosers in the PN condition (4 boys, 2 girls), compared to 1 in the CN condition (1 girl). In the 20-month age group, 8 infants were classified as being consistent labeled-object choosers in the PN condition (3 boys, 5 girls), whereas only 1 was classified as such in the CN condition (1 boy). Finally, in the 23-month age group, 9 infants fell in the consistent labeled-object choosers' category in the PN condition (5 boys, 4 girls), compared to 1 in the CN condition (1 girl).

Age Group	*Label Condition*	*Number of Consistent Labeled-Object Choosers (out of 16)*
17-month	CN	1
	PN	6
20-month	CN	1
	PN	8
23-month	CN	1
	PN	9

Table 2.1: Number of infants in the 17-, 20-, and 23-month age groups classified as consistent labeled-object choosers in the CN and PN conditions.

Chi-square tests (with Yates' correction for continuity) yielded significant effects of label condition in the 20-month age group, χ^2 (1, N = 32) = 5.57, p = .02, w = .47 and in the 23-month age group, χ^2 (1, N = 32) = 7.13, p = .008, w = .54, but not in the 17-month age group, χ^2 (1, N = 32) = 2.93, p = .09, w = .38.

Together, the results from the ANOVA and the Chi squares tests reveal not only that infants in the 20- and 23-month age group selected the labeled object significantly more often in the PN condition than in the CN condition, but also that they were significantly more likely to be consistent in choosing the labeled object in the PN condition than in the CN condition.

To examine infants' responses on the filler trials (i.e., when infants were asked to select "one" object to perform an action), a 3 × 2 × 2 mixed ANOVA was performed with age group (17-month, 20-month, and 23-month age groups) and label condition (CN and PN) as between-subjects factors, and trial type (contrasting and identical) as a within-subjects factor. The dependent measure was the mean proportion of completed filler trials on which infants chose the labeled object. The ANOVA yielded no significant main effects or interactions, indicating that, as predicted, there was no difference between the mean proportion of labeled-object choices in the CN condition and in the PN condition across age groups (see Figure 2.5).[10]

[10] The analysis yielded no significant main effect of age group [$F(2, 79) = .67$, $p = .52$, $\eta_p^2 = .02$], of label [$F(1, 79) = .26$, $p = .62$, $\eta_p^2 = .003$], or trial type [$F(1, 79) = .23$, $p = .64$, $\eta_p^2 = .003$].

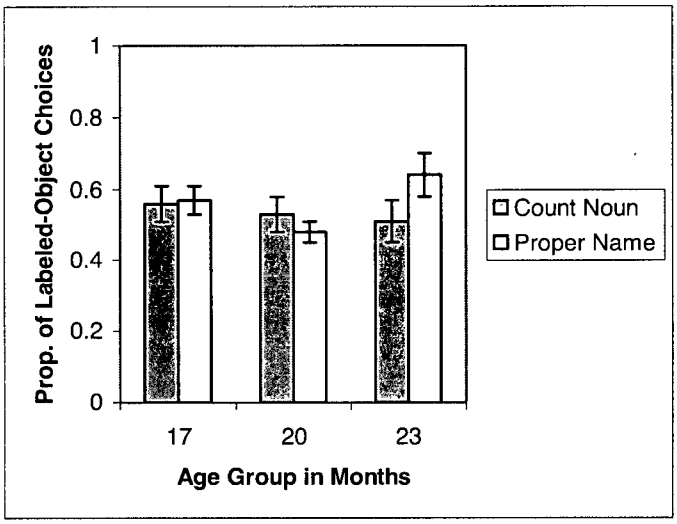

Figure 2.5: Mean proportion of labeled-object choices on filler trials in the CN and the PN conditions by infants in the 17-, 20-, and 23-month age groups.

Recall the prediction that if the discrepancy in age found between previous studies was due to methodological differences unrelated to the use of contrasting and identical objects, infants in this experiment should have restricted a novel proper name to the labeled doll or extended it to a second doll on both contrasting and identical trials at the same age. Alternately, if the discrepancy was related to the fact that contrast trials were somehow easier than identical trials, infants should have restricted a novel proper name to the labeled doll on contrast trials at an earlier age than on identical trials. To examine which prediction was supported by infants' reaching behaviour in this experiment, single-sample t-tests were performed comparing infants' mean proportions of labeled-object choices on contrast and identical trials to chance levels (see Figure 2.6).

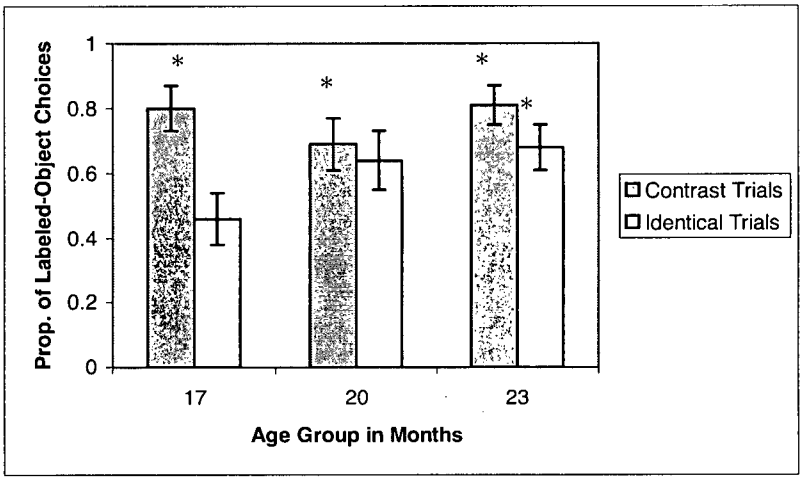

Figure 2.6: Mean proportions of labeled-object choices on contrast and identical test trials in the PN condition by infants in the 17-, 20-, and 23-month age groups (* indicates that the mean proportion is significantly above chance, $p < .05$).

Because the task was a two-object forced-choice task, chance was defined as 0.50.[11] After hearing a novel proper name, infants in the 17-month age group chose the labeled object significantly more often than expected by chance alone on contrast trials ($M = 0.80$, $SD = 0.29$), $t(15) = 4.07$, $p = .001$, $d = 1.03$ whereas on identical trials, the mean proportion of labeled-object choices ($M = 0.46$, $SD = 0.32$) did not differ from chance, $t(15) = -0.53$, $p = .60$, $d = .13$. Similarly, infants in the 20-month age group also selected the labeled object at above-chance levels on contrast trials ($M = 0.69$, $SD = 0.32$), $t(15) = 2.42$, $p = .03$, $d = .59$ but not on identical trials ($M = 0.64$, $SD = 0.35$), $t(15) = 1.57$, $p = .14$, $d = .40$. Only the oldest age group picked the labeled object significantly more often than expected by chance on both contrasting ($M = 0.81$, $SD = 0.25$), $t(15) = 4.88$, $p < .001$, $d = 1.24$ and identical trials ($M = 0.68$, $SD = 0.29$), $t(15) = 2.67$, $p = .02$, d

[11] Recall that in less than one percent of trials in each condition, infants chose both objects simultaneously, but those trials were excluded from these analyses.

= .62. Therefore, the age discrepancy found in previous studies can be explained by the fact that the task involving contrasting objects was in some sense easier than the one involving identical objects. In the current study, infants averaging 17 months of age (and for the first time, both girls and boys) demonstrated an understanding of the proper-name-to-individual-object link on contrast trials but not in identical trials.

Production vocabulary scores were computed based on parents' responses in the infant or toddler version of the MCDI. To verify that infants in the CN and PN conditions within each age group did not differ in terms of reported vocabulary size, three separate independent samples t-tests were performed on the percentile rank calculated on infants' productive vocabulary raw scores at each age group independently. There was no significant difference between the productive vocabulary percentile rank of the infants in the 17-month age group in the CN condition (M = 35.80, SD = 28.30) and in the PN condition (M = 48.33, SD = 29.79), $t(28) = 1.81$, $p = .25$, $d = .43$, between the percentile ranks of the infants in the 20-month age group in the CN condition (M = 48.10, SD = 26.06) and in the PN condition (M = 32.50, SD = 40.08), $t(14) = -0.95$, $p = .36$, $d = .47$, or between the vocabulary sizes of the infants in the 23-month age group in the CN condition (M = 52.87, SD = 29.32) and in the PN condition (M = 52.86, SD = 31.98), $t(28) = -0.002$, $p = .99$, d = .00.

To examine the possibility that children with higher vocabulary scores performed better than those with low vocabulary scores (cf. Waxman & Markow, 1995), infants were categorized as high vocabulary if their percentile ranks were 50% or above and as low vocabulary if their ranks were below 50% (see Table 2.2 for number of infants in each category). A 4-way mixed ANOVA with age group (17-month, 20-month, and 23-

month age groups), label condition (CN and PN), and vocabulary category (high vocabulary and low vocabulary) as between-subjects factors and trial type (contrast and identical) as a within-subjects factor yielded no significant main effect of vocabulary, $F(1, 64) = 1.07$, $p = .31$, $\eta_p^2 = .02$, and no significant interactions involving vocabulary.[12] Therefore whether infants were categorized as being high vocabulary or low vocabulary did not seem to be related to their proportion of labeled object choices at test.[13]

Age Group	*Label Condition*	*Number of Infants in the High Vocabulary Category*	*Number of Infants in the Low Vocabulary Category*	*Total Number of Infants*[14]
17-month	CN	8	8	16
	PN	6	9	15
20-month	CN	7	7	14
	PN	6	8	14
23-month	CN	9	7	16
	PN	8	6	14

Table 2.2: Number of infants classified as "high vocabulary" and "low vocabulary" in each condition.

[12] The analysis yielded no significant interactions involving vocabulary, including the Vocabulary × Label interaction, $F(1, 64) = 1.86$, $p = .18$, the Vocabulary × Age Group interaction, $F(2, 64) = .90$, $p = .41$, and the Vocabulary × Trial Type interaction, $F(1, 64) = .92$, $p = .34$.

[13] The same pattern of results were obtained after categorizing infants as low vocabulary if their rank was 25% or lower and as high vocabulary if their rank was 75% or higher. The ANOVA yielded no significant effect of vocabulary on object choices, $F(1, 18) = .014$, $p = .91$. Similarly, there were no significant correlations between infants' vocabulary percentile rank and their object choices overall, $r(35) = -.081$, $p = .62$, on contrast trials, $r(35) = .073$, $p = .68$, or on identical trials, $r(35) = -.119$, $p = .50$.

[14] The data are missing for a total of seven infants because their parents failed to return the MCDI form.

Discussion

The main goal of this experiment was to examine the reasons for a noted discrepancy found in previous research. Results from previous studies have yielded a disparity in terms of the age at which infants successfully extended a novel count noun to another object of the same category, and restricted a novel proper name to a labeled object. More specifically, in a seminal study, girls with a mean age of 17 months showed evidence of an understanding of the distinction between count nouns and proper names when tested on a task involving perceptually contrasting objects (Katz et al., 1974). More recent studies using a task with perceptually identical objects have not replicated this result with infants younger than 23 months of age on average with a reaching task (Hall et al. 2001) and 20 months of age on average with a looking task (Bélanger & Hall, 2006).

This experiment examined whether this discrepancy was due to methodological differences between these studies unrelated to the use of contrasting or identical objects or whether it indicated that an understanding of the lexical-category-to-meaning links involving count nouns and proper names appears earlier when the test involves objects contrasting in their perceptual properties. This discrepancy was addressed by studying infants from three different age groups on an interactive task including trials with perceptually contrasting dolls and trials with perceptually identical dolls. If the inconsistency in findings is due to task differences unrelated to the use of contrasting or identical objects, infants within each age group should not have differed in their responses on contrasting and identical trials. If, on the other hand, the discrepancy reflects the fact that the use of perceptually contrasting objects somehow facilitates

infants' interpretation of proper names, infants should have succeeded on contrast trials earlier than on identical trials.

The results were consistent with the second possibility: Infants restricted a novel proper name to the labeled doll on contrast trials earlier than on identical trials. Specifically, infants in the 17- and 20-month age groups who heard a novel proper name labeling a doll restricted the word to the labeled doll when the second doll was perceptually contrasting, but not when the second doll was identical. Infants in the 23-month age group restricted a novel proper name to the labeled doll regardless of whether the second doll was contrasting or identical. Therefore, the age discrepancy found in previous studies does appear to have been due to task differences between the studies related to the use of contrasting or identical object pairs. Possible explanations for this difference will be discussed in detail in Chapter 5.

