The Concept of Animacy versus the Object Bias Principle in 18-Month-Olds' Word Learning

Marina Katerelos

A Thesis
in
The Department of Psychology

Presented in Partial Fulfilment of the Requirements
for the Degree of Masters of Arts at
Concordia University
Montreal, Quebec, Canada

July 2000

0-612-54276-9

Abstract

The Concept of Animacy versus the Object Bias Principle in 18-Month-Olds' Word Learning

Marina Katerelos

Researchers have postulated word-learning biases to explain infants' effortless acquisition of object words. One such bias, the whole object assumption, helps infants acquire new words by narrowing the referent of a novel label to an entire object, rather than to actions, spatial relations or parts of that object (Woodward & Markman, 1998). This object bias is surprising given that motion is particularly salient to young infants (Poulin-Dubois, 1999).

The main objective of the present experiment was to determine whether the whole object assumption could be overridden when a novel label is presented in the context of a novel object displaying an animate or an inanimate motion. To address this issue, 18-month-old infants were presented with an animate object, engaged in an animate motion and an inanimate object engaged in an inanimate motion. A novel label was paired with each of these events. On test trials, infants were simultaneously presented with the event originally paired with the target label and the event paired with the other label. In the generalization trials, the original pairings presented in the training phase were switched, such that infants saw the animate object performing the inanimate motion and the inanimate object performing the animate motion.

The results of the present study revealed that as a group, 18-month-old infants were unable to learn a label for an object in motion. The current results are discussed in the context of the recent word learning literature.

Acknowledgements

I would like to express my deepest appreciation to my research supervisor, Dr. Diane Poulin-Dubois for her contribution to this project, as well as for her continuous guidance and support. I am truly grateful for her care and warmth, as well as for her enthusiasm and dedication, which have been invaluable for me during these past two years.

I would also like to thank the members of my thesis committee, Dr. Norman Segalowitz and Dr. Lisa Serbin for their helpful comments and feedback. Their interesting and thought-provoking questions helped make my defence an exciting and rewarding experience.

My warmest appreciation goes to the members of the Poulin-Dubois lab for their support, encouragement, and for knowing when it was time to stop and celebrate life. I would especially like to thank Rachel Baker for being such a supportive friend, for dropping everything whenever I interrupted with questions, and for helping me with this project and various graduate mini-crises along the way. I would like to thank Paula Bennett and Julie Eichstedt for passing on their graduate student knowledge, and intervening with laughter and chocolate at the appropriate moments. I would also like to thank Johanna Vyncke for her friendship, warmth and encouragement - and for knowing when it was time for a *Croissanterie* trip. I would like to extend my thanks to David Rakison for stirring up much scientific debate, and helping in the fine tuning of this project, and to Valentina Munoz for her support and help on this project.

My warmest thanks goes to Elka Leiba for her friendship and continuous support, as well as for her ability to make me laugh and to help keep things in perspective. She has truly made these past two years very enjoyable.

My thanks also goes to Carlos Mendes and Paul Eifert for helping me with the technical aspect of this project, and with the many troubleshooting problems that kept occurring, as my personal experience was contrary to the claim by Swingley, Pinto, & Fernald (1999), who state that "computer control permits precise timing of stimulus presentation and has resulted in fewer errors due to equipment malfunction. It is also relatively easy to balance the brightness of computer monitors!"

My love and thanks go especially to Tina Antonopoulos, for her invaluable advice, often disguised in the form of "do whatever you want," as well as for her much cherished friendship and support.

I would also like to express my warmest appreciation to Eirini Tsakiri, who offered us the taste of the marvellous journey and the strength and desire to set sail for it.

Lastly, my deepest appreciation goes to my parents, my sister, and my family for their unending love and support throughout all my years and for giving me the courage and the push to strive for even greater heights.

This research was supported by a grant from the Natural Sciences and Engineering Research Council of Canada to Dr. Poulin-Dubois. While conducting this research, I was supported by scholarships from the Fonds pour la Formation de Chercheurs et l'Aide à la Recherche and the Centre for Research in Human Development.

Table of Contents

List of Figures

List of Tables

List of Appendices

Children typically reach their first word milestone around the age of 12 months. They then slowly acquire a small vocabulary of words, until the middle of the second year, at which point they start acquiring words at a seemingly effortless and faster pace (Bloom, 1998). By the time children reach the age of 18 months, they have developed a 50-word lexicon, and begun to undergo what researchers in the field have dubbed the "vocabulary spurt," (Bates, Dale, & Thal, 1995; Bloom, 1973, 1993; Bloom, Tinker, & Margulis, 1993; Dromi, 1987, 1993; Nelson, 1973). It has been estimated that children learn 5.5 new words a day, and reach a vocabulary of 10, 000 words by the time they are in first grade (Anglin, 1993).

This rapid linguistic development is somewhat surprising when one considers the "logical induction problem of word learning," (Quine, 1960). The problem is one of attaching a label to the appropriate referent whenever one is presented with linguistic information. How do children manage this formidable task considering all the plausible referents available? A child can choose to apply the referent to the entire object presented, to a specific part of the object, a characteristic of the object, or the action it is undergoing. The present thesis is concerned with precisely this issue: under what conditions will the infant choose to apply a new label to an action or a whole object.

In order to explain the ease with which children make the correct attributions, and thus their sudden increase in vocabulary, researchers have postulated various word-learning constraints that guide infants through the language acquisition process (Woodward & Markman, 1998). One such constraint is the whole object assumption, which states that when hearing a new word, infants are likely to attach the label to the whole object, and not to the object's properties, shape, or motion (Markman, 1989). This hypothesis has received support from empirical research (Baldwin, 1989; Landau, Smith, & Jones, 1988; Markman, 1989). In a classic study by Soja, Carey and Spelke (1991), 2-year-olds were taught a label for an object made of a salient substance. Infants were then asked to find the referent of the word, when presented with the same object made of a different substance, or with three pieces of the original substance. In accordance with the Whole Object Assumption, infants chose the object that had the same shape as the original referent. This study therefore supports the existence of the Whole Object Assumption guiding the child in the lexical acquisition process.

Linguistic constraints have been primarily concerned with explaining the acquisition of nouns (Bloom, 1998; Brown, 1958; MacNamara, 1982). It is consistent with the widespread assumption that nouns are learned more easily than all other types of words. In particular, Gentner (1982) has claimed that it is easier for infants to attach labels to objects, as they are distinct units, as opposed to action words, which depict relationships among events. Her claim is that nouns refer to simpler concepts, and should thus be learned first. In contrast, the concept of an action is more developmentally advanced, and thus acquired at a later stage (Gentner, 1981; MacNamara, 1972). Indeed, nouns are the largest word class in infants' vocabulary (Bloom, 1998), and they are among the first words to be acquired (Gentner, 1978; MacNamara, 1972; Nelson, 1973).

