WORDS AS INVITATIONS TO NAME CONTRASTS BETWEEN OBJECTS

by

JENNIFER CAMPBELL

B.Sc., UNIVERSITY OF CALGARY, 2011

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

MASTER OF ARTS

in

THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

(Psychology)

THE UNIVERSITY OF BRITISH COLUMBIA

(Vancouver)

August 2014

ABSTRACT

An inherent difficulty for infants learning their first language is that when a caregiver presents a name for an object there are many possible referents of the label. For example, the new word could refer to an individual (proper name), a category (count noun), or a property (adjective). Here I explored how infants might identify a novel word's lexical category and limit its possible meaning.

Research has revealed that infants appear to possess an early expectation that a consistent word applied to multiple objects labels a category, in the manner of count nouns (see Waxman & Gelman, 2010). At the same time, studies suggest that hearing distinct labels for a set of objects can serve to highlight contrasts among the objects (Xu, 1999). Labels can contrast objects from one another in a number of different ways (e.g., contrastive count nouns, adjectives, proper names). Yet some types of contrasts may be more salient for some kinds of objects than for others. Although distinct labels might pick out subordinate categories (i.e., count nouns) or distinguishing properties (i.e., adjectives) for objects of any kind, only in the case of people are distinct labels likely to pick out individuals (i.e., proper names) (see Hall, 2009; Macnamara, 1982). We propose that hearing distinct words highlights contrasts between people more so than contrasts between artifacts or other animals.

Fourteen-month-old infants viewed images of emus paired with images of female faces. Infants who heard the same label for every pair behaved like infants who heard no

labels, and did not preferentially select a new face or new emu for the referent of the same word. In contrast, when infants heard a different label for each face-emu pair, they selected a new face as the referent of a novel word. These findings are consistent with the possibility that infants inferred that distinct labels function to pick out contrasts between people as opposed to contrasts between nonhuman animals. We will discuss how these results bear on the issue of how infants learn the way in which words from different lexical classes are marked in their language.

PREFACE

The author had the primary responsibility for conducting the research and analysis presented in this manuscript. The ideas were initially developed by her advisor, Dr. D. Geoffrey Hall, and the methodology and experimental design were developed in a collaboration between the author and Dr. D. Geoffrey Hall.

The research presented here was approved by the UBC Behavioral Research Ethics Board (Project Title: “Origins of Word Learning”, H07-01582).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

I would first like to thank my supervisor, Dr. D. Geoffrey Hall, for his guidance and support. I am very grateful for all of his patience and encouragement throughout my Master's program. I would also thank my M.A. committee members, Dr. Janet Werker and Dr. Frances Chen, for their helpful and insightful comments on this project.

The hard work provided by the members of the Language Development Centre was invaluable to this completion of this thesis. In particular, I would like to thank Margaret Sun, Cally Fung, and Alyssa Reinsma for their dedication to this project. I especially would like to thank Kristan Marchak for being a fantastic lab sister who provided immense support and encouragement throughout this experience. I am also grateful for the funding support I have received from the Social Sciences and Humanities Research Council. Many thanks to all the families who took the time to come into the centre and participate in this study.

Finally, I would like to thank my family for their unwavering belief in me and for their never-ending support throughout my education.

INTRODUCTION

Learning names for things may seem like a simple process at first glance; however, it is in actuality a surprisingly complex process that involves more than forming basic associations between objects and words. To illustrate this difficulty, imagine a scenario in which an infant watches as a caregiver points to a rabbit running by and says "Gavagai" (Quine, 1960). In this situation there are, in theory, an infinite number of possible referents for the novel word. This label could refer to all rabbits, to only this individual rabbit, to a part of the rabbit, to a property of the rabbit, or to an action the rabbit is performing. The issue for infants is that knowing "Gavagai" maps to a particular rabbit does not help them identify the word's lexical class or the label's meaning. Understanding that "Gavagai" maps to this rabbit is only one step in learning this term. To fully understand a novel label, the infant must figure out both the appropriate referent of the word and how this term generalizes to other objects.

One way to narrow down the possible meanings of a new label is to discover the lexical class of a word. The lexical class of a label often indicates the term's general meaning (Bloom, 2000; Macnamara, 1986). For instance, count nouns map to kinds of objects, adjectives map to properties of objects, and proper names map to individual objects. Being able to identify the class of a word enables infants to narrow their inference about the label's possible meaning.

The current study investigated how infants infer the meaning of a word presented in an ambiguous labelling context. Our study explored how infants resolve Quine's problem (1960); specifically, we examined how infants decide that the new word labels a category (e.g., rabbit), property (e.g., white), or individual (e.g., Thumper). Although each of these word classes can share a common object referent (the rabbit running by), there are important differences between the words in each class in how the labels are conceptualized and generalized. For example, if the novel word meant rabbit, then this label would generalize to other rabbits (count noun); if it meant white, it would pick out the colour of the rabbit (adjective), whereas if the novel word meant Thumper, then it would identify this individual rabbit (proper name).

When adults encounter a new label, they can often use information from the linguistic context to help resolve the class of a word and its meaning. For instance, when an adult English speaker sees someone point to a rabbit and hears, "That is Gavagai!", a likely interpretation of this word is that it is a proper name or adjective (i.e., "Thumper" or "white") as opposed to a count noun (i.e., "rabbit"). If instead a person points to a rabbit and says, "That is a Gavagai!", now an adult might infer that the label is a count noun (i.e., "rabbit"). To disambiguate labelling scenarios, English-speaking adults can use lexical clues (e.g., the presence or absence of a determiner) to discover the class of a word and its general meaning. These lexical cues are not available to infants at the outset of language development; infants must learn the specific lexical cues for the word classes particular to their native language. Studies have suggested that English-learning infants first begin to learn the lexical cues for word classes before their second birthday

(Bélanger & Hall, 2006; Booth & Waxman, 2003; Gelman & Taylor, 1984; Hall, & Bélanger, 2009; Hall, Lee, & Bélanger, 2001; Hall, Corrigall, Rhemtulla, Donegan, & Xu, 2008; Katz, Baker & Macnamara, 1974, Waxman, 1999; Waxman & Booth, 2001, 2003; Waxman & Markow, 1995, 1998). Prior to the mastery of these linguistic cues, infants face a substantial problem in identifying and learning the properties of the different form classes of their first language. How do infants recognize the class of a word without access to linguistic context cues?

Studies with Japanese children suggest that English-speaking children can learn the distinctions between the word classes without linguistic cues. In Japanese, there are not linguistic cues that clearly differentiate a proper name from a count noun; nonetheless, 2- and 4-year-olds are able to interpret labels as proper names and count nouns by using object category information. Imai and Haryu (2001) found that children seemed to make a proper name interpretation when the referent was an anthropomorphized, familiar animal, but interpreted the novel name as a count noun when the referent was an unfamiliar animal or artifact. Since Japanese children are able to identify word classes without linguistic cues, then infants learning other languages may be able to use such cues as well. The current study focused on this possibility by examining whether infants could use information from (1) the pattern of word labelling and (2) the kind of object receiving the label to provide them with cues about the meaning and lexical class of a particular word. The next two sections examine each of these potential sources of information.