When infants' object choices on both types of trials were combined in an overall analysis, the results suggested that infants in the 20- and 23-month age groups (but not in the 17-month age group) distinguished appropriately between novel labels presented linguistically as count nouns and those presented linguistically as proper names (when their responses were combined across contrast and identical trials). In other words, when infants in the 20- and 23-month age groups were presented with a doll and heard it labeled with a novel word presented linguistically as a proper name, they subsequently did not extend it to a second doll, suggesting that they understood that proper names refer to individual objects. However, when the same label was presented linguistically as a count noun, infants were more likely to extend it to a second doll, indicating that they interpreted the word as referring to the object category (perhaps the category "doll").

Another factor included in this experiment was gender. Recall that Katz et al. (1974) reported an understanding of the count noun/proper name distinction in girls at 17 months on average, but no earlier than 28 months of age on average in boys. Also, Hall et al. (2001) reported an earlier understanding of the above distinction in girls than in boys. In one version of their task (Experiments 2 and 4), girls succeeded at an average age of 24 months, whereas boys did so only at an average age 31 months. In a subsequent experiment (Experiment 5), boys showed an understanding of the lexical-category-to-meaning links involving count nouns and proper names at an average age of 23 months, but only after being given more exposure to the label. However, there was no evidence of any gender effects in the current experiment. In fact, this experiment provided the first reported evidence that boys with an average age below 20 months understand the proper-name-to-individual-object link. It is possible that the use of an engaging and interactive task during which a novel label was repeated several times in a multitude of different linguistic contexts allowed the boys in this study to demonstrate an understanding of the count noun/proper name distinction.

A final factor examined in this experiment was productive vocabulary size. The motivation for studying this variable was a previous finding that suggested that lexical advances were associated with infants' greater sensitivity to the word-to-object-category linkage (Waxman and Markow, 1995). However, results from this experiment did not support this hypothesis. Infants classified as "high vocabulary" (50^{th} percentile rank or higher on the MCDI) did not perform any better on the task than another group of same-age infants classified as "low vocabulary" (lower than 50^{th} percentile rank on the MCDI).

Therefore, infants' productive vocabulary was not related to their understanding of the proper-name-to-individual-object link.

To summarize the main findings and contributions of this experiment, the discrepancy in the age at which infants have been reported to have an understanding of the lexical-category-to-meaning links involving count nouns and proper names was explained by showing that infants do in fact succeed earlier at demonstrating this understanding in the *same* task when perceptually contrasting objects are used than when identical objects are used (at an average age of 17 months as opposed to 23 months). Tracking an individual doll labeled with a proper name when it is paired with a contrasting doll is in some sense easier for infants than tracking the *same* doll labeled with the *same* proper name when it is paired with an identical doll. Possible reasons for this finding will be explored further in Chapter 5. Furthermore, this experiment contains the first evidence that boys with an average age below 20 months will restrict a novel proper name to an individual object.

The findings from this experiment leave us with another question: Given evidence that infants with an average age of 17 months *do* succeed at distinguishing count nouns from proper names on contrast trials, could we find even earlier success using contrasting dolls? Experiment 2 presented in the following chapter addressed this question by testing infants with a mean age of 14 months on the same procedure as the one used in Experiment 1.

Chapter 3: Learning Count Nouns and Proper Names: Evidence from 14-Month-Olds

The previous experiment provided evidence that girls and boys with a mean age of 17 months have an understanding of a distinction between count nouns and proper names when tested using a task involving perceptually contrasting objects. This experiment further examined the emergence of the count noun/proper name distinction in infants by testing younger infants on the same task presented in the previous chapter. Although there have been no previous empirical reports of an understanding of this particular distinction before 16 or 17 months of age, evidence of an earlier understanding of a semantic distinction between count nouns and words from other lexical categories such as verbs and adjectives has been reported. Recall that Echols and Marti (2002) and Waxman and her colleagues (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001) reported a partial understanding of the distinction between words presented linguistically as count nouns and those presented linguistically as verbs or adjectives by infants as young as 13 or 14 months of age. In addition, recall that Nelson (1973) reported that 24% of the first 10 words produced by the infants in her study (ranging in age between 13 and 19 months) were words for specific individuals such as *mommy* and *daddy*. Also, lexical norms compiled for the MCDI indicated that between 53% and 56% of 12-month-olds were reported to produce a word to refer to their own mother or father (Dale & Fenson, 1996). In addition, on average, 91% of 9-month-old infants were reported by their parents to understand *mommy* or *daddy* (Dale & Fenson). It is therefore possible that by a mean age of 14 months, infants have the beginnings of an understanding of the count noun/proper name distinctions as well.

Method

Participants

Thirty-two infants were included in this 14-month age group (16 males; 16 females, with a mean age of 14.60 months and a range of 13.23 to 15.98 months) participated in this experiment.[15] An additional 12 infants were tested but excluded from the final sample for failing to complete the task (N = 10), because the parent reported that the child was born several weeks prematurely (N = 1), or because of experimenter error (N = 1). Eight males and eight females were randomly assigned to each condition. Participants were recruited through advertisements placed in local media, as well as through local community centres and public libraries. Infants were exposed primarily to English and were from middle-class or upper-middle-class homes.[16]

Stimuli

The stimuli were the same as those in Experiment 1.

Procedure

The procedure was the same as in Experiment 1 with one exception. The order of the trials was held constant across all infants; that is, we did not counterbalance which type of trial infants received first. All infants were given the contrast trial first and the identical trial second. There were two reasons for this procedural change:

(1) We were mainly interested in these younger infants' responses on the contrast trial since this is the only trial on which infants in the 17-month age group were successful. There was no reason to expect that the infants in the 14-month age

[15] As in Experiment 1, the age group label (i.e., 14-month age group) was chosen to most accurately represent the mean attained age in months by infants in the age group.

group would succeed on the identical trials since infants in the 17-month age group (and even those in the 20-month age group) had failed on these trials to distinguish between count nouns and proper names in the previous experiment. However, both types of trials were included to allow for comparisons with older age groups on the task.

(2) After pilot testing with this age group, it became evident that the task was lengthy for these younger infants. In fact, more than a third of them could complete only the first trial.

Because of the younger age of this group and because of their shorter attention span, we did not require that they complete both trials in order to be included in the final analyses. To be included, infants had to respond to at least two test prompts on the contrast trial only.

Prior to the experiment, parents were asked to fill out the infant version of the MCDI. At the end of the visit, the family was thanked, and children were given a t-shirt and a certificate of appreciation for their participation.

Coding

The video clips were coded in the same way as in Experiment 1.[17] Inter-rater reliability on 25% of the video clips was calculated to be 94% (93% in the CN condition and 95% in the PN condition). All disagreements were resolved through discussion between the two coders.

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[16] Parental reports indicated that infants heard English at least 80% of the time they were exposed to language.

[17] None of the infants in this experiment chose both objects simultaneously at test.

Hypotheses

If 14-month-old infants have forged appropriate links between the novel label and its meaning, they should understand that when used as a count noun, the word refers to the object category and should be extended to other objects of the same category. On the other hand, they should understand that a proper name refers solely to the labeled object and should not be extended to other objects. Therefore, the first prediction was that infants would be more likely to select the labeled object in the PN condition than in the CN condition. On the filler trials, there should be no difference in the mean proportion of labeled-object choices in the PN and CN conditions since infants are simply asked to choose an object.

The results of Experiment 1 suggested that the age difference found in previous studies (Bélanger & Hall, 2006; Hall et al., 2001; Katz et al., 1974) was due not to methodological differences unrelated to the use of contrasting or identical objects, but rather to the fact that contrast trials were somehow easier than identical trials. Therefore, a second prediction in the current experiment was that infants would be more likely to succeed on contrast trials than on identical trials. In other words, infants should select the labeled doll as a referent for the novel label more often after hearing a proper name than after hearing a count noun on contrasting trials only.

As mentioned in the previous experiment, another factor that may influence infants' performance on the task is gender (e.g., Hall et al., 2001; Katz et al., 1974; Macnamara, 1982). Gender was therefore included as a factor in this experiment to examine the possibility that girls would outperform the boys on the task. Finally, also as in the previous experiment, the relationship between productive vocabulary and infants'

performance on the task was also examined in this experiment (cf. Waxman and Markow, 1995). If higher productive vocabulary size is associated with an earlier understanding of the proper-name-to-individual-object link at a mean age of 14 months, infants with high vocabulary scores should perform better on the task than infants with lower vocabulary scores. If, on the other hand, productive vocabulary is not related to these infants' understanding of the proper-name-to-individual-object link, there should be no difference between the performance of infants with high vocabulary scores and those with low vocabulary scores.

Results

To begin, a one-way ANOVA performed on the number of completed trials (out of a possible of eight trials) yielded no significant difference between the number of trials completed by infants in the CN condition (M = 6.06, SD = 1.69) and in the PN condition (M = 6.06, SD = 1.84), $F(1, 30) = 0.00$, $p = 1.0$, $\eta_p^2 = .00$, indicating that infants on average completed more than three quarters of the trials in both conditions.

A 2 × 2 × 2 mixed ANOVA was performed with gender (male and female) and label condition (CN and PN) as between-subjects factors, and trial type (contrasting and identical) as a within-subjects factor. The dependent measure was the mean proportion of completed trials on which infants chose the labeled object at test. This analysis yielded no significant main effects or interactions (see Figure 3.1). Of note, there was no significant difference between the number of labeled-object choices in the CN (M = 0.47, SD = 0.22) and PN (M = 0.50, SD = 0.15) conditions, $F(1, 24) = 0.01$, $p = .97$, $\eta_p^2 = .00$. Also, there was no significant main effect of gender, $F(1, 24) = 1.50$, $p = .44$, $\eta_p^2 = .03$ or trial type, $F(1, 24) = .83$, $p = .37$, $\eta_p^2 = .03$.

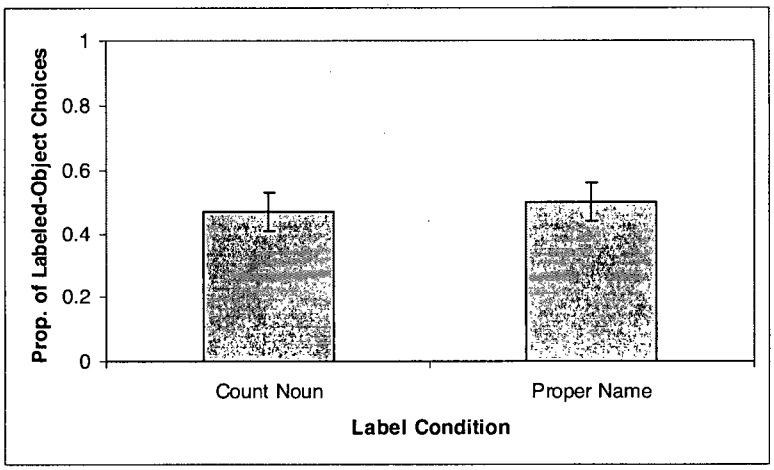

Figure 3.1: Mean proportion of labeled-object choices on test trials in the CN and PN conditions in the 14-month age group.

A similar pattern of results emerged when we classified infants as being consistent labeled-object choosers according to whether they selected the labeled object on at least 75% of completed trials (see Table 3.1). In this age group, there were 2 consistent labeled-object choosers in the CN condition, and 1 in the PN condition. Chi-square tests (with Yates' correction for continuity) yielded no significant effect of Label condition, $\chi^2(1, N = 32) = 0.00$, $p = 1.0$, $w = .05$. Therefore, infants in the 14-month age group were no more likely to choose the labeled object in the PN condition than in the CN condition, nor were they more likely to be consistent labeled-object chooser in the PN condition than in the CN condition.

Age Group	*Label Condition*	*Number of Consistent Labeled-Object Choosers*
14-month	CN	2
	PN	1

Table 3.1: Number of infants in the 14-month age group (out of 16 per condition) classified as consistent labeled-object choosers in the CN and PN conditions.

To examine infants' responses on the filler trials (i.e., when infants were asked to select "one" object to perform an action), a 2 × 2 mixed ANOVA was performed with label condition (CN and PN) as between-subjects factors, and trial type (contrasting and identical) as a within-subjects factor. The dependent measure was the mean proportion of completed filler trials on which infants chose the labeled object. The ANOVA yielded no significant main effects or interactions, indicating that, as predicted, there was no difference between the mean proportion of labeled-object choices in the CN condition and in the PN condition, $F(1, 21) = 0.25$, $p = .62$, $\eta_p^2 = .01$ (see Figure 3.2).