Researchers have reported that verbs become part of the child's lexicon only around their second birthday (Bloom, 1998), when they begin noticing relationships among events. This newly acquired affinity for relationships is believed to develop around this time to prepare the child for full syntactic utterances. This view therefore holds that the acquisition of action words would not be possible before this stage.

Recently, some researchers have challenged the view that suggests a developmental advantage for the acquisition of labels for objects. Certain authors report that words for actions or events are acquired even among children's first set of words (Bloom, 1973, Bowerman, 1974; Gopnik & Meltzoff, 1986; Huttenlocher, Smiley, & Charney, 1983; Nelson, 1973; Tomasello, 1992). Other authors point out that names for objects only make up about 35 - 40% of children's early lexicon before the age of 2 (Bates, Bretherton, & Snyder, 1988, Bloom 1973; Bloom et. al., 1993; Gopnik, 1982; Hampson, 1989; Lieven, Pine, & Barnes, 1992; McCune-Nicolich, 1981; Nelson, 1973; Nelson, Hampson, & Shaw, 1993, 1988; Pine, 1992; Tomasello & Todd, 1983). In particular, Nelson et al., (1993) found that 36% of 18-month-olds' lexicon consisted of names for objects, 18% of nouns that were not labels for objects, proper nouns and mass nouns made up 4% and 8% of the lexicon respectively, and 10% of their lexicon were verbs. These high percentages of other linguistic categories in the young child's lexicon are inconsistent with the view that infants have a strong bias towards interpreting words as object labels.

Other researchers question the primacy of nouns in infants' early vocabulary. They claim that this perceived noun bias is simply an artefact of the linguistic structure of English, and not something universally true (Au, Dapretto, & Song, 1994; Choi & Gopnik, 1995; Tardif, Gelman, & Xu, 1999). Proponents of this view call attention to the fact that languages differ in their emphasis on nouns. For example, in

English, names of objects are most likely to be the loudest part of the sentence (Messer, 1981), and the part that comes at the end of the sentence. These characteristics of English are likely to make names the most salient part of the sentence, making it easier for English-speaking children to attend to them. Researchers have pointed out that in languages such as Korean that allow for nominal ellipsis (the ability to omit the subject when it is evident from the context), verbs have prominence in the sentence. In a study by Au et al., (1994), Korean parents ended their sentences with a verb in 46% of their utterances to their children, whereas only 10% of their sentences ended with a noun. However, the reverse was true of the speech samples of American parents, where 30% of the sentences ended with a noun, and only 9% ended with verbs. Korean parents were more likely to use action terms when addressing their children, whereas American parents were more likely to use object words (Choi & Gopnik, 1995). Thus cross-linguistic research suggests that the emphasis placed in a sentence is variable, and this variability may exert an influence in the type of words that children learn.

Studies examining language acquisition in Korean- (Choi & Gopnik, 1995) and in Mandarin-speaking children (Cheng, 1994; Tardif, 1996), seem to provide evidence supporting the hypothesis that the presence of the noun bias is indeed a linguistic artefact due to the linguistic input infants are exposed to, and not due to a privileged status for object labels. In a study examining this issue, Tardif et al., (1999) compared the language acquisition process in 20-month-old infants learning English and Mandarin. Linguistic productions were measured with vocabulary checklists, as well as with laboratory observations of book reading and toy playing contexts.

Although they found that nouns were an important linguistic category for both groups of children, Mandarin-speaking children had a larger proportion of verbs among their first words than English-speaking children. Furthermore, Mandarin-speaking mother-child dyads used more verbs than English-speaking dyads. Interestingly, when comparing the words uttered during a session, and those reported by mothers, it appears that mothers are increasingly likely to remember the object labels that their child produces, and to underreport their verbs (Tardif et al., 1999). Other studies corroborate this finding (Bloom, 1998; Pine, 1992; Pine, Lieven, & Rowland, 1996). It appears that mothers are more attentive to children's production of nouns, and thus provide inaccurate accounts of the verbs their children produce. This finding emphasizes the possibility that the perceived preference for object labels may be inflated due to a parental report bias.

Bloom (1998) argues that nouns are perceived as being the largest class of words produced by infants, simply due to the fact that no other category assignments can truly be made before the child is making sentences, as part of speech can only be determined within the context of the sentence. In particular, when the child says "cup", we take it to signify that the child is attaching the label to the object. However, without the syntactic context, we can never know the specific "juice-cup relation" the child is referring to (Bloom et al., 1993).

Further evidence against this postulated "noun bias," are lexical training studies that show that infants can learn action words as easily and as readily as they can learn object words. In a study by Tomasello and Farrar (1986), 14- and 21-month-old children were only slightly better on comprehension tasks for the object rather than the action words they were taught. This difference may have been influenced by the increased task demands in demonstrating knowledge of the action word. In particular, infants simply needed to point to the referent of the object, whereas they were required to imitate the referent action.

Other studies have shown that infants can acquire verbs after very few training trials. Poulin-Dubois and Forbes (2000; also Forbes & Poulin-Dubois, 1997) familiarized 21- and 27-month-olds to actions labelled by novel words. In order to test for whether they learned these verbs, infants were asked to find the referent while being presented with two images, one of which depicted the identical action, whereas the other depicted a different action. After only two training trials, infants as young as 21 months, demonstrated knowledge of the action word by looking longer at the original referent.

Arguments made for the later acquisition of verbs are indeed somewhat surprising when one considers infants' interest and experience with motion. Infants are more likely to respond to moving objects than to stationary ones (Slater, 1989). Furthermore, moving objects tend to attract infants' attention, as they notice them at greater distances than stationary objects (Burnham, 1987). Motion is thus a characteristic that is a salient feature of the young child's environment.

It is precisely this type of information that is hypothesized to be central to the child's developing concepts, according to a theory developed by Mandler (1992). She postulates a specific mechanism of *perceptual analysis* that helps infants conceptualize their world. This process consists of infants translating the perceptual properties of the world into *image schemas,* by extracting and *recoding* perceptual information into a representation of meaning. Furthermore, she proposes that the presence of these preverbal concepts facilitates the acquisition of language, as infants can attach a label to the particular referent for which they have a mental representation.