Pattern of Labelling

A substantial body of literature has demonstrated that infants have an early expectation that a consistent word applied to a set of objects labels a category, in the manner of count nouns (Balaban & Waxman, 1997; Fulkerson & Haaf, 1998; Waxman & Booth, 2003; Welder & Graham, 2001). In a seminal study (Waxman & Markow, 1995), 12- to 13-month-old infants watched as an experimenter presented four distinct toy animals and introduced each one with a common novel word (e.g., "See the X?"). A second group of infants viewed the same four toys, but heard phrases that did not contain a novel word (e.g., "See here?"). After viewing the four animals, infants were presented with a pair of toys, one belonging to the same superordinate category as the toys previously seen (e.g., another animal) and one which did not belong to the same superordinate category as the toys previously seen (e.g., a tool). While viewing the two test objects, infants heard an attention-prompting sentence ("See what I have?"). Infants who heard a common novel word in training showed a novelty preference for the object from a different superordinate category, indicating that the labels highlighted the object category. In contrast, infants who did not hear a novel word did not display a preference for either toy at test. These results support the claim that infants will interpret a common name as a count noun that labels a category.

More recent research has sought to further support the claim that infants expect words to label categories by using more direct infant measurements. In a forced-choice task, 14-month-old infants were familiarized with a set of animals, which were each

given a common label (e.g., "X") (Waxman & Booth, 2001). They then viewed a contrast trial in which an out-of-category member (e.g., a carrot) was introduced with the phrase "Uh oh! This one is not an X!" At test, infants viewed a new out-of-category member (e.g., a rolling pin) and a within-category member (a different animal) and were asked to point to the referent of the familiarized label (e.g., "X"). Infants who heard a common noun label selected the within-category object over the out-of-category object. This result lends further support to the claim that infants interpret a novel word applied consistently across objects as a category label and can demonstrate this assumption in a choice task.

Further studies have demonstrated that attentional factors alone do not drive infants' assumption that a consistent word applied to multiple objects labels a category. In a series of studies, infants were shown sets of objects while presented either with a word or a sine-wave tone matched to the word in amplitude and duration, and then were measured for whether they demonstrated a novelty preference (Balaban & Waxman, 1997; see also Fulkerson & Haaf, 1998; Roberts & Jacob, 1992). Consistent with previous findings, infants interpreted the word as a label for the object's category, but did not appear to interpret the tone as picking out the object category. These findings support the claim that infants' expectation for words as labels for objects is linguistically driven and does not extend to other auditory stimuli.

Work over the last few years has demonstrated the robustness of infants' assumption that a consistent word applied to a set of objects labels a category. Many

studies have shown that infants' expectation that words act as count nouns also applies to object sets in which the commonalities between the objects are hidden (e.g., the functions of the objects) (see Booth & Waxman 2002; Diesendruck, 2003; Gelman & Kalish, 2006; Graham, Kilbreath, & Welder, 2004; Nazzi & Gopnik, 2001; Waxman & Lidz, 2006; Welder & Graham, 2001). Although much of the research has focused on infants' interpretations of labels for familiar objects, research using sets of novel objects has shown that by 18 months infants exhibit the assumption that words applied to objects name categories (Booth & Waxman, 2002; Fulkerson & Haaf, 2003; Gopnik, Sobel, Schulz, & Glymour, 2001; Maratsos, 2001; Nazzi & Gopnik, 2001). Together these results suggest that infants expect a novel word that is applied to a set of objects to generalize like a count noun. Additionally, infants' tendency to interpret a novel word as a category label appears to be a relatively robust effect that is observable with a variety of testing methods and with familiar and novel objects.

In sum, the substantial research in this area has provided abundant support for the claim that providing a name for a set of objects guides infants to map this term as a category label (count noun). Importantly, this effect does not simply apply to the words and objects presented in familiarization but extends to infants' assumptions about labels for novel objects as well. This work has led to the claim that infants expect novel words to highlight commonalities between objects (Waxman & Booth 2003) and that infants interpret these terms as category labels (Brown, 1985; Macnamara, 1982). This research supports the idea that when infants encounter a novel word applied to across a set of objects, they will assume that this label is a count noun mapping to a category.

Recent work has clarified the previous claim that words serve to highlight categories by specifying that the label must be a term that is consistently applied to all objects in a set. When 12-month-old infants were familiarized with a set of objects (animals) and each object was introduced with a distinct, unique label, infants did not show evidence of mapping the words as category terms (count nouns) (Waxman & Braun, 2005). The recent findings leave open, however, the question of how infants interpret sets of distinct labels applied across objects.

One study examining infants' abilities to track objects has shed some light on a possible function of distinct labelling (Xu, 1999). In this experiment, ten-month-old infants viewed a stage on which two objects (a duck and a ball) emerged from behind an opaque screen one at a time while each object was given a label. One group of infants heard the same name for both objects (e.g., "It's a toy; it's a toy"), and a second group of infants heard different labels for each object (e.g., "It's a duck; it's a ball"). Then in a test trial, the screen was lowered revealing one or both items. If infants were able to successfully individuate the objects then they would be expected to show surprise if there was only one object behind the screen; however if infants had difficulty tracking the two objects they would not be expected to show surprise when seeing only one object behind the screen. In this study, 10-month-old infants appeared to expect two objects behind the screen when each object was given a distinct label, but did not have any expectations when the objects were given the same label. These results suggest that distinct names serve a different function in word learning than common labels: unique labels for each

member of a set appear to guide infants' attention away from commonalities between objects and toward differences. Distinct names might better enable infants to track individual objects by highlighting contrasts between them. Infants could be interpreting the distinct labels as count nouns picking out objects which belong to different categories (i.e., duck, ball), as adjectives picking out objects with divergent properties (i.e., yellow, red), or as proper names picking out individual objects (i.e., Sally, Betty). Thus distinct labels could serve as a way for infants to learn count nouns, adjectives or proper names.

Taken together, the research on naming patterns has suggested that infants begin with an early expectation of what words map to. In the case of consistently applied labels, infants appear to expect these labels to name object categories in the manner of count nouns. Xu's (1999) work suggests that distinct labels might highlight contrasts and generalize in the manner of count nouns, adjectives or proper names. The research on distinct labels has largely focused on artifacts and animals (Xu, 1999); yet researchers have argued that some objects are more easily picked out as individuals than others, and therefore are more likely to be the referents of proper names (Hall, 2009; Macnamara, 1982). If different kinds of objects are conceptualized differently, then contrastive labels might be more likely to pick out objects from certain kinds than objects from others.

Conceptualization of Kinds of Objects

Macnamara (1982), and more recently Hall (2009), have hypothesized that infants have a conceptual bias to construe some objects, like people, as individuals but other

kinds of objects, like artifacts, as instances of kinds. Under this hypothesis, infants should be likely to interpret an ambiguous label for a person as a proper name for an individual. In contrast, children should be more likely to interpret an ambiguous label for an artifact as a category name. Although it is possible to construe artifacts, animals and people as instances of categories and as possessing salient, namable properties, only people are naturally thought of as individuals who are distinct from other members of their kind. In the prior section, it was suggested that distinct labels might pick out contrastive categories, properties, or individuals. This raises the possibility that infants may interpret distinct labels as count nouns, adjectives or proper names. Since people, but not artifacts, are likely to be picked out by proper names, contrastive labels might be more likely to pick out contrasts between people than between other objects, such as non-human animals.