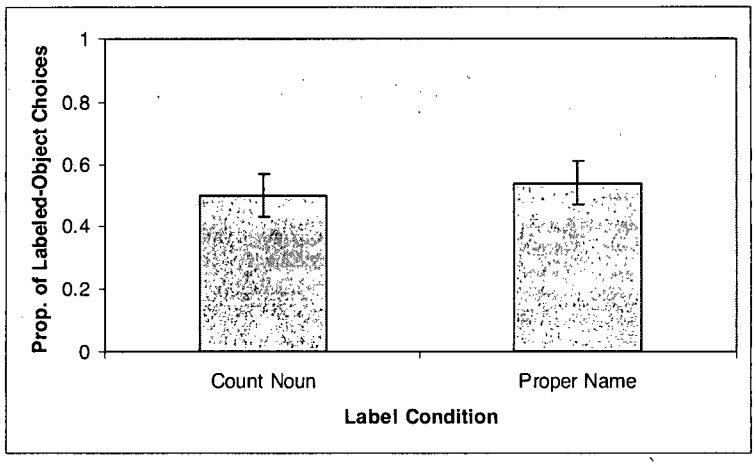

Figure 3.2: Mean proportion of labeled-object choices by infants in the 14-month age group on filler trials in the CN and PN conditions.

To address the second prediction that infants in the 14-month age group would be more successful on the contrast trials than in the identical trials, single-sample t-tests were performed comparing infants' mean proportions of labeled-object choices after hearing a proper name on contrast and identical trials to chance levels (see Figure 3.3). As in Experiment 1, chance was defined as 0.50. The prediction was not supported. After hearing a novel proper name, infants chose the labeled object at chance on contrast trials

(M = 0.58, SD = 0.37), $t(15) = 0.90$, $p = .38$, $d = .22$, and on identical trials (M = 0.40, SD = 0.37), $t(13) = -1.03$, $p = .32$, $d = .27$. However, notice that although the difference is not significant, it is nonetheless in the expected direction: The average proportion of labeled-object choices was 18% higher on the contrast trials than on the identical trials.

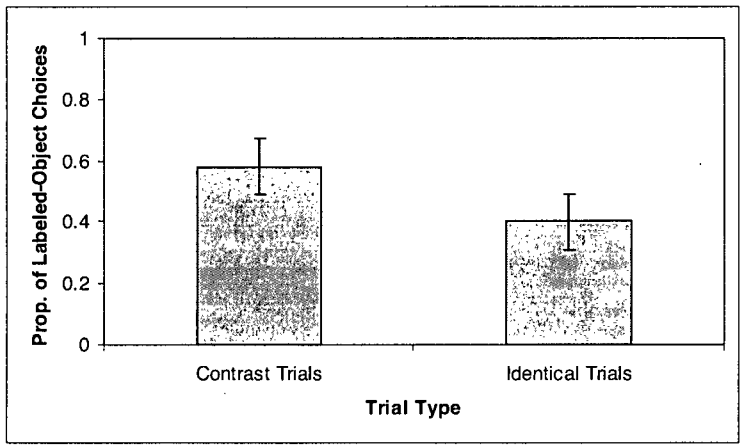

Figure 3.3: Mean proportions of labeled-object choices by infants in the 14-month age group on contrast and identical test trials in the PN condition.

In addition, production vocabulary scores were computed based on parents' responses in the infant version of the MCDI. To verify that infants in each condition did not differ in terms of reported vocabulary size, an independent samples t-test was performed on the percentile rank calculated on infants' productive vocabulary raw scores in the CN condition and in the PN condition. There was no significant difference between infants' productive vocabulary percentile rank in the CN condition (M = 40.57, SD = 32.92) and in the PN condition (M = 39.19, SD = 28.95), $t(28) = -.12$, $p = .90$, $d = .04$.

To examine the possibility that infants with higher vocabulary scores performed better than those with low vocabulary scores, infants were categorized as high vocabulary if their percentile rank was 50% or above and as low vocabulary if their rank was below

50% (see Table 3.2 for the number of infants in each category). A 3-way mixed ANOVA with label condition (CN and PN), and vocabulary category (high vocabulary and low vocabulary) as between-subjects factors and trial type (contrast and identical) as a within-subjects factor yielded no effect of vocabulary on infants' mean proportion of labeled object choices, $F(1, 23) = .10$, $p = .75$, $\eta_p^2 = .004$.[18]

Age Group	*Label Condition*	*Number of Infants in the High Vocabulary Category*	*Number of Infants in the Low Vocabulary Category*	*Total Number of Infants*[19]
14-months	CN	6	8	14
	PN	6	10	16

Table 3.2: Number of infants classified as "high vocabulary" and "low vocabulary" in each condition.

Discussion

This experiment was conducted to examine whether 17 months is the youngest mean age at which infants can demonstrate an understanding of the count noun/proper name distinction. As discussed previously, there has been no previous experimental study reporting that infants with an average age below 16 or 17 months understand this distinction. However, one reason to believe that younger infants may have an understanding of this distinction (although perhaps an immature one) is research reported by Echols and Marti (2002) and Waxman and her colleagues (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001), indicating that infants as young as 13 or

[18] The same pattern of results was obtained after categorizing infants as low vocabulary if their rank was 25% or lower and as high vocabulary if their rank was 75% or higher. The ANOVA yielded no significant effect of vocabulary on object choices, $F(1, 7) = 3.27$, $p = .11$. Similarly, there were no significant correlations between infants' vocabulary percentile rank and their object choices overall, $r(16) = .47$, $p = .07$, on contrast trials, $r(16) = -.08$, $p = .39$, or on identical trials, $r(14) = .50$, $p = .07$.

14 months of age on average show a partial understanding of the lexical-category-to-meaning links involving verbs and adjectives. In addition, recall that reports based on infants' productive vocabularies by Nelson (1973) and Dale & Fenson (1996) suggested proper name understanding and production by infants between the ages of 9 and 12 months (though these reports have not been verified experimentally).

Results from this experiment provided no evidence that infants in the 14-month age group can distinguish between novel words presented linguistically as count nouns and those presented linguistically as proper names. When asked to select a referent for the novel label, infants who heard a proper name label did not restrict their choices to the labeled object, but rather seemed to extend it to a second doll. Also, contrary to prediction, even in the case where the dolls were perceptually contrasting, infants in the 14-month age group (unlike those in the 17- and 20-month age groups in the previous experiment) did not demonstrate a significant distinction between their understanding of words presented linguistically as proper names and those presented as count nouns. Moreover, girls did not perform any better than boys on this task. Therefore, these data suggest that an understanding of the count noun/proper name distinction emerges some time between 14 and 17 months of age on average, at an age up to four months older than the reported age of the initial emergence of an understanding of the count noun/verb and the count noun/adjective distinctions (e.g., Booth & Waxman, 2003; Echols & Marti, 2002; Waxman, 1999; Waxman & Booth, 2001).

The following chapter describes a third experiment focusing on how infants acquire distinctions between count nouns and proper names. If 23 months is the youngest

[19] The data are missing for a total of two infants because the parents failed to return the MCDI form.

mean age at which we see clear evidence of an appropriate understanding of the count noun/proper name distinction (i.e., on both contrast and identical trials), then it is of interest to learn more about how infants of this age might have arrived at this understanding. In particular, the following experiment examined the role of object properties (such as animate/human properties of the object and object familiarity) on infants' interpretation on novel proper names at an average age of 23 months, by manipulating these properties on a task similar to the one described in the first two experiments. In a word learning situation, young children and infants may use these object properties to help identify objects that might be more likely to be bearers of proper names, therefore simplifying the task of learning which words are proper names.

Chapter 4: Non-Linguistic Cues in Learning Proper Names

The previous two experiments help to chart the emergence and development of an understanding of the count noun/proper name distinction. Findings from these experiments suggest that an adult-like understanding of the proper-name-to-individual link is in place at a mean age of 23 months. The present experiment examined how such an understanding might have been achieved. As discussed earlier, Waxman (e.g., Waxman, 1998, 2004) has argued that when infants interpret novel words such as count nouns and adjectives, they initially rely on a mechanism that leads them to extract commonalities (both category-based and property-based) across labeled objects. Infants then start to notice the correlations between words from different lexical categories (count nouns, adjectives, and verbs) and their associated types of commonalities, allowing them to learn the different lexical-category-to-meaning links in their language. Data reported by Echols and Marti (1999) were also consistent with the hypothesis that infants extract commonalities (although this time, across events instead of objects) to learn novel verbs. However, this account cannot explain how infants acquire the link between proper names and individual objects, because in order to learn proper names, infants must have the ability to interpret a novel word as applying to an individual object itself, and not to a commonality among objects or actions. This experiment examined the possibility that infants use non-linguistic cues to help identify a novel word as a proper name designating an individual object.

Previous research has identified several types of non-linguistic cues used by children with an average age of 28 months (17 months for girls) to 4 years when interpreting a novel proper name as labeling an individual object. For example, by 4 years

of age, children appear to be biased to assume that a novel proper name does not apply to an object that already has a proper name (e.g., Hall & Graham, 1999). However, infants cannot rely on this type of information when first learning the proper-name-to-individual link since it implies a prior understanding of proper names. In addition, when no clear lexical class information is provided, children with a mean age of 37 months use a novel label's range of reference to guide interpretation. They interpret a novel word as a proper name if it is used to refer to one object rather than across sets of objects but as a count noun (or adjective) if it is applied to two objects of the same kind (e.g., Hall, 1996; Hall & Bélanger, 2005).

The current experiment focused on the role played by two other types of non-linguistic cues in the emergence of the proper-name-to-individual-object link. First, children between the mean ages of 28 months (17 months for girls) and 30 months have been shown to use animate and human properties of labeled objects as a cue that the objects are being singled out as individuals and that the labels should be interpreted as proper names (e.g., Gelman & Taylor, 1984; Hall, 1994; Katz et al., 1974; Liittschwager & Markman, 1993). However, these studies used sets of contrasting objects and did not include sets of identical objects, therefore leaving open the possibility that children interpreted the novel proper name as an adjective or as a count noun. This experiment investigated whether infants with a mean age of 23 months, the youngest age group to show a mature understanding of the proper-name-to-individual-object link, use these object properties when interpreting novel words in a task involving trials with contrasting objects and trials with identical objects.

It is possible that the comprehension of labels referring to salient animate figures such as one's parents begins earlier than the comprehension of labels for other familiar objects. This claim is consistent with reports that infants' first productive words commonly contain terms for people (Dale & Fenson, 1996; Nelson, 1973). For example, in her longitudinal study of 18 children, Nelson reported that the two most common words produced among the first 10 words were *mommy* and *daddy*. However, previous research that has investigated young children's use of animate properties of labeled objects to help them learn proper names has not studied the role of human properties separately from other animate properties such as the ones found in animals (e.g., Gelman & Taylor, 1984; Hall, 1994; Katz et al., 1974; Liittschwager & Markman, 1993). In some of these studies, human surrogates (i.e., dolls) have been used, whereas in others, animal surrogates (i.e., stuffed animals) have been used, but no study has directly compared children's ability to learn proper names for these two types of stimuli. The current experiment examined the role of animate/human properties of objects in infants' interpretation of novel proper names at a mean age of 23 months, by comparing their willingness to interpret a novel proper name appropriately for a doll (representing people), a rabbit (representing an animate non-human), and a toy airplane (representing an inanimate object).

Second, children averaging 32 months of age have been shown to be more likely to interpret a novel label as a proper name if they are familiar with the object (i.e., if they already know a count noun label for the object) than if the object is unfamiliar (e.g., Hall, 1991; Imai & Haryu, 2001). The current experiment also examined whether object familiarity could be an important cue for infants with a mean age of 23 months in

acquiring the lexical-category-to-meaning link between proper names and individual objects by comparing infants' willingness to interpret a proper name appropriately for an unfamiliar animate object (i.e., a novel monster) and for a familiar one (i.e., a doll or a stuffed rabbit).