Mandler argues that infants are particularly attuned to motion cues, as animacy is one of the earliest types of perceptual information that is conceptualized. Infants process animacy, by abstracting certain properties that characterize animate or inanimate beings, such as motion path and trajectories (Mandler & McDonough, 1993). In particular, animate beings, such as people, animals and insects are conceptualized as being self-starting, that is, initiating their own motion without being acted on by an external force, and following an irregular motion path. They are also defined by the ability to change trajectories before coming into contact with an obstacle (Johnson, 1987). In contrast, inanimate objects, such as vehicles, rocks, furniture and toys, are defined by caused-motion, that is when a particular force acts on them in order to initiate motion. Furthermore, they follow a straight line, and are unable to avoid obstacles, simply colliding with them and usually bouncing off the obstacles. Mandler's theory holds that infants focus on these motion cues in order to create concepts of animals and vehicles. Evidence for this conceptualization of animacy has been reported in infants as young as 9 months (McDonough & Mandler, 1991).

It appears that infants entering into their second year of life are particularly sensitive to motion cues highlighting the animate-inanimate distinction. Children can differentiate among different motion types, such as between self-motion and caused-motion (Leslie, 1982, 1988; Oakes & Cohen, 1995; Premack, 1990), two different types of trajectories: goal-directed and random motion, and among two types of motion contingencies: motion at a distance vs. motion after direct contact (Poulin-Dubois, 1999; Spelke, Phillips, & Woodward, 1995), as well as between intentional and accidental motion (Rochat & Striano, 1999).

Evidence suggests that infants are sensitive to categorical differences in movement. One study reported that at the age of 3 months, infants responded differently to motion that is typical of humans, from other movement types that were similar, but inconsistent with biological motion (Bertenthal, 1993; Bertenthal, Profitt, Spetner, & Thomas, 1985). Infants' sensitivity to biomechanical motion is further refined at 5 months, as they do not discriminate among a light display of an upside-down walking motion and a random light display (Bertenthal & Davis, 1988).

Infants later start to develop their own expectations regarding animate or inanimate motion types, as 6-month-olds have an expectation that only animates can begin moving by action at a distance (Molina, Spelke, & King, 1996). By 9 months, children are surprised when they see self-propelled inanimates (Golinkoff & Harding, 1980; cited in Golinkoff, Harding, Carlson, & Sexton, 1984; Poulin-Dubois, Lepage, & Ferland, 1996; Poulin-Dubois & Shultz, 1988). Furthermore, 12-month-olds associate goal-directedness with animates (Woodward, 1998).

When looking at children's view of animacy, children's reactions to objects interacting with obstacles are important (Gergely, Nadasdy, Csibra, & Biro, 1995). In a particular study, 12-month-olds saw a large and a small disk, on each side of a rectangular block. The small disk would move closer to the large disc, pause before the wall, return to its original position and then jump over the block. This resulted in the small disc reaching the large disk. When presented to adults, this event is interpreted as a rational act to attain a specific goal, such as a baby trying to get to its mother. After being habituated to this event, infants were then presented with the test trial. In a scene where the block was now removed, infants saw the small disc either moving directly toward the large disc, or performing the previous action. Infants looked longer at the disc that was undergoing the same action as before. This suggests that they interpreted the original event as a rational action to attend a goal, and were thus surprised by the "non-rational, non-optimal" motion path.

Considering the saliency of motion for infants, we would expect infants to continue to notice and attend to such information in a linguistic context. It would then be plausible to believe that because infants are indeed likely to notice these relationships, as they already have a conceptual understanding of motion and animacy, that their sensitivity to motion cues would make them increasingly likely to attach a label to motion, particularly when the motion is typical of animate or inanimate objects. When examining the literature, there appears to be only few studies that have indeed examined children's ability to associate words with actions.

Werker, Cohen, Lloyd, Casasola and Stager (1998) examined children's ability to learn word-object associations by using objects that highlighted the animate-inanimate distinction, as this is precisely what children are sensitive to. In order to make the objects more salient, both objects were presented moving at a constant speed either back and forth, or from side to side. Eight to 14-month-old children were tested using the "switch design." That is children were habituated to seeing each object paired with a specific label. During the testing phase, children were presented with one of the original word-object pairings and with a new word-object pairing. If children did indeed learn the association of the label with its designated object, they should then significantly increase their looking time to the event that violated the original pairing, in contrast to the event that respected the original pairing. Fourteen-month-olds were indeed able to learn a word-object association, however this effect was eliminated when the objects were presented in a stationary condition. The authors interpreted these findings as motion being critical in allowing children to incorporate all of the present elements in order to make a word-object pairing. It appeared that infants presented with static images seemed to be aware of the various parts involved, but were unable to integrate everything into a whole. Younger infants were similarly able to detect all of the various elements, but unable to understand the presented relationship, despite the presence of motion cues. The authors argue that motion is a variable facilitating children's developing ability to integrate the various parts and understand the presented relationship. In particular, children were able to learn a word-object pairing, since associating words to moving objects was interpreted as an event. They assert that this helped children learn the label, as children have an affinity for learning event labels from the beginnings of the word learning process (Nelson, 1982).

A study by Casasola and Cohen (2000) examined children's ability to link a label to a novel action. Children were habituated to two events where a nonsense label was attached to a causal action, pushing and pulling. More specifically, children saw a Lego car drive into the scene where a can was then dropped. The car either pushed or pulled the can away. Children were habituated to both events, each paired with a novel label. On the test trials, children's looking time to the same event presented with the same or a different label was examined. If children had learned the label associated to the specific event, they were expected to look longer at the novel, unexpected relationship, than at the one that preserved the original pairing. However, children were not expected to be surprised if they did not learn the particular relationship, as all of the labels and the events had been familiar to the child.

The results indicated that 14-month-olds did not learn the association between the linguistic label and the action event, as they did not respond differently to a novel combination of event and label, despite being able to discriminate among the label-event pairings presented, as well as between the two actions. However, 18-month-olds were indeed able to learn the pairing between object and action. Cohen and Casasola bring to our attention the fact that although 14-month-olds in the Werker et al. (1998) study were able to form an association between a moving object and a word, applying a label to an action event is an ability that occurs by 18-months. It thus appears more difficult for children to attach the label to the action than to the object, suggesting that actions require increased cognitive effort to process them linguistically.

The review of the current literature suggests that young infants do possess action words in their early vocabulary, can learn labels for objects in motion, as well as for actions. By 18-months, children begin to experience a vocabulary spurt, and the type of verbs they possess also increases exponentially. However, it appears that despite the evidence that motion words are important in children's early vocabularies, their acquisition has been overlooked. Their presence in the vocabulary of the young infants is left unexplained, as word learning constraints do not take them into account, and therefore do not apply to them.