Numerous studies of cognitive development in infants support the claim that infants construe people differently from instances of most other categories of objects (e.g., Bloom, 2004; Bonatti, Frot, Zangl, & Mehler, 2002; Carey, 2009; Kulmeier, Bloom, & Wynn, 2004; Leslie, 1984; Mandler, 2000; Mandler & McDonough, 1993; Quinn & Eimas, 1998; Spelke, Philips, & Woodward, 1995; Woodward, 1998; see also Rakison & Poulin-Dubois, 2001). Research suggests that young infants will attribute goals to people but not to artifacts (e.g., Bloom, 2004; Carey, 2009). Moreover, parental reports indicate that infants' earliest proper names tend to label people and their earliest count nouns are more often for artifacts (e.g., Dromi, 1987; Fensen, Dale, Reznick, Bates, Thal, & Pethink, 1994; Macnamara, 1982; Nelson, 1973; Tardif et al., 2008). This

research is consistent with the claim that infants to view people as individuals but do not have this same view of artifacts.

Experimental research examining children's interpretations of labels for different kinds of objects has largely supported the claim that members of different kinds of objects (e.g., people, animals, artifacts) are not all equally likely to be construed as individuals. In a recent study, 16- to 17-month-old infants were familiarized to a novel word (e.g., "Daxy!") presented with a face (Leung & Hall, 2011). Infants were then shown the familiar face and a novel face side-by-side on the screen and heard either the same word presented (e.g., "Daxy!") or a novel word (e.g., "Blicky!"). The results showed that infants looked to the familiar face when hearing the familiarized label but looked to the novel face upon hearing the novel word. This exclusion effect is consistent with the possibility that infants interpreted the familiar term as a proper name labeling an individual face. In an artifact condition, a second group of infants were familiarized to a single word for an artifact (e.g., a ball) and were at test given the familiar ball and a novel ball. Infants did not systematically look more at one ball over the other upon hearing the familiar word or the novel word at test. It thus appeared that, with artifacts, infants did not interpret the label as a proper name and instead possibly construed the label as a count noun labelling a category. This research suggests that people are more easily construed as individuals than are artifacts.

Animals, however, are sometimes thought of as individuals. The tendency to think of animals as individuals depends on a person's familiarity with the animal and

whether the animal is a prototypical pet in the person's culture. For animals that are novel or unfamiliar, children do not typically interpret a label for them as labelling an individual animal (Hall, 1991; Hall & Bélanger, 2009, Imai & Haryu, 2001). In contrast, labels for familiar animals that are anthropomorphized or are typical household pets (e.g., dogs, cats) are often readily interpreted as labels for individuals. Although children are unlikely to believe a word picks out an individual when it labels a familiar animal that is not typically a pet (e.g., caterpillars, bees), they will interpret a label as a proper name if the familiar animal is described as being owned or if it is anthropomorphic (Imai & Haryu, 2001; Hall, 1994; see also Jaswal & Markman, 2001). Overall, children appear to construe animals as individuals if they familiar animals that are anthropomorphized or pet-like.

Unlike their construal of people, children do not appear to think of artifacts as being strongly individuals in their own right. Research examining toddlers' and preschoolers' interpretations for artifact labels has shown that children often fail to learn individual names for familiar or unfamiliar artifacts (Jaswal & Markman, 2001; Katz, Baker, & Marcnamara, 1974; Sorrentino, 1999; Hall 1994; Gelman & Taylor, 1984). One particular study demonstrated an exception to these results, such that if a novel artifact was described as having mental states, preschoolers interpreted a novel word as a proper name for it (Sorrentino, 1999). In general, however, children do not tend to assume an ambiguous label for an artifact is a proper name.

In summary, although people, animals, and artifacts are typically easily construed as instances of kinds, some members of these kinds of objects are more easily construed as being individuals. People appear to be the most easily construed as individuals (e.g., Mary for a woman, John for a man). Animals appear to occupy a middle ground in that they are not typically construed as individuals, unless they are familiar animals that are anthropomorphized or pet-like (e.g., Fido for a dog, Fluffy for a cat). Artifacts on the other hand appear to be at the opposite end of the continuum from people, whereby they are rarely construed as individuals (e.g., Titanic for a ship, Herbie for a car) and are more often construed as instances of kinds (e.g. a ship, a car). In terms of these three types of objects, people seem to be the most easily construed as individuals and appear to be the most likely candidates for proper name labels.

Artifacts, animals and people are all plausible referents for count nouns or adjectives; however, only people have the additional appeal of being good referents for proper names. In light of our previous discussion of the fact that contrastive labels might pick out subcategories, properties or individuals, it seems that people might be more likely than the other kinds of objects to be identified by distinct words since words for people might possess a larger range of likely meanings.

Current Experiment

The present experiment sought to examine 14-month-olds' interpretations of consistent and distinct labels for people versus non-human animals. Previous work

suggests that distinct labels are more likely to pick out contrasts among objects (Xu, 1999). This result is consistent with the possibility that distinct labels may function in the manner of contrastive count nouns, adjectives, or proper names. Although distinct labels applied to people could plausibly pick out individuals, properties or contrastive categories, distinct labels applied to non-human animals are unlikely to pick out individuals and instead are more likely pick out properties or contrastive categories. We hypothesized that distinct labels are more likely to pick out people than distinct non-human animals, since words for people could have a larger number of plausible meanings than words for non-human animals. Our study explored this possibility by examining whether 14-month-olds would map distinct labels preferentially to people rather than non-human animals.

METHODS

Participants

This study included 48 14-month-olds (*M* = 14.01 months, *SD* = 13 days, range = 13.49 to 14.72 months). We were interested in this age group because of previous studies which suggested that by 14 months infants can respond to a forced-choice task in learning category labels for objects (Waxman & Booth, 2001). Additionally, the nature of our experimental design involved ambiguous labelling events and previous work has suggested that 14-month-old infants can track word-object pairings to resolve ambiguities across trials (Smith & Yu, 2008). Finally, we sought to examine infants how infants could identify the lexical class of a word without lexical cues. Therefore, we chose to examine infants before they had gained access to lexical cues to word classes, which is largely shown to emerge around infants' second birthday (Bélanger & Hall, 2006; Booth & Waxman, 2003; Gelman & Taylor, 1984; Hall, & Bélanger, 2009; Hall, Lee, & Bélanger, 2001; Hall, Corrigall, Rhemtulla, Donegan, & Xu, 2008; Katz, Baker & Macnamara, 1974; Waxman, 1999; Waxman & Booth, 2001, 2003; Waxman & Markow, 1995, 1998).

All infants in this study came from homes in which English was the primary language spoken (80% criterion). An additional seven infants were tested but removed from the analysis due to parental interference (n = 2), experimenter error (n = 1), or fussiness (n = 4). All infants received a certificate and small book for their participation in the study.

Stimuli

Infants saw images of five different cartoon women across all trials. The women differed in the shape of their jaw, nose, mouth and face, as well as hair colour and hairstyle. The women all wore the same colour shirt and were all depicted as Caucasian. See Figure 1 for complete set of face images.