Method

Participants

Sixty-four children (32 males; 32 females, with a mean age of 23.42 months and a range of 22.00 to 24.98) participated in this experiment.[20] An additional 12 infants were tested but excluded from the final sample for failing to complete the task (N = 4), because of parental interference (N = 2), because the parent reported that the child was regularly exposed to a language other than English (N = 2), or because of experimental or recording equipment error (N = 4). Sixteen participants were randomly assigned to each of the four stimulus conditions: doll (mean age = 23.38 months), rabbit (mean age = 23.68 months), monster (mean age = 23.23 months), and airplane (mean age = 23.38 months). Eight males and eight females were assigned to each condition. Participants were recruited through advertisements placed in local media, as well as through local community centres and public libraries. Children were exposed primarily to English and were from middle-class or upper-middle-class homes.[21]

Stimuli

Two triads of dolls, one triad of stuffed rabbits, one triad of unfamiliar monsters, and one triad of toy airplanes were used (see Figure 4.1). As in Experiments 1 and 2, each

[20] As in Experiments 1 and 2, the age group label (i.e., 23-month age group) was chosen to most accurately represent the mean attained age in months by infants in the age group.

triad was composed of two identical-looking objects and one contrasting object (contrasting in colour). The dolls were the same as those used in Experiments 1 and 2 were used. One of the triads consisted of female dolls, and the other consisted of male dolls. Half the participants in the doll condition saw the female dolls and half saw the male dolls. The monsters measured approximately 12 cm high, the stuffed rabbits were 20 cm high, and the toy airplanes were 7 cm high.

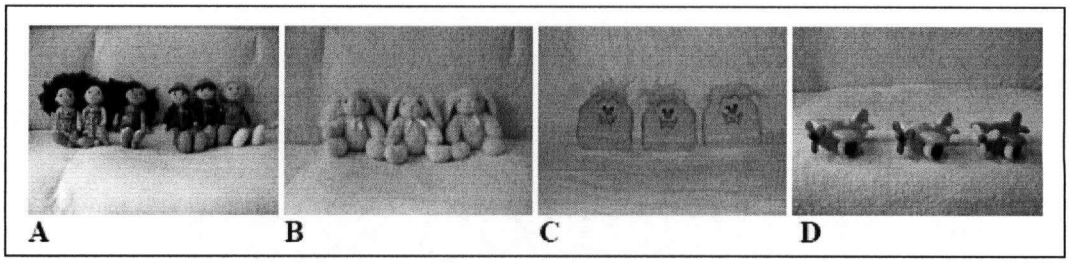

Figure 4.1: Pictures of the stimuli used in Experiment 3. (Picture A shows the two triads of dolls used in the doll condition, picture B shows the triad of stuffed rabbits used in the rabbit condition, picture C shows the unfamiliar monsters used in the monster condition, and picture D shows the inanimate toy airplanes used in the airplane condition).

The triad of monsters was designed to look animate (with two eyes, a nose, a smiling mouth, and hair on their head), but did not resemble any known animal. Dolls, rabbits, and airplanes were chosen in part because they were very likely to be familiar objects to the infants. In their large scale study examining lexical norms in English-speaking North American infants using parental reports (for the MCDI), Dale and Fenson (1996) stated that 72% of 23-month-olds were reported to produce a word to refer to dolls, 91% produced a word to refer to rabbits (toys or real), and 87% produced a word to refer to airplanes (toys and real). Based on the parental reports on the MCDI in this

[21] Parental reports indicated that infants heard English at least 80% of the time they were exposed to language.

experiment, 12 of 16 infants in the doll condition were reported to produce a word to refer to dolls, 14 out of 16 infants in the rabbit condition were reported to use a consistent word to pick out rabbits, and 16 out of 16 infants in the airplane condition were reported to have a word in their productive vocabulary to refer to airplanes. These numbers are likely conservative estimates of the number of infants who were familiar with these terms since vocabulary production lags behind comprehension (e.g., Dale & Fenson; Nelson, 1973). It is therefore possible that the four infants whose parents reported they had yet to produce a word to refer to dolls and the two infants whose parents reported they did not produce a word to refer to rabbits, were familiar with a category term for those objects. After the experiment, parents were asked if their infants ever played with dolls or stuffed rabbits. Three of the four parents of the infants reported to lack a word in the productive vocabulary for dolls reported that their infants owned dolls and played with them on a regular basis (the data for the fourth infant are missing). One of the two parents of the infants reported to lack a word for rabbit in his productive vocabulary reported that the child owned a stuffed rabbit (the data are missing for the second infant). These results suggest that the vast majority, if not the totality of the infants in the doll, rabbit, and airplane conditions were familiar, at least in comprehension, with the words "doll" and "rabbit" (or other equivalent words) respectively.

As in Experiments 1 and 2, a small puppet was used during the test trials to make the task more interesting for the infants. A series of seven prop objects was used to perform actions with the objects during the teaching phase and the test trials (see Figure 4.2). Some of the props and parts of the script used in the previous experiments were replaced in this experiment because they were not appropriate for use with inanimate

objects. We therefore replaced the spoon with a blanket (40 cm long and 31 cm wide), and the script was modified to avoid using mental state verbs (e.g., Sorrentino, 1999) or verbs such as drinking that would apply felicitously only to animate objects.

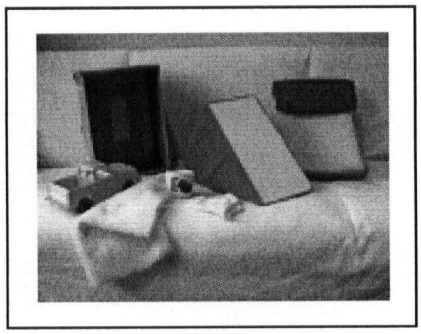

Figure 4.2: Picture of the prop objects used in Experiment 3 (from left to right, the truck, the blanket, the box, the cup, the cloth, the slide, and the bed).

Procedure

The procedure was similar to the one used in Experiments 1 and 2, with the following two differences: (1) all infants heard novel labels presented linguistically as proper names, and (2) the script was slightly modified to be equally appropriate for use with animate and inanimate objects (see Appendix B for full script). The label used in this experiment was either MOOPY or BLICKY.

After the experiment, parents were asked to fill out the MCDI, toddler form. As in previous experiments, this vocabulary checklist was used to determine whether infants in all four conditions had equivalent vocabulary sizes and whether infants' performance on the task was related to their vocabulary sizes. At the end of the session, parents were thanked and children were given a t-shirt and a certificate of appreciation for their participation.

Coding

The video clips were coded in the same way as in Experiment 1. In order to count as a choice, the infant had to at least touch one of the objects. If the child picked both objects simultaneously, the trial was excluded from further analyses.[22] Inter-rater reliability on 25% of the video clips in each condition was calculated to be 96% (97% in the doll condition, 95% in the rabbit condition, 98% in the monster condition, and 94% in the airplane condition). All disagreements were resolved through discussion between the two coders.

Hypotheses

First, if infants are sensitive to the fact that certain objects (i.e., ones that have animate/human properties) are more likely to be labeled with proper names, they were expected to show a difference in their interpretation of novel proper names used to label objects differing in their animate/human properties. Specifically, they were expected to be more likely to interpret a novel proper name as referring to an individual object if it was used to label a doll or a rabbit than if it was used to label an inanimate object such as an airplane. Second, if infants perceive humans and human surrogates to be particularly important as individuals, they were predicted to be more likely to map a novel proper name onto a doll (human surrogate) than onto another animate object such as a stuffed rabbit.

[22] The number of trials on which infants chose both objects simultaneously was very low (less than one percent of trials in each condition). When the overall analyses were performed with these trials included, the effects were the same as when they were excluded. These trials were excluded to facilitate comparisons of infants' responses to chance levels.

Third, if infants use object familiarity as a cue to restrict the possible meanings of a novel label, they were expected to be more likely to map novel proper names appropriately to familiar animate surrogate objects (i.e., dolls and rabbits) than to unfamiliar ones (i.e., monsters). To summarize these three predictions, infants were expected to choose the labeled object more often in the doll and rabbit conditions than in the monster and the airplane conditions, and they were expected to choose the labeled doll more often in the doll condition than in the rabbit condition. On the filler trials, no difference was expected in the mean proportion of labeled-object choices between the four stimulus conditions since infants were simply asked to choose an object.

Based on the results from the infants in the 23-month age group in Experiment 1 with dolls, infants were expected to choose the labeled object at above-chance levels when the objects were perceptually contrasting (on contrast trials) and when they were identical (on identical trials). However, this prediction pertained only to the doll and rabbit conditions, given the previous hypotheses that infants would not interpret the novel proper name as referring to an individual object in the monster and airplane conditions. In addition, since the script used in this experiment replaced all mental state verbs that were used in Experiment 1 by neutral verbs that could be used felicitously with inanimate objects (thereby reducing the cues to animacy), the overall tendency to select the labeled object in the doll condition was expected to be lower than the tendency to do so in the PN condition in Experiment 1.

As in Experiments 1 and 2, gender was included as a factor to examine whether girls performed better than boys on the task. Although no gender differences were found in Experiments 1 and 2 of this dissertation, recall that Katz et al. (1974) and Macnamara

(1982), and Hall et al. (2001) reported an understanding of the count noun/proper name distinction earlier in girls than in boys.

Finally, similarly to Experiments 1 and 2, this experiment examined the relationship between productive vocabulary size and infants' performance on the task. No evidence of such a relationship was observed in Experiments 1 and 2, but recall that Waxman and Markow (1995) found that productive vocabulary size was associated with 12-month-olds' greater sensitivity to the word-to-object-category linkage. Therefore, if higher productive vocabulary size is associated with an earlier understanding of the proper-name-to-individual-object link, infants with high vocabulary scores should perform better on the task than infants with lower vocabulary scores. If, on the other hand, productive vocabulary is not related to infants' understanding of this link, there should be no difference between the performance of infants with high vocabulary scores and infants with low vocabulary scores.

Results

To begin, a one-way analysis of variance (ANOVA) performed on the number of completed trials (out of a possible of eight trials) with stimulus condition (doll, rabbit, monster, and airplane) as a between-subjects factor yielded a significant effect of stimulus condition, $F(3, 63) = 3.11$, $p = .03$, $\eta_p^2 = .14$. On average, infants completed 7.81 trials (SD = 0.40) in the doll condition; 7.19 trials (SD = 1.05) in the rabbit condition; 7.88 trials (SD = 0.34) in the monster condition; and 7.69 trials (SD = 0.79) in the airplane condition. However, note that all means were very high: In each condition, at least 7 out of the 8 trials were completed on average, indicating that infants had no problems completing the task.

A 4 × 2 × 2 mixed ANOVA on the mean proportion of labeled object choices with stimulus condition (doll, rabbit, monster, airplane) and gender (male and female) as between-subjects factors, and trial type (contrast and identical) as a within-subject factor was per formed.[23] As in the previous experiments, the ANOVA yielded no significant main effect of gender $F(1, 56) = 3.22$, $p = .08$, $\eta_p^2 = .05$, or significant interactions involving gender. Consistent with the first hypothesis, there was a significant main effect of stimulus condition, $F(3, 56) = 14.40$, $p < .001$, $\eta_p^2 = 0.44$.

Follow-up Tukey post hoc comparisons yielded significant differences among the stimulus conditions. More precisely, infants selected the labeled object significantly more often in the doll condition (M = 0.73, SD = 0.15) than in the monster condition (M = 0.49, SD = 0.11), p < .05, or in the airplane condition (M = 0.48, SD = 0.14), p < .05. In addition, infants in the rabbit condition (M = 0.68, SD = 0.11) chose the labeled object significantly more often than the infants in the monster condition (M = 0.49, SD = 0.11), p < .05, and in the airplane condition (M = 0.48, SD = 0.14), p < .05. However, contrary to the second prediction, there was no difference in infants' mean proportion of labeled-object choices between the doll (M = 0.73, SD = 0.15) and rabbit (M = 0.68, SD = 0.11) conditions (see Figure 4.3). Notice, however, that the mean difference was in the predicted direction with the proportion of labeled-object choices being 5% higher in the doll condition than in the rabbit condition.

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[23] Trial type order (i.e., whether infants completed a contrast or identical trial first) was also included as a factor in an initial ANOVA, but no main effect or interaction involving this factor was significant. The order in which the trials were presented thus did not affect infants' performances at test. As a result, the factor was dropped from the analysis.