Overall, the literature on animacy suggests that motion is a salient feature of the child's environment. Children are attentive to motion cues, as they are instrumental in helping them conceptualize their world. Mandler (1992) postulates that these preverbal concepts facilitate and mediate the language acquisition process. Therefore, as infants are particularly attuned to the animate-inanimate distinction, animate and inanimate motion appears to be a likely candidate to be labelled by the young child.

In the present study, we were interested in exploring the role of motion cues in the language acquisition process. Specifically, the study examined how children construed a label paired with an object in motion. In a word-learning context where the object and motion cues were competing as possible referent interpretations, the question of interest was whether infants understood the referent to be the object, the motion, or the specific word-motion combination. According to word learning constraints such as the Whole Object Assumption, children will be guided to attach the linguistic label to the object, regardless of its motion path. However, the salient motion cues that are being presented may help the child to override the proposed lexical principles, and allow the labelling of the motion itself. We therefore make the hypothesis that the salient motion cues may override the whole object assumption.

The preferential looking paradigm was considered to be the methodology that would be most attuned to this process, and would give us greatest insight into children's word learning. This methodology was first implemented by Golinkoff, Hirsh-Pasek, Cauley and Gordon (1987), allowing to assess children's comprehension of words. Children are seated in front of two computer screens, on which an image or event is presented that is paired with the specific label. In order to examine the child's linguistic comprehension, two different images or events are presented on each of the screens during the testing phase. By examining the child's looking time at each of the concurrently presented events, one gets a measure of the child's comprehension of the label. This methodology presumes that the child will turn and look at the image that matches the linguistic label. Studies have demonstrated the validity of this methodology, as children do indeed look longer at the screen that matched the linguistic label. The validity of this methodology was confirmed by Golinkoff et al. (1987) for both nouns and verbs. The validity of this paradigm for word learning has also been proven by other researchers (Bavin, Wales, & Kelly 1999; Naigles, & Kako, 1993; Swingley, Pinto, & Fernald 1999). Furthermore, this methodology offers a good "simulation of the verb learning experience," as it allows for the labelling of dynamic events, as opposed to static pictures representing an object in action (Naigles, & Kako, 1993).

This methodology also overcomes some of the previous problems that have plagued research examining the acquisition of nouns and verbs, as it minimizes the expectations placed on the child (Tomasello & Farrar, 1986; also criticized in Casasola & Cohen, 2000). Children are not required to respond by talking, touching or demonstrating the referent of the label, in order to show that they have learnt the word. Therefore this current methodology allows for the accurate assessment of children's knowledge.

The preferential looking paradigm is commonly used in lexical training studies. In a study by Graham and Poulin-Dubois (1998), two nonsense labels for either two novel animals or two novel vehicles were taught to 18-month-olds using this paradigm. The results showed that after 4 training trials for each event, 18-month-old infants were indeed able to learn both of the labels, as children looked significantly longer at the original referent. Furthermore, infants were able to generalize the label in order to apply it to other objects of the same shape.

Schafer and Plunkett (1998) taught 15-month-olds two labels for two static objects. Infants heard the label paired with each object a total of 6 times for each word. The preferential looking paradigm was used to assess word comprehension. Infants were thus presented with two images, while being prompted to find a particular referent. Children's differential looking time at each screen was examined. The results show that infants preferred to look at the images that matched the linguistic label. The authors concluded that rapid lexical training could occur with infants before they have reached their vocabulary spurt.

In order to examine the current question, 18-month old infants were presented with a novel object on a computer screen, engaged in an animate or inanimate motion, and they heard a novel label paired with this event. Children were taught a label for an animal-like object jumping over a wall, and another for a vehicle-like object bouncing off the same wall.

On the test trials, infants were simultaneously presented with the event originally paired with the target label and the event paired with the other label. If children learned the association, it was expected that they would look longer at the event originally paired with the label. In the generalization trials, the original pairings presented in the training phase were switched, such that infants saw the animate object performing the inanimate motion, and the inanimate object performing the animate motion. If infants have associated the novel label with the object in the event, they were expected to ignore the motion path and to look longer at the screen with the target object. However, if infants associated the novel label with the motion in the event, they were expected to look longer at the screen presenting the motion path initially paired with the label.

Method

Participants

Twenty-three children (14 girls and 9 boys), from primarily middle class families participated in this study. Twelve of these children were francophone, and 11 were anglophone. The children's mean age was 18.08 months, ranging from 17.52 to 18.85 months. All children had a minimum 36-week gestation period. Furthermore, these children did not suffer from auditory or visual problems, as reported by the parents. To ensure that children understood the verbal prompt used in the study, only participants who were not exposed to a second language for more than 30% of their waking time were included in the final sample. A copy of the questionnaire on language exposure is provided in Appendix A.

Children were recruited from birthlists provided by the Régie Régionale de la Santé et des Services Sociaux de la Région de Montréal-Centre after approval from the Commission d'Accès à l'Information du Québec. A letter describing the purpose and the nature of the study was first sent to parents (Copy provided in Appendix B).

They were later contacted by telephone, to determine whether they were interested in participating.

An additional thirteen children (8 females and 5 males) were eliminated from the final sample, due to computer malfunction (n=4), fussiness (n=3), experimenter error (n=1), and parental interference (n=1). Another 4 participants were excluded from the final sample after data screening criteria were applied.

A separate sample of 16 children was tested (9 girls and 7 boys, with a mean age of 17.92), in order to assess the saliency of the stimuli.

Stimuli

Coloured drawings of a car and a dog obtained from children's picture books, were the stimuli used in the control trials. These pictures were digitized using an Abaton Scan 300/Colour Scanner, and later modified using Adobe Photoshop 2.01 software. The stimuli used in the testing and training phases of the study were brightly coloured simple drawings of an animal-like figure and a vehicle-like figure (Graham & Poulin-Dubois, 1998). These drawings were digitized in the same manner, and were later animated using the software Macromind Director 6.5. All events were presented on a computer monitor with a light blue background and a green "floor". A dark blue wall was located in the middle of the right side of the screen. Characters moved on this stage following an animate or an inanimate motion path. The animate motion path consisted of the character jumping over the wall, whereas the inanimate motion path consisted of the character bouncing off the wall. Copies of the movie frames are included in Appendix C. To control for salience effects, the speed, height and duration of both motions were equivalent across movies, which lasted a total of 9 seconds. In between trials, infants were presented with a blank green screen for 3 seconds. A chime was then heard at the end of this interval, redirecting the child's attention back to the screen.