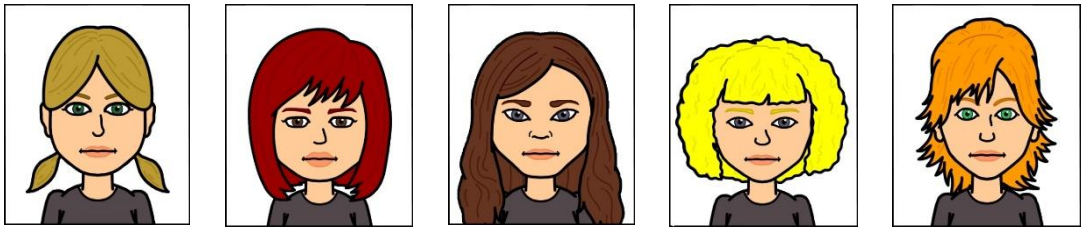

Figure 1. Female face images used in the experiment.

In the study, infants saw five images of different emus across the trials. All the emus had a similar stance to one another but differed individually by body shape, feather patterns and colour. Our motivation in selecting emus was based on previous research suggesting that these animals should not be easily construed as individuals since they are not anthropomorphic, pet-like, or familiar to most infants (Hall, 1994; see also Jaswal & Markman, 2001). See Figure 2 for the images of emus.

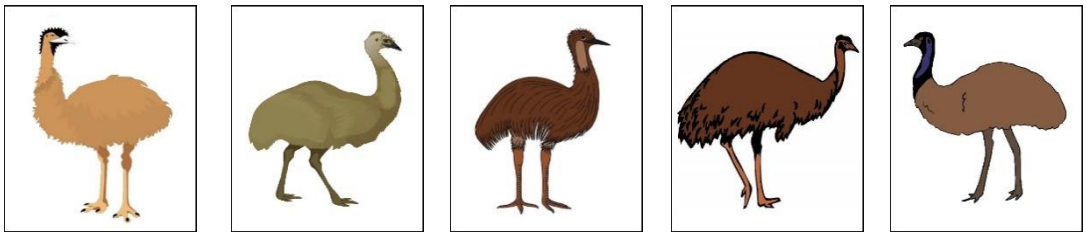

Figure 2. Emu images used in the experiment.

A female native English speaker presented each label in infant-directed speech. All labels were novel monosyllabic CVC forms. Preceding each novel word was the phrase "Look!" See Appendix A for the complete script for each condition.

Procedure

Before the study began, parents filled out the MacArthur Communicative Development Inventory (CDI) short form (Fensen et al., 1994) which assesses infant vocabulary development.

We conducted the study in a psychology laboratory, with each child assessed individually. Children sat on their parent's lap at a table for the duration of the study. Parents were instructed to close their eyes and not to interfere with the study. A female experimenter sat at the other side of the table from the child and administered the task.

The experiment consisted of two blocks of five trials each (four familiarization trials followed by one test trial). The two blocks contained the same visual and auditory stimuli, but the familiarization trials were presented in a different order. Each infant

viewed one of four random presentation orders in which the specific pairings of auditory and visual stimuli differed. Additionally, the visual stimuli presented on the left- and right-hand sides were counterbalanced within each infant.

For each familiarization trial, the experimenter held up two images side-by-side out of the infants' reach. Each trial consisted of one emu and one female face, and within each block, every trial introduced a new pair of images. The familiarization trials began with a live experimenter providing the infants with a two-word prompt, followed by a seven-second pause. The experimenter then uttered a second prompt, which was followed by another seven-second pause. Each familiarization trial was thus approximately 15 seconds long (including the length of the experimenter's phrases).

We randomly assigned infants to one of three conditions that determined the auditory stimuli they heard during the familiarization trials. In all conditions, the experimenter said, "Look! ____!"; then after a seven-second pause, the experimenter said, "Yes! ____!" For the *Consistent Label* condition, the experimenter used the same novel word on all familiarization trials. In the *Distinct Label* condition, the experimenter used a different novel label on each familiarization trial. On all familiarization trials, infants in the *No Label* condition heard the experiment say, "Look! See!"; then seven seconds later the experimenter said, "Yes! See!"

On the test trials, infants viewed another new face and a new emu presented side-by-side. The experimenter first provided the test prompt and then moved the image cards

within the reach of the infant. Infants who were in the *Consistent Label* condition heard a request for the same label that was presented to them in the familiarization trials: "Where's Fep?" Infants in the *Distinct Label* condition heard a request for the same test label as the *Consistent Label* condition but for them this was a novel label that was not presented in the familiarization trials: "Where's Fep?" In the *No Label* condition, infants heard the phrase, "Where's one?" Once the infants gestured to a single image, the trial terminated. On a few occasions, infants did not reach out and select an image. When this occurred, a second test prompt was given 10 seconds after the first prompt and infants were given 20 seconds to respond to the second prompt. If an infant dropped an image card, the experimenter tried to retrieve it and return it to the table as quickly as possible. At the conclusion of the test trials, the experimenter said, "All done. Thank you!" and retrieved the image cards from the infant. The experimenter then began the second block of trials, which presented the same image and word pairs as the first block in a different order. See Table 1 for a full outline of all the conditions.

	Trial 1	Trial 2	Trial 3	Trial 4	Test Trial
Consistent Label	Look! Fep!	Look! Fep!	Look! Fep!	Look! Fep!	Where's Fep?
	After 7 sec: Yes! Fep!	After 7 sec: Yes! Fep!	After 7 sec: Yes! Fep!	After 7 sec: Yes! Fep!	
Distinct Label	Look! Wug!	Look! Gorp!	Look! Dax!	Look! Blick!	Where's Fep?
	After 7 sec: Yes! Wug!	After 7 sec: Yes! Gorp!	After 7 sec: Yes! Dax!	After 7 sec: Yes! Blick!	
No Label	Look! See!	Look! See!	Look! See!	Look! See!	Where's one?
	After 7 sec: Yes! See!	After 7 sec: Yes! See!	After 7 sec: Yes! See!	After 7 sec: Yes! See!	

Table 1. Trial structure for each of the three conditions

Coding

We used a video camera to record infants' responses, which were later coded off-line by coders blind to the experimental conditions. Infants' gestural behavior and eye gaze were coded frame-by-frame. We scored infants as choosing an image if they made a gesture (point or grab) accompanied by an eye gaze fixation towards the same image. For infants who did not have a clear gestured selection, we examined which image they looked longer at in test. Previous studies have shown that eye gaze fixation is a reliable measure of infants' knowledge in word-learning tasks (e.g., Bélanger & Hall, 2006; Halberda, 2003; Hollich, Hirsh-Pasek, Golinkoff, 2000). Eye gaze coding was used for seven of the infants, who did not make clear gestural indications (one infant in the *Variable Label* condition, three infants in the *Consistent Label* condition, and three infants in the *No Label* condition). Inter-rater reliability was assessed by having an independent researcher code 50% of the infants' choice behavior (r = .95).

We recorded the experimenter's behaviour for half the infants to examine whether the experimenter was influencing the infants' choice behaviour. Two research assistants blind to the hypothesis and study design watched the videos and coded for any cues from the experimenter towards either image. If the assistant observed any such cues, the assistant then marked which of the images she believed the experimenter was biased towards. For two of the participants, the assistants reported that the experimenter was biased. In both cases of reported experimenter bias, however, the children did not appear to follow the experimenter's cues. The research assistants also recorded what they

thought the referent object was for half of the infants. The coders' speculations about the intended referent image did not correlate with infants' choices (r = -.03).