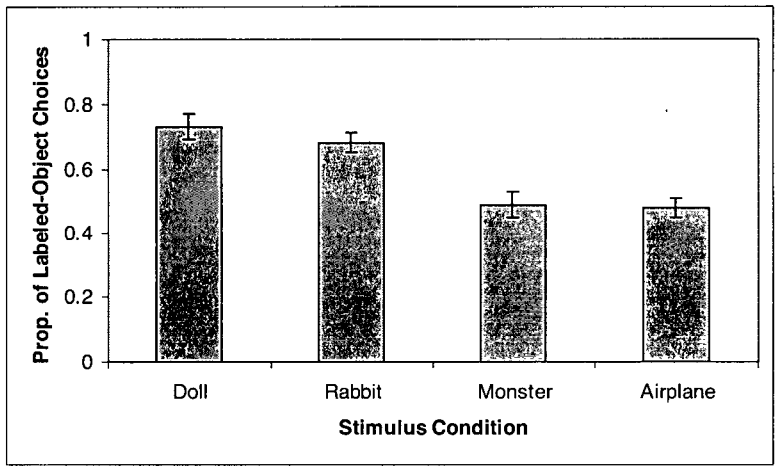

Figure 4.3: Mean proportions of labeled-object choices on test trials in the doll, rabbit, monster, and airplane conditions.

A consistent pattern of results emerged when we classified infants as consistent labeled-object choosers according to whether they selected the labeled object on at least 75% of completed trials. In the doll condition, 10 infants were categorized as consistent labeled-object choosers; in the rabbit condition, 7 infants fell into that category; and in both the monster and the airplane conditions, only 1 infant was classified as such (see Table 4.1).

Label Condition	*Number of Consistent Labeled-Object Choosers*
Doll	10
Rabbit	7
Monster	1
Airplane	1

Table 4.1: Number of infants (out of 16 per condition) classified as consistent labeled-object choosers in the doll, rabbit, monster, and airplane conditions.

First, an overall Chi-square test yielded a significant effect of stimulus condition, $\chi^2(3, N = 64) = 18.19, p < .001, w = .53$. To further investigate this effect of stimulus condition and to parallel the post hoc comparisons performed previously, a second series of Chi-square tests was performed, comparing the number of consistent labeled-object choosers in each stimulus condition to each other. Chi square tests revealed that there were significantly more consistent labeled-object choosers in the doll condition than in both the monster condition, $\chi^2(1, N = 32) = 8.87, p = .003, w = .59$, and the airplane condition, $\chi^2(1, N = 32) = 8.87, p < .003, w = .59$ (with Yate's correction for continuity). There were also significantly more consistent labeled-object choosers in the rabbit condition than in both the monster condition, $\chi^2(1, N = 32) = 4.17, p = .04, w = .43$, and in the airplane condition, $\chi^2(1, N = 32) = 4.17, p = .04, w = .43$ (with Yate's correction for continuity). Finally, there was no difference between the number of consistent labeled-object choosers in the doll and in the rabbit conditions, $\chi^2(1, N = 32) = .50, p = .49, w = .12$, or between the number in the monster and in the airplane conditions, $\chi^2(1, N = 32) = 0, p = 1, w = 0$. Therefore, not only were the infants in the doll and rabbit conditions more likely to choose the labeled object than infants in the monster and airplane conditions, they were also significantly more likely to be consistent in their tendency to do so.

To examine infants' responses on the filler trials (i.e., when infants were asked to select "one" object to perform an action), a 4 × 2 mixed ANOVA was performed with stimulus condition (doll, rabbit, monster, and airplane) as between-subjects factors, and trial type (contrasting and identical) as a within-subjects factor. The dependent measure was the mean proportion of completed filler trials on which infants chose the labeled object. The ANOVA yielded no significant main effects or interaction, indicating that

there was no difference between the mean proportions of labeled-object choices across stimulus conditions (see Figure 4.4).[24]

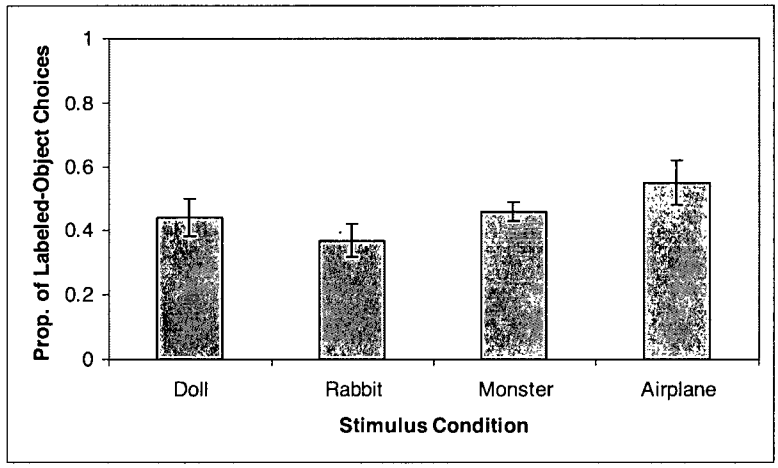

Figure 4.4: Mean proportions of labeled-object choices on filler trials in the doll, rabbit, monster, and airplane conditions.

To address the prediction that infants would choose the labeled object at above-chance levels on both contrast trials and identical trials in the doll and rabbit conditions, but not in the monster and airplane conditions, single-sample t-tests were performed, comparing infants' mean proportions of labeled-object choices on contrast and identical trials to chance levels (see Figure 4.5).

As in Experiments 1 and 2, chance was defined as 0.50. Results were consistent with Experiment 1 and with the ANOVA results of Experiment 3. As predicted, after hearing a novel proper name for a doll, infants chose the labeled object significantly more often than expected by chance alone on contrast trial (M = 0.75, SD = 0.27), $t(15) = 3.65$, $p = .002$, $d = .93$, and on identical trials (M = 0.71, SD = 0.18), $t(15) = 4.64$, $p < .001$, $d =$

[24] The analysis yielded no significant main effect of stimulus [$F(3, 60) = 1.71$, $p = .17$], or of trial type [$F(1, 60) = .64$, $p = .64$], and no significant Stimulus × Trial type interaction [$F(3, 60) = 1.07$, p = .37].

1.17. In addition, after hearing a proper name for a stuffed rabbit, infants also selected the labeled object significantly more often than chance on both contrast test trials (M = 0.68, SD = 0.17), $t(15) = 4.20$, $p < .001$, $d = 1.06$, and identical test trials (M = 0.69, SD = 0.27), $t(15) = 2.82$, $p = .01$, $d = .70$. However, after hearing a proper name for an unfamiliar monster, infants did not pick the labeled object at above-chance levels on the contrast test trials (M = 0.44, SD = 0.41), $t(15) = -.56$, $p = .58$, $d = .15$, or on the identical test trials (M = 0.55, SD = 0.40), $t(15) = .47$, $p = .65$, $d = .13$. The same result was observed for infants who heard a proper name for a toy airplane; they did not select the labeled object significantly more than expected by chance on the contrast test trials (M = 0.41, SD = 0.19), $t(15) = -1.98$, $p = .07$, $d = .47$, or on the identical test trials (M = 0.55, SD = 0.36), $t(15) = .52$, $p = .61$, $d = .14$.

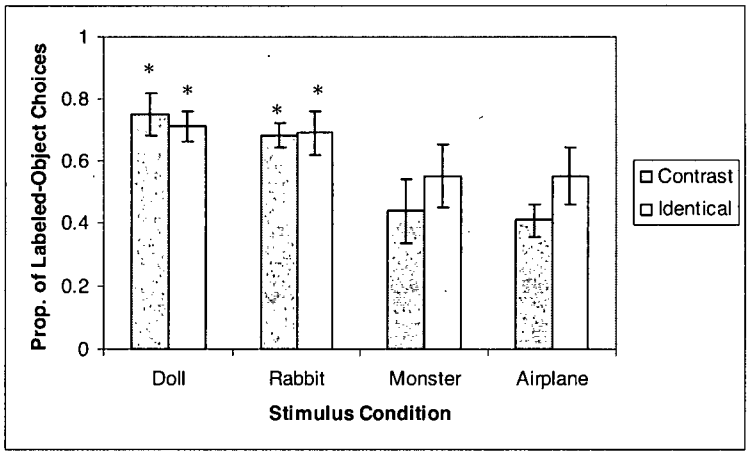

Figure 4.5: Mean proportions of labeled-object choices on contrast and identical test trials in the doll, rabbit, monster, and airplane conditions (* indicates that the mean proportion is significantly above chance, p < .05).

Production vocabulary scores were computed based on parents' responses on the toddler form of the MCDI. To verify that infants within each stimuli condition did not differ in terms of reported vocabulary size, we performed a 1-way ANOVA with stimulus

condition as the between-subjects factor and the percentile rank calculated on infants' productive vocabulary raw scores as the dependent measure. There was no significant difference between infants' mean reported productive vocabulary percentile ranks whether they were assigned to the doll condition (M = 43.19, SD = 27.40), the rabbit condition (M = 52.00, SD = 25.55), the monster condition (M = 44.75, SD = 32.02), or the airplane condition (M = 62.27, SD = 30.31), $F(3, 62) = 1.40$, $p = .25$, $\eta_p^2 = .07$.

As in the previous experiments, to examine the possibility that infants with higher vocabulary scores performed better than those with low vocabulary scores, they were categorized as high vocabulary if their percentile ranks was 50% or above and as low vocabulary if their rank was below 50% (see Table 4.2 for number of infants in each category). A 3-way mixed ANOVA with stimulus condition (doll, rabbit, monster, airplane), and vocabulary category (high vocabulary and low vocabulary) as between-subjects factors and trial type (contrast and identical) as a within-subjects factor yielded no effects of vocabulary category on infants' object choices, $F(1, 55) = .06$, $p = .82$, $\eta_p^2 = .001$.[25]

[25] The same pattern of results were obtained after categorizing infants as low vocabulary if their rank was 25% or lower and as high vocabulary if their rank was 75% or higher. The ANOVA yielded no significant effect of vocabulary on object choices, $F(1, 31) = 1.02.$, $p = .32$. Similarly, there were no significant correlations between infants' vocabulary percentile rank and their object choices overall in the doll condition, $r(16) = -.19$, $p = .49$, in the rabbit condition, $r(16) = -.38$, $p = .14$, in the monster condition, $r(16) = -.23$, $p = .39$, or in the airplane condition, $r(16) = .12$, $p = .66$.

Age Group	*Stimulus Condition*	*Number of Infants in the High Vocabulary Category*	*Number of Infants in the Low Vocabulary Category*	*Total Number of Infants*[26]
23-month	Doll	7	9	16
	Rabbit	9	7	16
	Monster	7	9	16
	Airplane	9	6	15

Table 4.2: Number of infants classified as "high vocabulary" and "low vocabulary" in each condition.

Discussion

This experiment examined whether infants with an average age of 23 months use their knowledge about animate/human properties of labeled objects to determine whether the objects are being singled out and labeled as individuals rather than as members of a category. The experiment also explored whether infants averaging 23 months of age are more likely to infer that a novel label refers to an individual object if the object is familiar. Although several studies have reported that children between the ages of 2 years and 4 years use object animacy and familiarity to interpret novel words presented linguistically as proper names (e.g., Gelman & Taylor, 1984; Hall, 1991, 1994; Hall et al., 1993; Hall et al., 2004; Imai & Haryu, 2001; Katz et al., 1974; Liittschwager & Markman, 1993; Markman & Wachtel, 1988), the use of these non-linguistic cues has never been investigated in children below two years of age. In addition, previous studies suffer from an interpretative problem because of the exclusive use of sets of objects that differed in some property: it remains unclear whether children who selected the labeled

[26] The data are missing for one infant because the parents failed to return the MCDI form.

object as a referent for the novel proper name interpreted the label as referring to the individual object or to a property or restricted category. In addition, no study has explored the possibility of an early bias to learn proper names for humans or human surrogates more easily than for animals or animal surrogates. In this experiment, infants with a mean age of 23 months were taught novel proper names for objects differing in their animate/human properties and in terms of whether the objects were familiar. They were then tested on their interpretation of the proper names in a task involving trials with pairs of contrasting objects and trials with pairs of identical objects.