The verbal prompts were recordings of a female voice talking in child-directed speech, digitized with MacRecorder and Sound-Edit 16 version 2.07 software. The same voice was digitized to deliver both the English and French instructions. The child heard the verbal label paired with each event within the context of a sentence, in order to ascertain that the word-learning situation was as naturalistic as possible. "*Gop*" and "*fep*" were the nonsense words chosen as the linguistic labels in this study, as these sounds abide by the phonotactic and phonological rules of both French and English. Furthermore, these words were phonetically distinct, from each other and from other words.

Apparatus

During the study, children were seated in a clip-on chair attached to a table, while their parents sat in a chair directly behind them. Parent and child were seated inside a black wooden three-sided partition. The side panels measured 203 cm wide by 183 cm high and were 211 cm apart. The front panel, measuring 195 cm wide by 183 cm high, was at a distance of 165 cm from the child.

The front panel had two square openings where two Apple Multiple Scan 15" Display colour monitors were located. These monitors were about 60 cm apart, and 100 cm from the floor. In between the monitors, at the child's eye level was a circular opening allowing a camera lens to videotape the child's face during the study. At 10 cm above the camera was a 40W blue light bulb that directed the child's attention at the beginning of the study. At 5 cm below the camera was an opening concealed by black material, where two loudspeakers played the audio prompts. Two Power Macintosh 6100 computers were used to run the experiment with a computer program developed with Macintosh HyperCard software. The front panel concealed the equipment and the experimenter from the child's view. A diagram of the apparatus is presented in Appendix D.

Procedure and Design

Participants were greeted in a reception area, allowing the child the opportunity to become comfortable with the experimenter before beginning the experiment. The nature and the purpose of the study were explained to the parents, and all questions were answered. Parents were subsequently given a consent form to read and sign, as well as an instruction sheet that explained what was expected of them during the experiment. A copy of the consent forms and the parent instructions are included in Appendix E and F respectively. The instruction sheet specified that parents should not label the images, should not point to the screen, and should also avoid touching or talking to their child during the study. Parents were also discouraged from redirecting their child's attention back to the monitors.

Participants were then brought into a dimly lit testing room, where the child was seated in the clip-on chair, and the parent sat behind them. The lights were dimmed even more, before the study was begun, to ascertain that the visual display would attract the child's attention.

The study consisted of a total of 10 trials, divided into 3 blocks of trials. Each child was presented with 2 control trials, 4 training trials, and 4 test trials. An outline of the trials is provided in Table 1. As the study began, a blue light went on to centre the child's attention to the middle of the two screens. During this time, the two monitors were black. The control trials were presented to children, in order to ensure that they could comply with the task demands. We examined whether children looked longer at the screen that matched the linguistic stimulus, to confirm the validity of the paradigm. The familiar words chosen for these trials were "*dog*" and "*car*". These words were selected, as most children understand these words by the age of 11 months (Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994). Furthermore, these words were also chosen, as they are both one-syllable words in English and in French. In the control trials, children were asked, "Can you find the car/dog? Where's the car/dog? Look at the car/dog." Children were then presented with the 4 training trials, where each of the two nonsense words was either paired with the event of the animal jumping, or the vehicle bouncing. Children were given the opportunity to see each event-label pairing twice, thus adding up to a total of 4 testing trials. The children heard a female voice saying: "Look this is gop/fep! See gop/fep? Look gop/fep!" while they saw the event of the animal jumping, or the vehicle bouncing on both monitors.

In the final part of the study, children were presented with the testing trials. Each testing trial included two repetitions of the same events. In the first presentation of the testing trial, children were asked: "Can you find gop/fep? Where's gop/fep?" On the second presentation of the trial, children heard: "Look gop/fep." Testing trials consisted of 2 match and 2 mismatch trials. Match trials tested whether children looked longer at the screen presenting the event that a label was originally paired

Table 1

Outline of Design (for Group 1, Order 1).

		trial	Slave	Audio	Master
Control Trials					
		1.	car	Can you find the **car**? Where's the **car**? Look at the **car**!	dog
		2.	car	Can you find the **dog**? Where's the **dog**? Look at the **dog**!	dog
Training Phase					
		3.	animal jumping	Look! **gop**. See **gop**.? Look **gop**!	animal jumping
		4.	vehicle bouncing	Look! **fep.** See **fep**.? Look **fep**!	vehicle bouncing
		5.	vehicle bouncing	Look! **fep.** See **fep**.? Look **fep**!	vehicle bouncing
		6.	animal jumping	Look! **gop.** See **gop**.? Look **gop**!	animal jumping
Testing Phase					
	Bounce Match	7.	animal jumping	Can you find **fep**? Where's **fep**? Look **fep!**	vehicle bounce
	Jump Mismatch	8.	vehicle jumping	Can you find **gop**? Where's **gop**? Look **gop!**	animal bouncing
	Bounce Mismatch	9.	animal bouncing	Can you find **fep**? Where's **fep**? Look **fep**!	vehicle jumping
	Jump Match	10.	vehicle bouncing	Can you find **gop**? Where's **gop**? Look **gop**!	animal jumping

▒ indicates the target event

with. This allowed us to determine whether children had learned the label for the events they were taught. Thus children had to choose among the image of the animal jumping, or the vehicle bouncing. In the mismatch trials, the original object and motion pairings were dissociated, such that the animal that was previously jumping, was now bouncing, and the vehicle that was previously bouncing was now jumping. Children's preferences for these trials would determine whether children mapped the linguistic label to the object, or to the action.

Children were randomly assigned to one of 4 presentation orders. Each event was presented half of the time on the right screen, and the other half on the left screen. The presentation of the visual events was such that a particular screen could not display a target event (the one that matched the label) for more than 2 consecutive trials. Furthermore, a particular object or motion could not be presented on the same screen for more than two consecutive trials. In the block of training trials, repetitions were permitted only once both events were presented. An outline of the study for each order is presented in Appendix G. For half the children, the animal jumping was labelled *"gop,"* and the vehicle bouncing *"fep,"* whereas the reverse was taught to the other half of the children.

Children who participated in the saliency experiment were presented with pairs of events without any linguistic labels. In order to attract children to the images, they simply heard "Wow, look at the pictures! See the pictures? Look at the pictures!" These children were presented with 3 pairs of images: the static animal and vehicle, the vehicle bouncing and the vehicle jumping, and the animal bouncing and animal jumping. Each of these sets of images was repeated twice.

After the study, parents were debriefed, and any additional questions were answered. Parents were also asked to fill out the MacArthur Communicative Development Inventory. Families were thanked for their participation and were given a certificate of merit for their child.