RESULTS

We predicted that infants who did not hear a label during familiarization would not show any preference for the face or the emu on the test trials because we expected that the face and emu would be equally appealing to them. Similarly, we anticipated that infants who were given a consistent label would show no preference for either image. The rationale for this prediction was that consistent labels should highlight categories for infants and that people and emus would be equally valid candidates for a category label. Yet in the *Distinct Label* condition, we expected that infants would select the face at test. We predicted that distinct names would highlight contrasts in people more so than in other animals. Although both emus and people might contrast with each other by belonging to different categories or having different properties, we expected that people would be likely to be picked out as individuals as well. Therefore, we predicted that distinct labels would pick out distinct people as opposed to distinct emus. See Table 2 for infants' expected choices at test for each condition.

Condition	Expected Choice at Test
No Label	Face or Emu
Consistent Label	Face or Emu
Distinct Label	Face

Table 2. Predicted choice for test trials

In a preliminary analysis of variance, the proportion of face choices did not depend on age, gender, order of presentation or the specific pairings of the faces with particular emus, so the results were collapsed across these factors. A one-way analysis of variance (with condition as the factor) showed a significant main effect of condition on the proportion of infants' face choices, $F(2, 45) = 6.82$, $\eta_p^2 = .23$, $p = .003$. Post-hoc analysis using Tukey's HSD (α=.05) indicated that infants chose the face more often when given distinct labels ($M = .81$, $SD = .25$), than when given consistent labels ($M = .50$, $SD = .18$, 95% CI for the difference between means [.08, .55], $p = .007$) and chose the face more often when given distinct labels than when given no label ($M = .50$, $SD = .37$, 95% CI for the difference between means [.08, .55], $p = .007$). There was no significant difference in infants' proportion of face choice between the *Consistent Label* and *No Label* conditions (95% CI for the difference between means [-.24, .24], $p = 1.00$). See Figure 3.

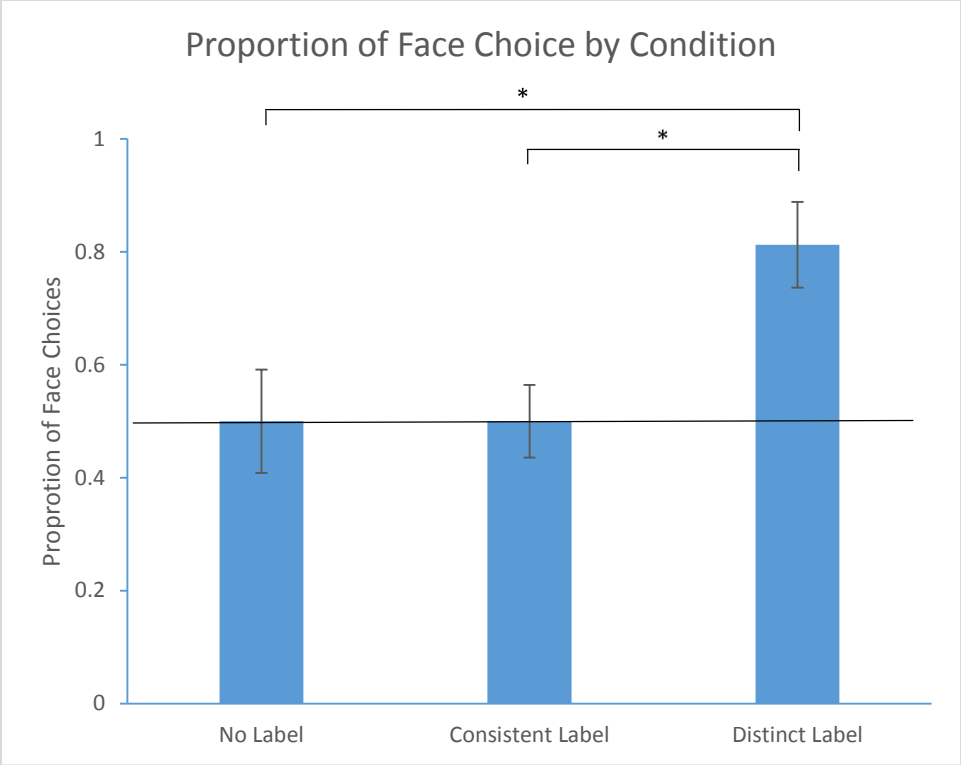

Figure 3. Proportion of face choices by condition. (A score below .50 indicates a preference for choosing the emu at test and above .50 indicates a preference for choosing the face at test. Error bars represent +/- one standard error of the mean. Asterisks indicate $p < .05$.)

As predicted, infants in the *No Label* and *Consistent Label* groups did not show a preference for either the face or the emu. With distinct labels; however, infants showed a significant preference for the face. These findings reveal that infants can track the labels provided across trials and are sensitive to the labelling pattern. Moreover, these findings suggest infants can use the labelling pattern to resolve an ambiguous choice between two different kinds of objects (people and animals). Further discussion about the interpretation of these results is presented in the following section.

To further probe the nature of infants' choices on the test trials, we analyzed infants' consistency of responding across two blocks. We carried out Fisher's exact tests, comparing the number of infants who consistently chose the face on both blocks (2/2) between pairs of conditions. The results showed that infants in the *No Label* group did not differ in their response patterns compared to those in the *Consistent Label* group N=32, p > .05 (one-tailed). Consistent with our previous results, infants in the *Distinct Label* group had a significantly different response pattern than the infants in the *Consistent Label* group, N=32, p =.037 (one-tailed), and the infants in the *No Label* group, N=32, p <.001 (one-tailed). This result supports the previous findings that with distinct labels infants show a preference for the face over the emu. See Table 3 for details of infants' response patterns.

	Consistently chose face (2/2)	Did not consistently choose face (1/2 and 0/2)
No label	4	12
Consistent label	1	15
Distinct labels	10	6

Table 3. Infants' response patterns for each condition.

We further broke down our analysis to examine the children who consistently chose the emu and those who had a mixed response and chose the emu on one trial and the face on the other. Eight infants in the *No Label* group had a mixed response and four consistently chose the emu. In the *Consistent Label* group, 14 infants had a mixed response, whereas one infant consistently chose the emu. Six infants in the *Distinct*

Labels group had a mixed response and chose the emu on one trial and the face on the other, whereas no infants consistently chose the emu. We ran a Fisher's exact test comparing the children who consistently chose the emu to those who had mixed responses. The infants in the *No Label* group did not differ in their responses from the infants in the *Consistent Label* group, N=32, p >.05 (one-tailed), or from the *Distinct Label* group, N=32, p >.05 (one-tailed). Additionally, the infants in the *Consistent Label* group did not differ from the *Distinct Label* group in their responses to consistently choose the emu or have a mixed response, N=32, p >.05 (one-tailed).