Recall the prediction that by an average age of 23 months, infants' interpretation of a novel proper name would be influenced by the animate/human properties of the object. Infants were expected to restrict the proper name to an individual object if the word was used to label a surrogate animate object, but to extend the novel word to another object if it was used to label an inanimate object. Results were consistent with this prediction: Infants were more likely to select the labeled object when prompted for a referent of the novel proper name if the word was used to refer to a doll or a stuffed rabbit than if it was used to refer to a toy airplane.[27] However, contrary to the prediction that among animate objects, infants in the 23-month age group would consider humans or human surrogates (i.e., dolls) to be particularly worthy of being labeled with a proper name, there was no significant difference in infants' tendency to choose the labeled

[27] Note that infants did not restrict the word to the labeled object if it was used to refer to a novel surrogate animate object such as a novel monster. It could be argued that one reason that led to their failure to restrict the novel proper name to the labeled monster is that it did not display important animate properties such as visible limbs (allowing it to be self-propelled). However, although there were no visible limbs on the monster, it would not have been difficult to imagine that the creature had limbs hidden in its fur. Also, the monster possessed other animate properties such as two eyes, a nose, a smiling mouth, and hair on its head that were good indicators that the object was a surrogate animate. Therefore it seems unlikely that infants' failure to restrict the proper name to the labeled monster was due to a lack of animacy cues.

object at test if the word was used to label a doll or a stuffed rabbit. This result still leaves open the possibility that infants with an average age below 23 months perceive human surrogates as particularly important as individuals and therefore especially deserving of being labeled with proper names, and that infants aged 23 months or younger perceive real humans as being the most likely to be bearers of proper names.

The results of Experiment 3 were also consistent with the hypothesis about object familiarity: At an average age of 23 months, infants' interpretations of a novel proper name for an object were influenced by whether the object was familiar. They selected the labeled object as a referent of the proper name more often when it was a familiar object (i.e., a doll or a stuffed rabbit) than when it was an unfamiliar object (i.e., a novel stuffed monster). These results are consistent with reports of the mutual exclusivity bias in infants before 23 months of age (e.g., Markman, Wasow, & Hansen, 2003; Halberda, 2003). Yet, object familiarity was not sufficient for interpreting a novel proper name as labeling an individual. If the object was inanimate (i.e., a toy airplane), infants did not interpret the word as labeling an individual.[28] These results thus highlight the importance of both familiarity and animacy to the interpretation of novel proper names.

Finally, as expected and consistent with results from Experiment 1, infants interpreted novel proper names in an appropriate adult-like manner by restricting the label for a doll or a stuffed rabbit to the labeled object when the objects involved were both perceptually contrasting and identical. Therefore, by a mean age of 23 months, infants have forged appropriate links between proper names and individual objects when

[28] A discussion of how infants interpreted the label when it was paired with a toy airplane (in contrast to when it was paired with a novel monster) will be presented in Chapter 5.

the objects are animate and familiar, regardless of whether the objects used at test were perceptually contrasting or identical.

Chapter 5: General Discussion

The series of experiments reported in the previous chapters addressed the questions of when infants first show a clear understanding of the distinctions between the lexical categories of count nouns and proper names (Experiments 1 and 2), and how infants might come to reach this understanding (Experiment 3).

All experiments included an interactive teaching phase during which infants repeatedly heard a novel label for an object. At test, they were presented with the labeled object along with another object of the same category. The object of the same category was either perceptually contrasting or identical. Infants were asked to select a referent of the new word. Their interpretation of the novel label was assessed by examining their object choice following these requests.

Experiment 1: The Emergence of the Proper-Name-to-Individual-Object Link

In Experiment 1, a primary goal was to address a noted discrepancy in previous research concerning the age at which infants first show an understanding of the lexical-category-to-meaning links involving count nouns and proper names. Katz et al. (1974) used a task involving perceptually contrasting objects (i.e., dolls differing in hair and dress colour) and found evidence that girls with a mean age of 17 months had an understanding of the count noun/proper name distinction. However, more recent studies using a task with perceptually identical objects have failed to replicate this finding with infants younger than 23 months on average using a task involving reaching behaviour as a dependent measure (Hall et al., 2001) and with infants younger than 20 months on average with looking behaviour as a dependent measure (Bélanger & Hall, 2006). Experiment 1 of this dissertation attempted to clarify this discrepancy by investigating

whether the differences in findings were due to task differences unrelated to the use of contrasting or identical objects or to the fact that an understanding of the count noun/proper name distinction appears earlier when objects involved in the test have contrasting properties than when objects are identical. In the experiment, infants in 17-, 20-, and 23-month age groups were taught a novel word presented linguistically either as a count noun or as a proper name and were then tested on some trials involving perceptually contrasting objects, and on other trials involving perceptually identical objects. After hearing a novel count noun, infants of all age groups generalized the label to the second object, consistent with the possibility that they interpreted the label as a category term (i.e., as a count noun). However, striking differences emerged in infants' object choices after they heard a novel proper name.

First, infants' performance after hearing a novel proper name for a doll provided clear evidence that the age difference found in previous studies (e.g., Bélanger & Hall, 2006; Hall et al., 2001; Katz et al., 1974) was not due to task differences between those studies unrelated to the use of contrasting or identical stimuli. Instead, the age difference appears to reflect the fact that infants show an earlier success in the task when perceptually contrasting objects are used than when perceptually identical objects are used. More specifically, infants in the 17-month and 20-month age groups restricted the novel word to the labeled object at above-chance levels when the objects were perceptually contrasting, but not when they were identical. This was the first report of boys at such a young age (ranging in age from 16.00 to 21.98 months) succeeding at interpreting proper names appropriately on a manual object-choice task. Infants in the 23-month age group (both boys and girls) restricted the novel word to the labeled object at

above-chance levels both when the objects were perceptually contrasting and when they were identical, indicating a clear and adult-like understanding of the proper-name-to-individual-object link.

Continuity or Discontinuity in the Representation of Lexical-Category-to-Meaning Links?

These results leave us with an outstanding question: Why did infants in the 17- and 20-month age groups succeed on contrast trials but fail on identical trials, whereas infants in the 23-month age group succeeded at interpreting proper names appropriately on both types of trials?

The discontinuity view. Does this age difference reflect a discontinuity in the ability to map proper names to individuals? In other words, are there fundamental differences betweens infants' mapping of proper names onto their referents around 17 and 20 months of age and around 23 months of age? What could be the basis of this discontinuity? The formation of lexical-category-to-meaning links entails several elements. First, a representation of the concepts related to each lexical category is required. For example, infants must have an appreciation of concepts such as *object category*, *action*, *object property*, and *individual*. Second, infants must identify the relevant words from a stream of linguistic input, and finally, they must establish the appropriate mappings between the words and concepts. The basis of the discontinuity could lie in infants' understanding of the concepts themselves, or in their understanding of the specific mappings between these concepts and the words from their respective lexical categories.

Previous research on infant cognition suggests that the second possibility is more likely because young infants seem to have an understanding of categories and individuals.

The ability to categorize in terms of object category membership and in terms of object properties has been shown to be in place early in infancy, prior to the onset of word learning, implying that young infants represent concepts of *object category* and *object property* (e.g., Eimas, 1994, Eimas & Quinn, 1994; Mandler, Bauer, & McDonough, 1991; Mandler, & McDonough, 1993; Quinn, Eimas, & Rosenkrantz, 1993). Moreover, an understanding of an object as an individual presupposes the ability to distinguish the object from other objects of the same object category and to track this individual through displacement. This distinction could be achieved through the identification of idiosyncratic features of the object and of its spatiotemporal location. Previous research suggests that the ability to use spatiotemporal and featural information to identify and track individual objects through time and space is also in place early in infancy (e.g., Spelke, Kestenbaum, Simons, 1995; Xu & Carey, 1996; Wilcox & Baillargeon, 1998). Therefore, it seems unlikely that the age discrepancy found in tasks using contrasting and identical objects is rooted in a change in infants' representation of the concept of *individual*. Consequently, the age difference may reflect a change in infants' ability to map appropriately proper names onto individuals. For example, perhaps infants first interpret novel proper names as referring to restricted object categories (such as blonde dolls) or object properties (such as blonde) rather than to individual objects. If the age difference reflects discontinuity in the ability to form appropriate proper-name-to-individual-object links, it would suggest that infants have to change the way in which they represent proper names in a relatively short period of time.

A discontinuity view of the age discrepency noted previously leaves open the question what could be the basis for this rapid change. A similar question is raised by a

discontinuity interpretation of the results reported by Echols and Marti (1999) and Waxman and her colleagues (e.g., Waxman, 1998, 2004). Their results could be interpreted as reflecting a change in infants' representation of verbs between 13 and 18 months of age on average and a change in infants' representation of adjectives between 13 and 21 to 24 months of age on average.

The continuity view. An alternative account of the earlier success on contrast trials than on identical trials points to continuity in the ability to link appropriately proper names to individual objects. In other words, it is possible that younger infants interpreted novel proper names appropriately as referring to individuals but that other factors led to their failure to demonstrate their understanding of this link in labeling situations involving identical objects. These include factors related to procedural features of the experimental task, to memory load constraints, and to infants' reliance on different types of information at different ages to identify and track individuals.

A first factor that may have led to failure on trials involving identical objects is procedural in nature. The methodology used was a two-object forced-choice reaching task and it is possible that the demands of this task (e.g., having to identify the chosen object and then having to actively select the chosen object) were too challenging to allow the younger infants in the 17-month age group to demonstrate their appropriate understanding of the proper-name-to-individual-object link. However, there are some reasons to doubt that task demands were responsible for masking these infants' understanding of this link. First, infants in this age group succeeded on contrast trials, where the same two-object forced-choice task was used. If task demands were too challenging for infants at this age, we would not expect them to have succeeded on

contrast trials. Moreover, previous studies that have used a preferential-looking procedure involving identical objects to help reduce the task demands of a reaching task involving identical objects, have failed to show an appropriate understanding of the proper-name-to-individual-object link in infants ranging in age from 14 to 18 months (i.e., Bélanger & Hall, 2006).

A second factor that may have led to infants' failure on the contrast trials is memory load constraints. Infants may have had an understanding of the proper-name-to-individual-object link, but they may also have had difficulty remembering which doll was labeled when both dolls were perceptually identical. In other words, it is possible that the perceptual difference between the dolls on contrast trials facilitated the task by reducing the memory load and thereby helping the tracking of the labeled doll through displacement. One way to address this possibility is to examine whether infants' performance declined across test prompts used on identical test trials. Recall that in this experiment, infants repeatedly heard a novel label for a doll during the teaching phase. The labeled doll was then placed on a chair (as the infant was reminded of the label one last time) and another doll was seated on a second chair next to the labeled one. The test prompts followed immediately. The infant was given up to seven prompts to perform specific activities with a doll. On four of the seven prompts, the infant was asked to select the referent for the novel proper name (e.g., "Can you put MOOPY in the box?") and between each test prompt, the infant was given a filler prompt (e.g., "Can you feed one?"). After the infant selected a doll, it was replaced on its chair, but the infant was not reminded of which doll was the labeled doll. Therefore, if memory is a factor in infants'

failure on identical trials, we would expect them to show greater success (i.e., choose the labeled doll more often) on the earlier test prompts than on later test prompts.

Examination of the proportion of infants who selected the labeled object after each prompt on identical trials revealed no evidence to support a constraint due to memory load (see Figures 5.1 and 5.2). Notice that the lines on both figures are essentially flat and thus neither infants in the 17-month age group nor the infants in the 20-month age group showed a linear decrease in their correct choices on identical trials in the PN condition.[29]

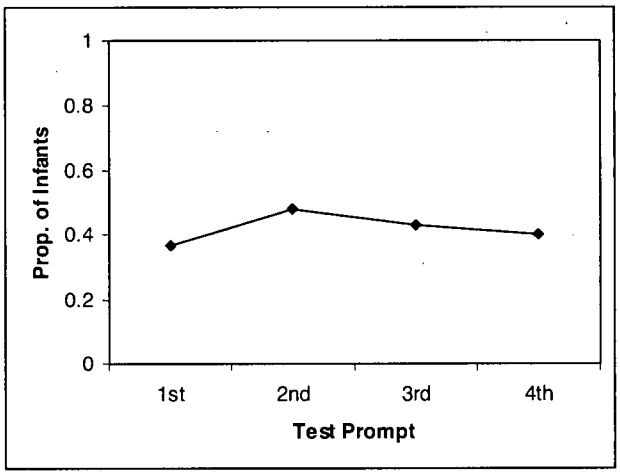

Figure 5.1: Proportion of infants in the 17-month age group in the PN condition who selected the labeled object after the 1st, 2nd, 3rd, and 4th test prompts on identical test trials.