Vocabulary Measure

The MacArthur Communicative Development Inventory: Words and Sentences (Fenson, Dale, Reznick, Thal, Bates, Hartung, Pethick, & Reilly, 1991) or the French-Canadian adaptation (Frank, Poulin-Dubois, & Trudeau, 1997) was given to parents to assess children's productive vocabularies. The CDI is a self-administered parent report checklist, consisting of 680 words, as well as items measuring morphological and syntactic development. The measure was developed for use with children aged 16- 36-months old. Studies have shown that the CDI has high internal consistency, good test-retest reliability and good concurrent validity (Fenson et al., 1994). Only the vocabulary section of the checklist was used for this study, as this was our primary interest.

Coding and Inter-observer Agreement

Children's total looking time at each screen was coded using the Events software (Ground Zero). The coder recorded infants' looks to the right or left screen, as well as off-screen looks by pressing a preset key on the keyboard. The coder was blind to the events that were being presented on the screens.

The primary researcher coded all of the data. Reliability data was obtained for a random selection of 20% of participants. Pearson product-moment correlations were computed across the left and right screen. The mean inter-rater reliability was $r = .97$ for the main sample, and $r = .98$ for the saliency sample.

Data Screening

To assure the validity of the data obtained, participant and trial elimination criteria, similar to those typically applied with this paradigm, were used (Golinkoff et al, 1987; Graham, 1995; Poulin-Dubois, Frank, Graham, & Elkin, 1999; Reznick, 1990).

Children who displayed a preference for a particular screen (defined as looking at the left or right screen for more than 75% of the total time, across all trials) were excluded from the final sample (n=3). Furthermore, participants were also excluded from the final sample if they did not look at the training trials for a minimum of 25% for each trial (n=1).

Data from specific trials was also eliminated. This included trials where: the child only looked at one of the two screens, the child was inattentive to the visual display presented (combined looking time of both screens was less than 25% of trial length). A total of 11 trials were eliminated based on these criteria, and the data was treated as missing. Children were excluded from the final sample if more than 50% of their trials were missing on the basis of these criteria. None of the children were eliminated on the basis of that criterion.

Results

Before examining whether children looked longer at the screen that matched the target label than at the screen displaying a distracter, it was important to determine whether a particular event was intrinsically more attractive to children than the other.

Analyses were thus conducted on a control group of children that were seeing the pairs of events without lexical training.

In order to determine whether the two novel objects depicted in the events were equally interesting, a paired t-test comparing children's mean looking time at each of the objects when they were stationary was conducted. This analysis revealed that children found the animal and the vehicle equally interesting, $t(15) = .557$, $p > .05$ (two-tailed). Next, the saliency of these objects when in motion was also examined. A paired t-test comparing children's cumulative looking time at the animal and the vehicle, summed over the two motion types, did not yield any significant preference for either object, $t(14) = -.542$, $p > .05$ (two-tailed). The saliency of the two motion types (jumping and bouncing) for infants was also examined. Children's cumulative looking times to the jumping and bouncing events, summed across the two objects, were also compared using a paired-t-test. This analysis did not yield any significant effects, indicating that the motion types were equally interesting for infants, $t(14) = 1.350$, $p > .05$ (two-tailed). The null results of these analyses ascertain that there were no saliency effects, and that children's looking time at a particular screen during the match and mismatch trials was not guided by an intrinsic preference for one of the two events.

When examining the saliency of these events separately, children were equally interested in the animal jumping as compared to the animal bouncing, $t(14) = -.177$, $p > .05$ (two-tailed). However, children appear to have a preference for the vehicle jumping, as there was a trend for them to look longer at the vehicle jumping (M=9.31, SD=3.69) than at the vehicle bouncing (M=6.2, SD=2.82), $t(15) = 2.029$, $p = .061$

(two-tailed), (See Figure 1). Mean total looking times at the saliency events are presented in Table 2.

Although the preferential looking paradigm has been demonstrated to be a reliable procedure for testing word comprehension, the validity of the paradigm was assessed with the current sample, by examining children's performance on the *"dog"* and *"car"* control trials, a set of words that infants understand by 11 months. If children thus understood the request, it was expected that they would look longer at the screen that matched the verbal prompt. Children's looking time at the target image, the image matching the linguistic label, was compared against the image that was not the target. Looking at both control trials together, it appears that children did indeed look at the image that was being labelled by the verbal prompt, $t(22) = 3.337$, $p < .05$ (two-tailed). Thus we see that across both control trials, children show evidence of understanding the words, as they looked at the target image, when hearing the labels *"car"* and *"dog"*. However, this effect was carried primarily by the *"dog"* trial. Paired t-tests revealed that children looked significantly longer at the dog than at the car when they heard the label "*dog,*" $t(22) = -4.533$, $p < .05$ (two-tailed). However, the same was not true of *"car"* when it was the target, $t(22) = -.358$, $p > .05$ (two-tailed). It should be noted however, that children's ability to look at the dog when it was the target, was not simply due to the saliency of the dog, as they would have looked longer at the dog in the *"car"* trials if this had been the case. However the mean looking time at the car ($M = 3.6$, $SD = 1.5$) and at the dog ($M = 3.8$, $SD = 1.8$) were very similar, when looking at the car was requested. The validity of the paradigm is thus nevertheless confirmed, particularly since all of the children in the

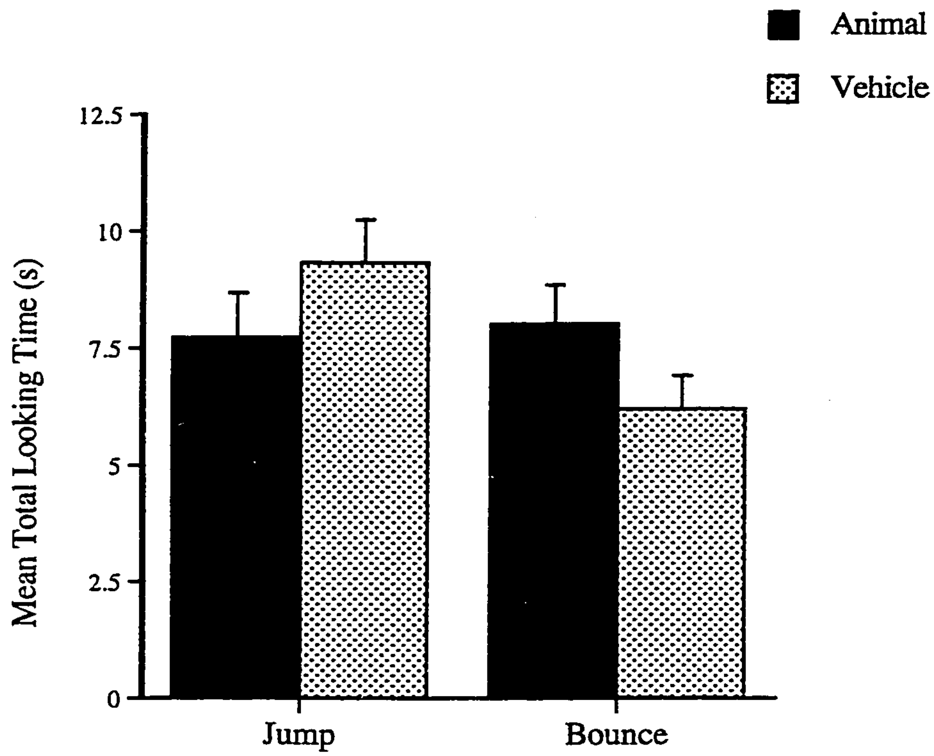


Figure 1. Mean total looking time (+SE) at the animal jumping and bouncing events (n=15) and the vehicle jumping and bouncing events (n=16).