Finally, we explored whether vocabulary development was related to infants' ability to use the pattern of labelling to resolve the ambiguous labelling events. It may be the case that infants with larger vocabularies have a better understanding of different classes of words. Specifically, infants with larger vocabularies might be more likely to understand that proper names map to individuals and that count nouns map to categories. Additionally, prior research has supported the claim that language development affects conceptual organization (e.g., Nazzi & Gopnik, 2001). This raises the possibility that infants with larger vocabularies have a stronger bias to construe people as individuals. A larger vocabulary may also help infants to be more sensitive and successful at tracking labelling patterns to resolve the ambiguous labelling events. We used parental reports of infants' vocabulary to examine whether infants' comprehension or production of words was related to their tendency to choose the face at test. In the *No Label* condition, infants' tendency to choose the face was not related to age (r =.01, p = .96), comprehension (r =-.16, p = .56) or production (r =-.09, p = .74). In the *Consistent*

Label condition, infants' tendency to choose the face was not related to age (r =.12, p = .32), comprehension (r =-.20, p = .23) or production (r =-.10, p = .36). With *Distinct Labels*, infants' tendency to choose the face was related to age (r=.47, p = .03) and comprehension (r =.46, p = .04), but infants' face choices were not related to production (r =.16, p = .27). Additionally, infants' comprehension and age were significantly related (r=.58, p = .014). In sum, these results revealed that older infants and infants with larger vocabularies were more likely to pick the face when hearing distinct labels. This suggests that the ability to use distinct labels to resolve an ambiguous labelling event is related to overall development and language abilities. We will return to this issue in the Discussion.

DISCUSSION

Fourteen-month-old infants who heard a consistent label or a phrase containing no label while viewing face-emu pairs did not appear to map the label to a new face or to a new emu. In contrast, infants who heard a distinct label presented with each pair of images tended to choose the face as the referent of another distinct label on the test trials, and they were more likely to select the face if they were older or had a larger vocabulary.

Many studies have found that providing a common label for a set of objects leads infants to interpret that word as a category name, in the manner of a count noun (Balaban & Waxman, 1997; Fulkerson & Haaf, 1998; Waxman & Booth, 2003; Welder & Graham, 2001). In one condition of our study, infants heard a consistent label for pairs of images (a face and an emu). After familiarization, infants viewed another face and emu pair while the experimenter asked the infants to find the referent of the same label they had heard on the familiarization trials. If infants interpreted the word as a category term, they would have had difficulty in resolving the ambiguity because faces and emus can both have category names (e.g., person, animal). We predicted that infants would find both faces and emus to be equally likely as referents of the novel label and therefore would not show a preference for either image on the test trials. Our results revealed that children chose the face and the emu equally often. This result is consistent with the possibility that infants interpreted the label as a count noun. Another interpretation, however, is that infants did not have had a preference; instead, they may have been guessing and perhaps did not map the label to either object. It is still unclear from these results if infants were interpreting the consistent label as a category word. Further experiments should examine

whether the infants were able to map the label to either object. One way to assess this possibility would be to provide infants with two images, one belonging to a different category from that of the objects that they saw during familiarization and one belonging to the same category as the objects they saw during familiarization. For example, infants could view the same familiarization trials with face-emu pairs and then be tested with a face-ball pair or an emu-ball pair. If infants have successfully mapped the labels, we would expect a replication of previous studies, with infants choosing the face or emu (the familiar object) over the novel object on test trials.

When distinct labels were provided for each face-emu pair during familiarization, infants were able to resolve the ambiguity and interpret a word as picking out the new face on the test trials. Previous research has suggested that distinct labels do not pick out categories and instead pick out contrasts among objects (Xu, 1999). Contrastive words could be interpreted as count nouns picking out subcategories of objects, as adjectives picking out distinguishing properties or as proper names picking out individuals. Evidence from previous studies has revealed that children tend to interpret labels as names for individuals for people and familiar animals that are anthropomorphized or pet-like. In contrast, children do not tend to interpret words as labels for individuals for unfamiliar animals or for familiar animals that are not pet-like or anthropomorphic (see Hall, 2009 for review). Therefore, people and animals are equally likely to be picked out based on their belonging to different subcategories or having unique properties, but only people are likely to be picked out based on their being individuals. Since people can be additionally contrasted from one another in terms of their distinct individual identities,

we predicted that distinct labels would be more likely to be interpreted as picking out contrasts in people than in other animals. Our finding that 14-month-olds who heard distinct labels for each emu-face pair chose the face on the test trials is consistent with the claim that infants interpret distinct labels as picking out distinct people rather than distinct emus. Infants could have interpreted the distinct labels as proper names that picked out separate individuals, as count nouns picking out different subcategories of the faces or as adjectives picking out discriminating properties of the faces. Each of these possible interpretations of distinct labels will be examined in turn.

Infants' tendency to choose the face on the test trials when they hear distinct labels is consistent with the claim that infants interpreted the distinct words as picking out individuals. Infants may have mapped the distinct labels to individuals in the manner of proper names because people have an additional contrastive dimension of being individuals that is not typically seen with animals that are not prototypical pets. This proposed interpretation of infants' behaviour is an intriguing possibility that raises the question of why infants might construe people as individuals more so than they do other objects. Perhaps the answer reflects the fact that people are animates, are agents, and are important social figures. Evidence from proper name learning for artifacts certainly suggests that children do not typically think of inanimate objects as individuals (Jaswal & Markman, 2001; Katz, Baker, & Marcnamara, 1974; Sorrentino, 1999; Hall 1994; Gelman & Taylor, 1984, Leung & Hall, 2011). Yet some research suggests that children appear to accept proper names for artifacts that have mental states (Sorrentino, 1999). By giving an artifact a mental state, its status becomes closer to that of an animate object.

The literature on children's expectations about the meanings of labels for animals seems to offer some insight into why children often construe people as individuals. Research has demonstrated that children will construe animals as individuals if they are familiar animals that are anthropomorphic or pet-like (Imai & Haryu, 2001; Hall, 1994; Jaswal & Markman, 2001). Thus with animals, it seems that being animate and being familiar alone does not result in easy construal as an individual. Animals appear to be easily construed as individuals if the animal is humanlike or owned and personally important to someone (i.e., their owner). This research on children's interpretations about labels for animals suggests that an important component of an object being more easily construed as an individual is its social importance; however, it is likely that all three of these factors (agency, familiarity and social importance) play a role in explaining why people are easily construed as individuals whereas other objects are not.

To further clarify whether distinct labels help infants learn proper names for people, future work should examine whether caregivers use these cues (pattern of labelling and information about the kind of object) to teach young infants the distinction between proper names and words from other lexical classes. There is some support for part of this claim from a study examining how caregivers teach words to young children (Hall, Burns, & Pawluski, 2003). Caregivers were asked to teach their 2- to 4-year-old children labels for drawings of familiar animate (e.g., dog) and inanimate (e.g., shoe) objects. When caregivers were asked to teach proper names for inanimate objects, they were more likely to mark the label as an exception that was odd in comparison to when they were asked to teach proper names for animate objects. This finding suggests that

caregivers also recognize and teach according to a conceptual bias that some objects (e.g., animals) are more likely picked out as individuals than other objects (e.g., artifacts). Future work should also examine whether caregivers are more likely to give distinct labels to people than to unfamiliar animals and artifacts, a result that would lend support to our findings presented here.

A second interpretation of infants' tendency to choose the face on the test trials after hearing distinct labels for each pair of face-emu in the familiarization trials is that distinct labels picked out subcategories of the faces (e.g., blonde-haired girl, brown-haired girl). If this interpretation is correct, then it is perhaps surprising that infants thought that the labels picked out subcategories for faces but not for animals. It is possible that salient perceptual differences between the faces, such as bright distinctive hair colours, made it easier to separate the faces into different categories. Alternatively, infants might have been more likely to pick out subcategories of objects that they were familiar with (e.g., people) than ones that were novel to them (e.g., emus). For example, if you were highly familiar with dogs but you were not as familiar with birds, you might be more likely to interpret distinct labels as picking out subcategories for dogs than for birds because you already have some understanding of the subcategories (e.g., breeds). Further research will be needed to explore this possibility and to gain insight into how children resolve ambiguous situations by using object familiarity.