[29] It could still be proposed that the reason for infants' failure on identical trials was related to memory load constraints between the time infants last heard the label and the time they heard the first test prompt. However, it is unlikely that infants in these two age groups had difficulties remembering which doll was labeled when they heard the first test prompt since they were reminded of the label very shortly (approximately 3 seconds) prior to the first test prompt and no other events that could have distracted the infants' attention occurred (e.g., the objects' positions were not switched).

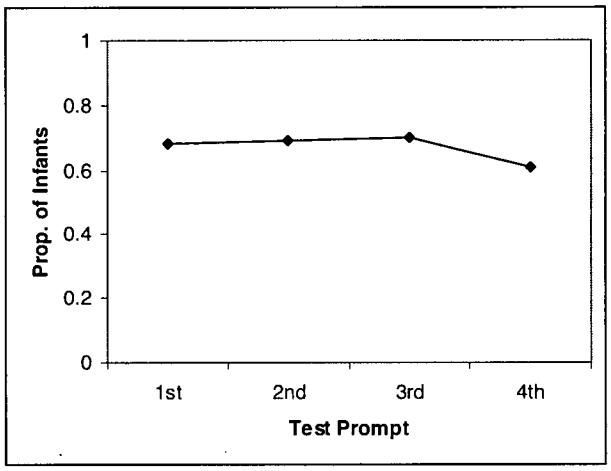

Figure 5.2: Proportion of infants in the 20-month age group in the PN condition who selected the labeled object after the 1st, 2nd, 3rd, and 4th test prompts on identical test trials.

A third factor that could explain the observed age difference is this: young infants may rely more heavily on different types on information (e.g., perceptual features and spatiotemporal information) at different ages to identify and track individuals. In other words, at a very young age, they may have an appropriate understanding that proper names refer to individual objects, but fail to identify and track a labeled object as an individual when it is paired with another identical object. An individual is typically distinguished from other objects of the same category, not only by its specific time-place location, but also by specific individual properties that make it different from other members of their category. For example, a dog (e.g., Fido) is distinguishable from other dogs by his specific location at a specific time (no other dog can be in the exact same place at the exact same time as him), but he is also different from other dogs in his physical characteristics and his behaviour, among other things. Young infants may initially rely more heavily on the second type of information (especially perceptual features) to identify and track individuals. In fact, cases where such information is

unavailable are uncommon in everyday life (e.g., encounters with identical twins tend to be rather infrequent). In cases where no such properties seem to distinguish two individual objects (i.e., in the case of two identical-looking objects), young infants may not succeed at identifying and tracking a labeled object and reliably map a proper name onto it. As infants gain more experience in identifying and tracking individuals, they may start to rely more heavily on spatiotemporal information as a cue to track individuals, therefore allowing them, in the absence of perceptually distinctive features between objects, to succeed at tracking an individual object through displacement.

In sum, it may be possible to rule out factors related to procedural features of the task or to memory load constraints as explanations for infants' failure to restrict a novel proper name to a labeled object on the identical trials (in contrast to their success in doing so on contrast trials) in the 17- and 20-month age groups. However, the data presented here do not allow us to determine whether the discontinuity or continuity view is correct. If the discontinuity hypothesis is correct, it would require an explanation of the rapid shift in infants' construal of proper names from interpreting such labels as referring to properties or restricted categories at a mean age of 17 to 20 months of age to interpreting those labels appropriately as referring to individual objects at a mean age of 23 months of age. Such an explanation would also be required for a discontinuity interpretation of the count noun/verb and count noun/adjective distinction (e.g., Echols & Marti, 1999; Waxman, 1998, 2004). The absence of such an explanation at this time lends some plausibility to a continuity account whereby infants' interpretation of proper names is appropriate from the beginning, but their limited experience with relying solely on spatiotemporal cues to identify and track objects through displacement leads to their

failure to appropriately map a novel proper name onto an individual object paired with an identical-looking object. Future research is needed to help determine with more certainty whether the discontinuity or continuity explanation is correct. For example, to help determine the role of spatiotemporal information to identify and track individual objects in helping with the proper-name-to-individual mapping, a training task during which young infants are explicitly taught to use spatiotemporal information to identify and track individual objects in the presence of other identical-looking objects may be informative.

Experiment 2: What about Younger Infants?

The findings from Experiment 1 left us with another important question. Since infants in the 17-month age group succeeded on contrast trials, could younger infants also succeed on such trials? Previous research has never reported an understanding of the proper-name-to-individual link before 16 or 17 months of age, but evidence of an earlier understanding of the distinction involving count nouns and words from other lexical categories such as verbs and adjectives has been reported (Booth & Waxman, 2003; Echols and Marti, 2002; Waxman, 1999; Waxman & Booth, 2001). There have also been reports of production and comprehension of proper names such as *mommy* and *daddy* in infants' early vocabularies, although there has not been any experimental verification of these reports (e.g., Dale & Fenson, 1996; Nelson, 1973). It was therefore important to test younger infants on the task used in Experiment 1. The results from Experiment 2, however, provided no evidence of an understanding of the count noun/proper name distinction in infants with a mean age of 14 months. It is also important to note that gender did not seem to be a factor with these younger infants: There was no evidence that girls performed better on the task than boys, suggesting that the use of an engaging and

interactive task eliminated gender differences found in earlier studies (e.g., Katz et al., 1974; Hall et al, 2001).

Together, Experiments 1 and 2 suggest an interesting developmental pattern: At an average age of 14 months, there is no evidence of an understanding of a count noun/proper name distinction, though the results are consistent with an appropriate understanding of the count-noun-to-object-category link. Therefore, the findings suggest that infants start by generalizing both novel count nouns and novel proper names to other objects of the same category. An understanding of the count noun/proper name distinction seems to emerge between 14 and 17 months of age on average, when infants restrict a novel proper name to an individual object if it is paired with a contrasting object, but generalize it to a second identical object. An understanding of the count noun/proper name distinction changes further between 20 to 23 months of age on average, at which time infants begin to show a clear appreciation of the distinction even when perceptually identical dolls are involved (see Figure 5.3).

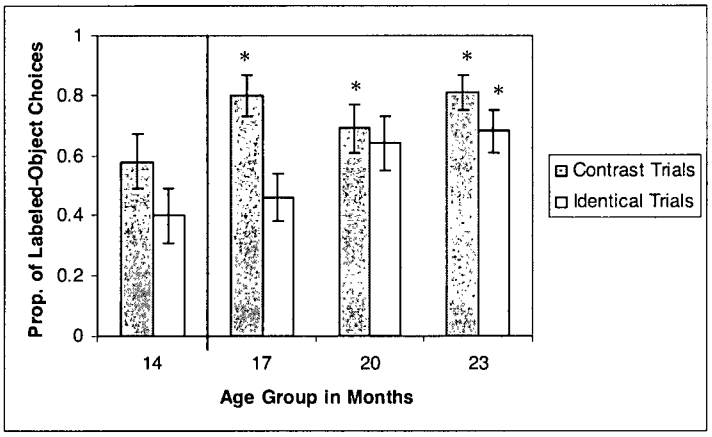

Figure 5.3: Mean proportions of labeled-object choices on contrast and identical test trials in the PN condition in Experiment 1 (in the 17-, 20-, and 23-month age groups) and in Experiment 2 (in the 14-month age group).

Experiment 3: Non-linguistic Cues in Learning the Proper-Name-to-Individual-Object Link

The first two experiments established that by an average of 23 months of age, infants show a clear understanding of the proper-name-to-individual object link. The third experiment addressed the question of how infants in this age group might come to such an understanding. Research reported by Echols and Marti (1999) and Waxman (e.g., Waxman, 1998, 2004) is consistent with the proposal that infants rely on a mechanism allowing them to extract commonalities across objects and events when learning novel count nouns, verbs, and adjectives. However, this account cannot be used to explain how infants acquire the proper-name-to-individual-object link, because in order to learn proper names, infants must have the ability to interpret a novel word as applying to an individual object itself, and not to a commonality among objects or actions.

Experiment 3 examined whether infants can use non-linguistic cues to help identify a novel word as a proper name designating an individual object. More specifically, the focus of this experiment was to examine whether infants averaging 23 months of age are (1) more likely to interpret proper names as naming individuals if objects have animate/human properties than if they are inanimate, and (2) more likely to interpret proper names as naming individuals if objects are familiar than if they are unfamiliar. Although several studies have reported that children between the ages of 2 years and 4 years use object animacy and familiarity to interpret novel words presented linguistically as proper names (e.g., Gelman & Taylor, 1984; Hall, 1991, 1994; Hall et al., 1993; Hall et al., 2004; Imai & Haryu, 2001; Katz et al., 1974; Liittschwager & Markman, 1993; Markman & Wachtel, 1988), the use of these non-linguistic cues had

never been investigated in children below two years of age in a task involving both contrasting and identical objects. In addition, previous studies have not compared infants' tendency to map a proper name to surrogate humans and to surrogate animals.

The findings suggested that both types of non-linguistic information are important for infants with a mean age of 23 months when interpreting novel labels presented linguistically as proper names. Infants were influenced by the animate/human properties of the objects and by whether the object was familiar. Importantly, the use of these non-linguistic cues was capable of overriding clear linguistic information indicating that the word was a proper name. In other words, if the object was an unfamiliar animate creature or if it was an inanimate familiar object, infants disregarded linguistic information indicating that a novel label was a proper name and selected either of the two objects randomly. In both cases, it is clear that infants did not interpret the label as a proper name because they did not restrict their choices to the labeled object.

How did infants interpret the novel label if it was applied to a novel monster and if it was applied to a toy airplane? Although the data presented here do not suggest a definitive answer to this question, the existing literature on word-learning constraints points to some likely possibilities. On the one hand, the finding that infants mapped a novel word presented linguistically as a proper name appropriately to a familiar individual object (i.e., a doll or a stuffed rabbit), but not to an unfamiliar individual object (i.e., a stuffed novel monster) is consistent with the proposal that an object-kind bias combined with a mutual exclusivity constraint are at work early in word learning (e.g., Halberda, 2003; Markman, 1989, 1994; Markman & Hutchinson, 1984; Markman & Wachtel, 1988; Markman et al. 2003; Woodward & Markman, 1998). Recall that

according to this proposal, children approach the task of word learning with biases that help them constrain the possible meanings of novel words. According to the object-kind constraint, children are biased to interpret the first label for an object as referring to the object's category. Therefore, if a child hears a label for an unfamiliar object (such as an unfamiliar monster), the object-kind bias leads them to interpret the label as a count noun, regardless of the lexical class information provided in the utterance. This is precisely what was found in Experiment 3: Infants who heard a novel label modeled linguistically as a proper name applied to an unfamiliar monster did not restrict the label to the labeled monster, but rather generalized it to a second identical or contrasting monster. In addition, there was one incidence of a spontaneous production of the novel label by one participant that is consistent with a count noun interpretation of the label. During the test phase the child pointed to one monster and then the second monster and said, "Two blickies!" This spontaneous statement clearly indicated that this participant interpreted the novel label as a count noun label.

On the other hand, in cases where a familiar object was used (i.e., a doll, a stuffed rabbit, or a toy airplane), the mutual exclusivity constraint would suggest that infants did not interpret the label as a count noun label for the object. This bias proposes that children expect objects to have only one object category label and that a second label used to refer to a familiar object must refer to something other than the category, such as the individual object itself or a property of the object. When the object was a familiar animate surrogate (i.e., a doll or a stuffed rabbit), infants' responses were consistent with their interpreting the novel label as a proper name: they restricted the new word to the labeled object most of the time, even when no visible property could be used to

distinguish the objects (i.e., on identical trials). When the object was familiar but inanimate (i.e., a toy airplane), infants' responses were consistent with their interpreting the novel label as a property rather than as an individual since they selected either object randomly.[30]

The findings from this experiment were thus consistent with the possibility that infants are influenced by these non-linguistic cues (animate/human properties and familiarity of the labeled object) early in word learning: They were able to interpret a novel label as referring to an individual object when the object possessed animate *and* familiar features (i.e., when it was a doll or a stuffed rabbit). It remains to be investigated whether even younger infants (i.e., 17-month-olds), ones who are at the very onset of their understanding of the lexical-category-to-meaning links involving proper names, have a bias to map novel proper names to familiar objects, ones for which they already know category labels.