Table 2

Mean Total Looking Times and Standard Deviations for Saliency Trials.

Condition	M	SD
Static		
Animal (n=16)	7.9	2.7
Vehicle (n=16)	7.2	3.4
Animal in motion		
Animal jumping (n=15)	7.7	3.7
Animal bouncing (n=15)	8.0	3.2
Vehicle in motion		
Vehicle jumping (n=16)	9.3	3.7
Vehicle bouncing (n=16)	6.2	2.8

sample were at least able to perform correctly on one of the two control trials. It should be noted that there were 8 infants who looked longer at the dog and the car respectively, when each was the referent of the target word. Mean total and mean percentage looking times at target and non-target during the control condition are presented in Table 3 and 4 respectively.

In order to determine whether children learned the linguistic label that was paired with a specific event, a 2 (Event) x 2 (Screen) x 2(Sex) mixed analysis of variance was conducted on the match trials. Total looking time was the dependent variable. "Event" referred to the event that was labelled, either the animal jumping or the vehicle bouncing. "Screen" referred to the total looking time at the target event, and at the non-target event. "Event" and "Screen" were both within-subject variables, whereas sex was a between-subjects variable. The ANOVA was conducted on nineteen participants. Children with incomplete data points were excluded from the analysis. This analysis did not reveal any significant main effects or interaction effects. This indicates that children were unable to learn the label for animal jumping and vehicle bouncing, as children looked equally at both screens (Figure 2). Mean total and percentage looking times at target and non-target during the match condition are presented in Table 3 and 4. Furthermore, the ANOVA source table is provided in Appendix H (Table 1).

Individual patterns were also explored in order to examine how many children did indeed learn the words that were taught. Eighteen children learned the label for at least one of the presented events, as they looked at the target screen more than 51% of the time. Thirteen children learned the label presented with animal jumping, and 11

Table 3

Mean Total Looking Times and Standard Deviations for Control, Match and Mismatch Condition.

	Target			Non-Target		
Condition	n	M	SD	n	M	SD
Control						
Car	23	3.6	1.5	23	2.8	1.4
Dog	23	4.8	1.3	23	3.8	1.8
Match						
Animal jumping	19	3.4	1.5	19	3.6	1.4
Vehicle bouncing	19	3.4	1.1	19	3.6	1.5
Mismatch						
Animal bouncing	18	3.6	1.5	18	2.9	1.4
Vehicle jumping	18	3.6	1.7	18	3.5	1.3

Table 4

Mean Percentage Looking Times and Standard Deviations for Control, Match and Mismatch Condition.

	Target			Non-Target		
Condition	n	M	SD	n	M	SD
Control						
Car	23	49.3	19.0	23	36.2	15.1
Dog	23	64.0	15.1	23	51.0	19.0
Match						
Animal jumping	23	49.0	19.1	23	51.1	17.4
Vehicle bouncing	23	49.0	17.4	23	51.3	19.1
Mismatch						
Animal bouncing	22	50.2	15.0	20	46.0	15.0
Vehicle jumping	20	54.4	15.0	22	50.0	15.0

Note. Data from all subjects was included in the computation of percentages.

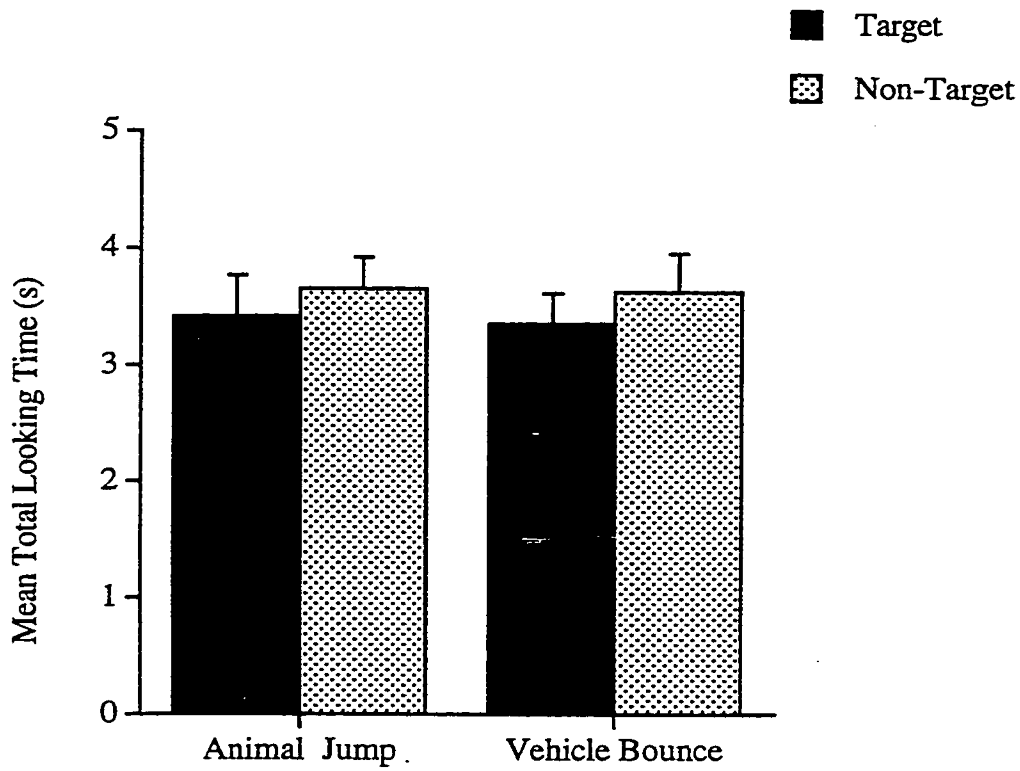


Figure 2. Mean total looking time (+SE) at the target and non-target event for the match trials (n=19).

children learned the label for vehicle bouncing. Only 6 children did indeed learn the label for both words.