A third possible explanation for infants' tendency to choose the face on the test trials when they have heard distinct labels for each face-emu pair in familiarization is that

infants interpreted these labels as adjectives. Distinct labels might pick out differences in the properties of objects. Infants might have picked out the faces rather than the emus, if infants interpreted these labels as mapping to distinctive properties (of the faces). If this were the case, then infants might have mapped these words to a salient feature like hair colour rather than to the more subtle colour distinctions seen between the emus. This would be a very intriguing finding because it would shed light on infants' early ability to learn adjectives. Previous work has largely shown that infants begin to understand adjectives around 21 months, with limited evidence of earlier understanding at 14 months (Booth & Waxman, 2003; Waxman, 1999; Waxman & Booth, 2001). To examine whether infants can use distinctive labelling patterns to learn adjectives, additional research is required.

As discussed, our research leaves open the question of how infants in our study interpreted the distinct labels. The infants in our study could have interpreted the distinct labels as proper names for individual people (e.g., Mary), as contrastive count nouns picking out subcategories (e.g., blonde-haired girl), or as adjectives picking out distinctive properties (e.g., hair colour). Although past work suggests that children are likely to interpret labels for people as labels for individuals, and although our results are consistent with this claim, our study does not rule out these alternative interpretations (see Leung & Hall, 2011). We are now further examining infants' expectation about distinct labels by conducting a follow-up experiment. In this new study, infants view pairs of objects in which one object is depicted as an agent and the other is depicted as a non-agent. For each agent and non-agent pair, infants hear a consistent label or distinct

labels. To help control for the possibility that infants interpret the labels as naming subcategories or distinguishing properties, the two objects look identical in terms of shape and colour. The objects in each pair differ from each other in terms of their depiction of agency; the agent object has human vocalizations, a face and moves independently. In contrast, the non-agent object in each pair plays machine-like sounds, has scrambled facial features and moves by a hand pushing it. After viewing several familiarization trials with either the same label presented for every pair of objects or distinct labels presented for every pair, infants are shown a new agent and a new non-agent and asked to find the referent of a word. With distinct labels, if infants pick the agent over the non-agent, it would suggest that infants infer that distinct labels pick out individuals, in the manner of proper names.

Our results are consistent with the possibility that infants infer that distinct labels applied across people are proper names. If infants do infer that distinct labels for people are proper names, the results suggest a way in which English-learning infants could use non-linguistic cues to identify proper names in speech--and thereby learn the linguistic cues marking these words. By being able to identify proper names (words that label individuals) at fourteen months, infants would be able to better attend to the sentence context of these terms and ultimately learn the specific linguistic cues that mark these words a few months later. Distinct names applied to objects appear to highlight contrasts and may help infants to learn contrastive proper names. Although infants may interpret distinct labels as proper names, it is important to note that the research presented here

does not exclude the possibility that infants may interpret distinct labels in the manner of contrastive category labels or contrastive adjectives.

Although the research here still leaves open interpretive questions for what distinct labels function to do, the findings indicate that with distinct labels infants are able to resolve the ambiguity inherent in the task design. In this study, the ambiguous labelling event consisted of four trials, each containing two referents with only one word provided. Infants who systematically selected only one object (the face) tended to have a larger vocabulary and be older. This result suggests that whatever mechanism is at work, infants' ability to use the labelling pattern improves with language development and age. The ambiguity presented to the infants here is a very simplified and controlled version of the ambiguity that infants face every day. As Quine (1960) discussed, even having someone point to an object is not always enough to resolve the ambiguity surrounding a word's meaning. An infant's ability to successfully decipher the lexical class of a novel label would help to drastically narrow down its possible meaning. The research here suggests that infants can begin to tackle this problem without using sentential cues.

Many studies have demonstrated that consistent labels applied to a set of objects highlight categories; however, limited research has explored how distinct labels might guide infants' interpretations and mappings. We found infants could not resolve an ambiguous labelling trial when given consistent labels but were able to when given distinct labels. These findings lend further insights into how infants learn words in ambiguous scenarios. Our results support the claim that distinct labels pick out contrasts

and that these labels more easily pick out contrasts between people than between non-human animals. These findings are consistent with the interpretation that infants map distinctive labels in the manner of contrastive count nouns, adjectives or proper names. Future work is still needed to further probe the nature of infants' interpretations of distinct labels.

REFERENCES

Balaban, M. T., & Waxman, S. R. (1997). Do words facilitates object categorization in 9-month-old infants? *Journal of Experimental Child Psychology, 64*(1), 3-26.

Bélanger, J. & Hall, D. G. (2006). Learning proper names and count nouns: Evidence from 16- and 20-month-olds. *Journal of Cognition and Development,* 7, 45-72.

Bloom, P. (2000). *How children learn the meaning of words.* Cambridge, MA: MIT Press.

Bloom, P. (2004). *Descartes' baby*. New York: Basic Books.

Bonatti, L., Frot, E., Zangl, R., & Mehler, J. (2002). The human first hypothesis: Identification of conspecifics and object individuation of the young infant. *Cognitive Psychology, 44,* 388-426.

Booth, A. E., & Waxman, S. R. (2002). Object names and object functions serve as cues to categories for infants. *Developmental Psychology, 38*(6), 948-957.

Booth, A. E. & Waxman, S. R. (2003). Mapping words to the world in infancy: On the evolution of expectations for count nouns and adjectives. *Journal of Cognition and Development, 4*(3), 357-381.

Brown, R. (1985). *Words and things*. Glencoe, IL: Free Press.

Carey, S. (2009). *The origin of concepts*. New York: Oxford University Press.

Diesendruck, G. (2003). Categories for names or names for categories: The interplay between domain-specific conceptual structure and the language. *Language and Cognitive Processes, 18* (5/6), 759-787.

Dromi, E. (1987). *Early lexical development*. Cambridge: Cambridge University Press.

Fensen, L., Dale, P. S., Reznick, J. S., Bates, E., Thal, D. J., & Pethink, S. J. (1994). Studies on the formation of perceptually based basic-level categories in young infants. *Child Development*, 65, 903-917.

Fulkerson, A.L., & Haaf, R. A. (1998). *New words for things: The relationship between novel labels and twelve-month-olds' categorization of novel objects*. Paper presented at the International Conference on Infant Studies, Atlanta, GA.

Fulkerson, A. L., & Haaf, R. A. (2003). The influence of labels, non-labeling sounds, and source of auditory input on 9- and 15- month olds' object categorization. *Infancy, 4*, 349-369.

Gelman, S.A. and Kalish, C.W. (2006). Conceptual development. In *Handbook of child psychology: cognition, perception, and language* (Vol. 2, 6th edition) (Kuhn, D. and Siegler, R. S., eds), pp. 687–733, Wiley

Gelman, S. & Taylor, M. (1984). How two-year-old children interpret proper and common names for unfamiliar objects. *Child Development, 55*, 1535-1540.

Gopnik, A., Sobel, D., Schulz, L., & Glymour, C. (2001). Causal learning mechanisms in very young children: Two-, three-, and four-year-olds infer causal relations from patterns of variation and covariation. *Developmental Psychology, 37*(5), 620-629.