Effects of Vocabulary Size on Lexical Development

It is noteworthy that all the experiments presented in this dissertation failed to show a relationship between infants' productive vocabulary size and their understanding of the proper-name-to-individual-object link. Although Waxman and Markow (1995) reported that vocabulary size was associated with the formation of the word-to-object-category linkage in 12-month-old infants, it is possible that this relationship is restricted to the emergence of that particular link. After all, the majority of the words in infants' early productive vocabulary are object words, not words referring to individual objects (e.g.,

[30] This finding is consistent with recent evidence suggesting that the mutual exclusivity bias is operative by about 17 months of age (e.g., Markman et al., 2003; Halberda, 2003).

Dale & Fenson, 1996; Nelson, 1973); therefore, it is possible that the preponderance of object words in "high vocabulary" infants helps them in the formation of the word-to-object-category link more than in the formation of the proper-name-to-individual-object link. In addition, infants tested in Waxman and Markow's task were younger than infants tested in the present experiments, and it is possible that this effect may be more pronounced in younger infants than in older ones.

Limitations and Future Directions

As discussed previously, an issue that remains unresolved is the basis for infants' tendency (in the 17- and 20-month age groups) to restrict a novel proper name to a labeled object when the object is paired with a perceptually contrasting object but not when it is paired with an identical object. Future research is need to clarify whether infants interpret novel proper names appropriately as referring to individuals from the start or whether there is a change in their ability to map proper names onto their appropriate referents between the mean ages of 17 to 23 months. For example, one way to determine whether young infants (i.e., 17 to 20-month-olds) map proper names appropriately to individuals, but simply lack the ability to rely solely on spatiotemporal information to identify and track individuals would be to provide them with training in using such cues with identical objects and examine whether training leads to improved performance on tasks such as the one used in the current experiments.

Although infants' behaviour in response to hearing a novel count noun labelling an object (in all age groups) was consistent with an appropriate count noun interpretation of the novel label (i.e., they generalized the label to the second object), the findings do not rule out the possibility that infants were simply guessing or that they were

interpreting the label as an adjective referring to a property shared by both objects. To rule out these possibilities and determine more clearly infants' interpretation of the novel count noun, a generalization task in which infants are asked to extend the label to other referents among objects from the same category and other objects from different categories sharing salient properties with the labeled object should be included (e.g., Gelman & Taylor, 1984). Adding more objects at test, however, is challenging with young infants because it increases the attentional demands of the task and risks making their responses difficult to interpret. In addition, results reported by Echols and Marti and Waxman and her colleagues (e.g., Echols & Marti, 1999, 2004; Waxman, 1999; Waxman & Booth, 2001; Waxman & Markow, 1995) indicate an appropriate understanding of the count-noun-object-category link between 12 and 13 months on average, supporting the view that in the present investigation, infants interpreted novel count nouns appropriately as well.

Experiment 3 offered evidence that infants with a mean age of 23 months use two non-linguistic cues to learn the proper-name-to-individual-object link. However, it is still unclear whether even younger infants who are in the process of forming the proper-name-to-individual-object link use these same cues to help them in this task. Future research testing infants with a mean age of 17 to 20 months is needed to explore this possibility. Furthermore, other non-linguistic cues such as range-of-reference information (i.e., information about the number of objects to which an label is extended), are also good candidates for helping infant restrict the number of possible objects that are likely to be labeled with proper names and therefore help them establish the proper-name-to-

individual-object link. Future research testing the use of such non-linguistic cues in infants under the age of two years would also be informative.

Finally, recall the prediction that among animate objects, infants would be more likely to map a proper name to humans or human surrogates (i.e., dolls) than to other surrogate animate objects such as stuffed animals. Data reported in Experiment 3 did not support this hypothesis, although there was a slight difference in the expected direction. It remains possible that this slight difference would be magnified if younger infants who are at the very beginning of an understanding of the proper-name-to-individual-object link were tested on a similar task. An interesting variation for such an experiment would be to examine the salience and perceived importance of humans in particular by using live humans (perhaps on video) instead of human surrogates (such as dolls) as stimuli. Dolls are merely human surrogates and representations of people. It is possible that young infants need to see actual people instead of representations of people to map proper names successfully onto individuals.

Conclusions

Previous research in the field has focused on older children's distinctions between lexical categories, or younger infants' distinctions between count nouns and verbs, or count nouns and adjectives. Very little research has investigated young infants' early acquisition of the distinctions involving count nouns and proper names, and so this research helps shed light on the emergence of this distinction and on how infants first form these distinctions. Learning more about the emergence of the count noun/proper name distinction also helps further our understanding of the generality of the time course of the emergence of lexical-category-to-meaning links and of how these links emerge. As

illustrated in Table 5.1, by combining results reported by Echols and Marti (1999) on the emergence of the count noun/verb distinction, the results reported by Waxman and her colleagues on the emergence of the count noun/adjective distinction (e.g., Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001; Waxman & Booth, 2003; Waxman & Markow, 1995), and the results reported here on the count noun/proper name distinction, we obtain a more complete picture of this time course.

Lexical Categories	*No Distinction*	*Some Distinction*	*Appropriate Distinction*
Count Noun/Verb	--	13 months	18 months
Count Noun/Adjective	11 months	13-14 months	21-24 months
Count Noun/Proper Name	14 months	17-20 months	23 months

Table 5.1: Summary of the mean ages reported with no distinction, some distinction, and an appropriate distinction of the lexical-category-to-meaning links involving count nouns and verbs, count nouns and adjectives, and count nouns and proper names.

These results suggest similarities and differences in the development of infants' understanding of the lexical-category-to-meaning links involving count nouns and verbs, count nouns and adjectives, and count nouns and proper names. Some understanding of the distinction between count nouns and proper names seems to appear 3 to 4 months later than an understanding of the other two distinctions, and an appropriate understanding of the count noun/verb distinction is observed 2 to 3 months before that between count nouns and adjectives and count nouns and proper names. However, it remains striking that the results are so similar given that infants' understanding of each distinction was tested using different methods and that not all ages were tested.

As noted previously, the acquisition of the understanding of the differences between lexical-category-to-meaning links involving count nouns, verbs, and adjectives may be based on a similar mechanism of extracting commonalities across events or objects. The evidence reported here suggests that a different mechanism is implicated in the acquisition of the lexical-category-to-meaning links involving proper names, one pertaining to infants' use of non-linguistic cues to limit the objects they think will be the bearers of proper names. In sum, this research sheds new light on when and how infants so impressively overcome the inductive problem of word learning by examining the origins of lexical-category-to-meaning links involving count nouns and proper names.

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Appendix A

Script Used in the Teaching and Testing Phases of Experiments 1 and 2.

Teaching Phase

The experimenter introduced a doll and said:

"Look at her![31] She's called (a)[32] MOOPY! See, she's (a) MOOPY. Let's play with (this) MOOPY."

The experimenter brought a box on the table and continued with the script:

"First, I'll put (the) MOOPY in the box. See? Now, can you put (the) MOOPY in the box? Good job!"

The box was removed and a truck was introduced:

"See this truck? (The) MOOPY wants to drive the truck! Now it's your turn, do you want to make (the) MOOPY drive the truck?"

The experimenter put the truck away and took the spoon:

"I think that (the) MOOPY is hungry, so I'll feed her. Now it's your turn, can you feed (the) MOOPY? Good job!"

The spoon was removed and a cup was the introduced:

"Okay, now (the) MOOPY is thirsty. I'll make her drink. Do you want to make (the) MOOPY drink? Great!"

The experimenter removed the cup and retrieved the face cloth:

"Now I'll wash (the) MOOPY's face, see? Now it's your turn, can you wash (the) MOOPY's face?"

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[31] Feminine pronouns were used with the female dolls, whereas masculine pronouns were used with the male dolls.

[32] Words in parentheses were used in the CN condition.

The face cloth was then replaced by the slide:

"See the slide? I'll make (the) MOOPY go down the slide. Now it's your turn, do you want to make (the) MOOPY go down the slide? Good job!"

Finally, the slide was removed to make place for the bed:

"Now (the) MOOPY is really tired, so I'll put her to bed. Here, now do you want to help and put (the) MOOPY in her bed? Great!"

The experimenter removed the bed and placed one of the chairs on one of the markers closest to the experimenter on the table (the left/right position of the chair was counterbalanced between trials and across participants) and continued by saying:

"Okay now I'm going to put (the) MOOPY and put her right here."

Testing Phase

The experimenter reintroduced the puppet and said:

"I want to play too. Can you put (a) MOOPY in the box? Thank you.[33] Can you make one drive the truck? Okay. Can you feed (a) MOOPY? Okay. Can you make one drink? Thank you. Can you wash (a) MOOPY's face? Okay. Can you make one go down the slide? Thank you. Can you put (a) MOOPY in the bed? Thank you."

The experimenter then removed all the objects from the table except for the labeled doll and started the second trial by saying:

"Remember her? She's called (a) MOOPY. See? She's (a) MOOPY. Let's play with (the) MOOPY a little more."

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[33] After each question, the experimenter removed the puppet from her hand and placed it halfway between the two dolls on the table. She then pushed both chairs with the dolls simultaneously onto the two markers closest to the child and looked straight at the child until the child chose a doll. The experimenter replaced the dolls and chairs to their original positions, making sure the infant was paying close attention to her actions.

The experimenter then brought a chair back and placed it on the marker (if the labeled doll had been placed on the left marker in the first trial, then it was placed on the right marker on the second trial) and said:

"I'm going to put (the) MOOPY right here."

Then the second chair was placed on the second marker and the experimenter put the third doll (either contrasting or identical, whichever had not been used on the first trial) on the chair and said:

"And I'm going to put her right here."

The second trial then proceeded as the first trial.

Appendix B

Script Used in the Teaching and Testing Phases of Experiment 3

Teaching Phase

The experimenter introduced an object and said:

"Look at her![34] She's called MOOPY! See, she's MOOPY. Let's play with MOOPY."

The experimenter brought a box on the table and continued with the script:

"First, I'll put MOOPY in the box. See? Now, can you put MOOPY in the box? Good job!"

The box was removed and a truck was introduced:

"See this truck? I'm going to put MOOPY in the truck! Now it's your turn, do you want to put MOOPY in the truck?"

The experimenter put the truck away and took the blanket:

"I'm going to hide MOOPY under the blanket. Now it's your turn, can you hide MOOPY under the blanket? Good job!"

The blanket was removed and a cup was the introduced:

"Okay, now I'm going to pour water all over MOOPY. Do you want to pour water all over MOOPY too? Great!"

The experimenter removed the cup and retrieved the face cloth:

"Now I'll wash MOOPY, see? Now it's your turn, can you wash MOOPY?"

The face cloth was then replaced by the slide:

"See the slide? I'll make MOOPY go down the slide. Now it's your turn, do you want to make MOOPY go down the slide? Good job!"

Finally, the slide was removed to make place for the bed:

"Now I'll put MOOPY in the bed. Here, now do you want to help and put MOOPY in the bed? Great!"

The experimenter removed the bed and placed one of the chairs on one of the markers closest to the experimenter on the table (the left/right position of the chair was counterbalanced between trials and across participants), put the object on it and continued by saying:

"Okay now I'm going to put MOOPY and put her right here."

The object was placed on the chair and another chair was placed on the other marker close to the experimenter, who placed a second object (in the identical test trials, the identical object was used, whereas the perceptually contrasting object was used in the contrast test trials) on it and said:

"Look here! I'm going to put her right here."

Testing Phase

The experimenter then introduced the puppet and the testing phase begun. The testing phase proceeded as it did in Experiments 1 and 2. The experimenter reintroduced the puppet and said:

"I want to play too. Can you put (a) MOOPY in the box? Thank you.[35] Can you put one in the truck? Okay. Can you hide MOOPY under the blanket? Okay. Can you pour water

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[34] Feminine pronouns were used with the female dolls, masculine pronouns were used with the male dolls, the stuffed rabbits, and the monsters, and neutral pronouns were used with the airplanes.

[35] After each question, the experimenter removed the puppet from her hand and placed it halfway between the two dolls on the table. She then pushed both chairs with the dolls simultaneously onto the two markers closest to the child and looked straight at the child until the child chose a doll. As the experimenter made sure the infant was paying close attention, she replaces the dolls and chairs to their original positions.

all over one? Thank you. Can you wash MOOPY? Okay. Can you make one go down the slide? Thank you. Can you put MOOPY in the bed? Thank you."