Graham, S. A., Kilbreath, C. S., & Welder, A. N. (2004). 13-month-olds rely on shared labels and shape similarity for inductive inferences. *Child Development, 75*, 409-427.

Halberda, J. (2003). The development of a word-learning strategy. *Cognition, 87*, B23-B34.

Hall, D. G. (1991). Aquiring proper names for familiar and unfamiliar animate objects: two-year-olds' word-learning biases. *Child Development, 62,* 1142-1154.

Hall, D. G. (1994). Semantic constraints on word learning: proper names and adjectives. *Child Development, 65,* 1299-1317.

Hall, D. G. (2009). Proper names in early word learning: Rethinking a theoretical account of lexical development. *Mind & Language, 24*(4), 404-432

Hall, D. G. & Bélanger, J. (2009). Infants' use of the mutual exclusivity assumption to learn proper names. Manuscript in preparation, Department of Psychology, University of British Columbia.

Hall, D. G., Burns, T. & Pawluski, J. (2003). Input and word learning: caregivers' sensitivity to lexical category distinctions. *Journal of Child Language, 30,* 711-729.

Hall, D. G., Lee, S., & Bélanger, J. (2001). Young children's use of syntactic cues to learn proper names and count nouns. *Developmental Psychology, 37,* 298-307.

Hall, D. G., Corrigall, K., Rhemtulla, M., Donegan, E. & Xu, F. (2008). Infants' use of lexical-category-to-meaning links in object individuation. *Child Development, 79,* 1432-1443.

Hollich, G. J., Hirsh-Pasek, K., Golinkoff, R. M. (2000). Breaking the language barrier: An emergentist coalition model for the origins of word learning. *Monographs of the Society for Research in Child Development, Vol. 65* (Serial No. 3)

Imai, M. & Haryu, E. (2001). Learning proper nouns and common nouns without clues from syntax. *Child Development*, 72, 787-802.

Jaswal, V. & Markman, E. (2001). Learning proper names and common names in inferential versus ostensive contexts. *Child Development, 72,* 768-786.

Katz, N., Baker, E., & Macnamara, J. (1974). What's in a name? A study of how children learn common and proper names. *Child Development, 45*, 469-473.

Kulmeier, V., Bloom, P., & Wynn, K. (2004). Do 5-month-olds see humans as material objects? *Cognition, 94,* 95-101.

Leslie, A. M. (1984). Infant perception of a manual pick-up event. *British Journal of Developmental Psychology, 2*, 19-32.

Leung, D. & Hall, D. G. in preparation

Macnamara, J. (1982). *Names for things: A study of human learning*. Cambridge, MA: MIT Press

Macnamara, J. (1986). *A border dispute*. Cambridge, MA: MIT Press.

Mandler, J. M. (2000). Perceptual and conceptual processes in infancy. *Journal of Cognition and Development, 1*, 3-36.

Mandler, J. M. & McDonough, L. (1993). Conceptual formation in infancy. *Cognitive Development, 8,* 291-318.

Maratsos, M. (2001). How fast does a child learn a word? *Behavioral and Brain Sciences, 24*, 1111-1112.

Nazzi, T., & Gopnik, A. (2001). Linguistic and cognitive abilities in infancy: When does language become a tool for categorization? *Cognition, 80*(3), B11-B20.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development, 38* (Serial No. 149).

Quine, W.V.O. (1960). *Word and object.* Cambridge, MA: MIT Press

Quinn, P. C. & Eimas, P. D. (1998). Evidence for a global categorical representation of humans by young infants. *Journal of Experimental Child Psychology, 69*, 151-174.

Rakison, D. & Poulin-Dubois, D. (2001). Developmental origin of the animate-inanimate distinction. *Psychological Bulletin, 197*, 209-228.

Roberts, K., & Jacob, M. (1992). Linguistic versus attentional influences on nonlinguistic categorization in 15-month-old infants. *Cognitive Development, 6*(4), 355-375.

Smith, L. & Yu, C. (2008). Infants rapidly learn word-referent mappings via cross-situational statistics. *Cognition, 106*, 1558-1568.

Sorrentino, C. (1999). Individuation, identity, and proper names in cognitive development. Unpublished doctoral dissertation, Massachusetts Institute of Technology.

Spelke, E. S., Philips, A., & Woodward, A. L. (1995). Infants' knowledge of object motion and human action. In D. Sperber, D. Premack, & A. J. Premack (Eds.), Causal cognition (pp. 150-184). Oxford, England: Clarendon.

Tardif, R., Fletcher, P., Liang, W., Zhang, Z., Kaciroti, N. & Marchman, V. (2008). Baby's first ten words. *Developmental Psychology, 44*, 929-38.

Waxman S. R. (1999). Specifying the scope of 13-month-olds' expectations for novel words. *Cognition, 70*(3), B35-B50.

Waxman, S. R. & Braun, I. E. (2005). Consistent (but not variable) names as invitations to form object categories: new evidence from 12-month-old infants. *Cognition, 95*, B59- B68.

Waxman, S. R., & Booth, A. E. (2001). Seeing pink elephants: Fourteen-month-olds' interpretations of novel nouns and adjectives. *Cognitive Psychology, 43*, 217-242.

Waxman, S. R., & Booth, A. E. (2003). The origins and evolution of links between word learning and conceptual organization: New evidence from 11-month-olds. *Developmental Science, 6*(2), 130-137

Waxman, S. R. & Gelman, S. A. (2010). Different kinds of concepts and different kinds of words: What words do for human cognition. In Mareschal, Quinn & Lea (Eds.) *The making of human concepts.* Oxford, UK: Oxford University Press.

Waxman, S. R. & Lidz, J. L. (2006). Early word learning. In D. Kuhn & R. Siegler (Eds.), *Handbook of child psychology* (6th ed., Vol. 2, pp 299-335). Hoboken, NJ: Wiley.

Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12- and 13- month-old infants. *Cognitive Psychology, 29*(3), 257-302.

Waxman, S. R., & Markow, D. B. (1998). Object properties and object kind: 21-month-old infants' extension of novel adjectives. *Child Development, 69*, 1313-1329.

Welder, A. N., & Graham, S.A. (2001). The influences of shape similarity and shared labels on infants' inductive inferences about nonobvious object properties. *Child Development, 72*(6), 1653-1673.

Woodward, A. L. (1998). Infants selectively encode the goal object of an actor's reach. *Cognition, 69*, 1-34.

Xu, F. (1999). Object individuation and object identity in infancy: The role of spatiotemporal information, object property information and language, *Acta Psychologica, 102*(2-3), 113-136

APPENDIX A

Script for each condition.

Consistent label condition

Familiarization

"Look! Fep! Yes! Fep!"

"Look! Fep! Yes! Fep!"

"Look! Fep! Yes! Fep!"

"Look! Fep! Yes! Fep!"

Test

"Where's Fep?"

Distinct labels condition

"Look! Wug! Yes! Wug!"

"Look! Gorp! Yes! Gorp!"

"Look! Dax! Yes! Dax!"

"Look! Blick! Yes! Blick!"

Test

"Where's Fep?"

No label condition

"Look! See! Yes! See!"

“Look! See! Yes! See!”

“Look! See! Yes! See!”

“Look! See! Yes! See!”

Test

“Where’s one?”