In order to determine whether the size of children's vocabulary was related to their ability to perform the task, the 2 (Event) x 2 (Screen) x 2 (Sex) mixed analysis of variance was conducted on only the children possessing a vocabulary above the median of 46 words. This analysis failed to yield any significant main effect or interaction effect. The ANOVA source table is provided in Appendix H (Table 2). Therefore, infant's vocabulary size was unrelated to their ability to map the labels and the events.

Considering that 18 children were able to learn one of the two labels that were taught, further analyses were conducted on this sub-sample, to test the main hypothesis. That is to say, when learning the label for a particular event, will the child associate the label with the object, or alternatively will the child believe that the label is referring to the salient motion type that is presented? A 2(Event) x 2 (Screen) x 2 (Sex) mixed analysis of variance was conducted on the mismatch trials for children that were able to learn one of the words. Total looking time was the dependent variable. In this analysis, "Screen" referred to the total looking time on the target and non-target event. The target event was arbitrarily defined as being the event portraying the motion initially paired with the label. This analysis did not yield any significant main effects, as children were no more likely to look at the screen representing the target motion, than the other screen. This indicates that although these children were able to learn the label associated with the event, neither the object cues nor the motion cues are specifically guiding children's interpretation of the label

(Figure 3). Mean total looking times at target and non-target during the mismatch condition are presented in Table 3. Mean percentage looking times are presented in Table 4. Furthermore, the ANOVA source table is provided in Appendix H (Table 3).

In summary, it appears that only a small sample of children was able to learn one of the labels paired to a specific event. Furthermore, performance on the task was not influenced by vocabulary size. In addition, it is unclear whether object or motion cues are directing the child in the labelling process.

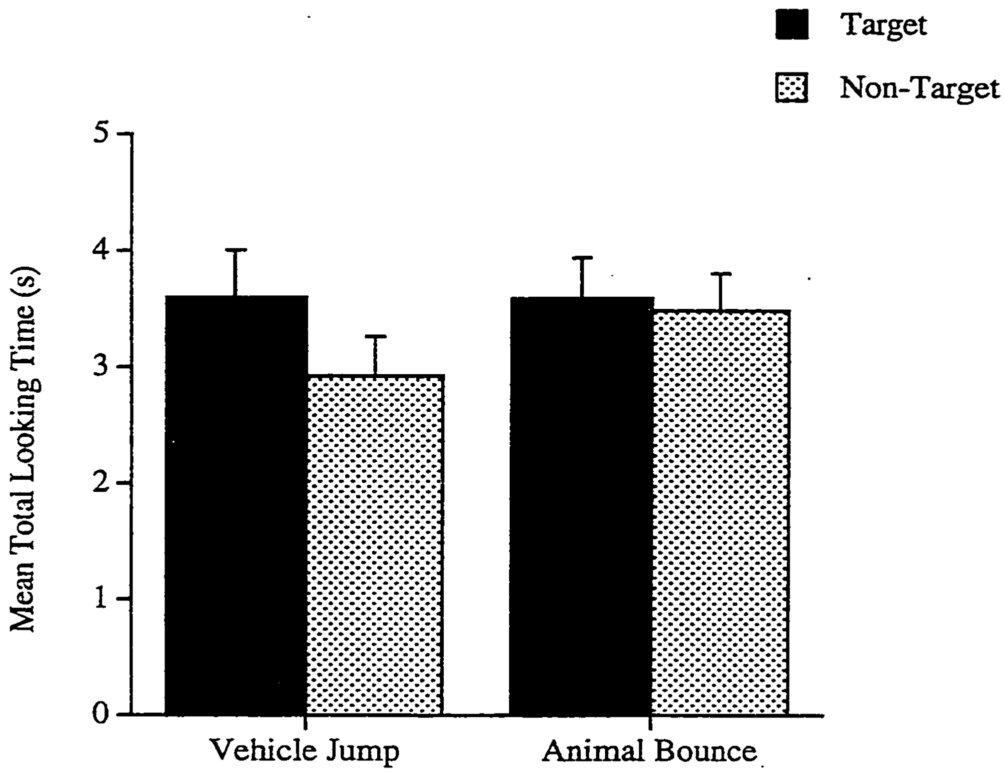


Figure 3. Mean total looking time (+SE) at the target and non-target event for the mismatch trials (n=18).

Discussion

The purpose of the present study was to examine whether 18-month-old infants can be taught a label for a novel animate or inanimate object undergoing an animate or inanimate motion. Furthermore, if such learning did indeed occur, the question of interest was how do children interpret this label. The current study examined whether the Whole Object Assumption would lead 18-month-olds to interpret the current label as applying to the object presented. Alternatively, the salient animacy cues may allow the child to override the Whole Object Assumption, and thus learn a label for the action that is being presented. Another possibility is that the child would attach the label to the specific object and motion combination.

The results of the study revealed that as a group, 18-month-old infants were unable to learn a label for an object in motion, whether it was an animal jumping or a vehicle bouncing, using a laboratory lexical training task. This inability to learn the labels did not seem to be explained by a relative preference for one event over the other, as testing of saliency effects on a separate group of 18-month-olds revealed that overall, children found both pairs of images to be equally interesting. Furthermore, this inability to learn the name for the labelled event can not be explained by an inability to perform on this task, as children's performance on two control trials indicated that overall, children were able to look longer at the image that matched the verbal prompt when familiar words were tested.

Individual performance patterns revealed that there was a subset of 18 children that were able to learn one of the labels presented. However, the ability to learn at least one of the word-event pairs was unrelated to the child's vocabulary size, as analyses conducted only with high vocabulary children did not show any significant effects. It should be noted that with the sample of children who did learn a label for one of the words, it was unclear whether object cues, motion cues, or both guided them in learning the label, as no significant pattern was apparent.

The current discussion will thus focus on explaining why these children were unable to learn the labels they were being taught for an object in motion, with a lexical training task using the preferential looking paradigm. Based on the current null results, the first issue that needs to be examined is whether the methodology provided the 18-month-old participants with enough exposure for the events and the labels that were being taught. In the current experiment, infants were presented with the labelled animal jumping and vehicle bouncing events twice. Thus a familiarization paradigm was used to train the children on the labelled events that were being taught. Perhaps the current paradigm did not allow children the necessary opportunities to learn the label for the object in motion. However, other lexical training studies that have succeeded in teaching children a word-object pairing will be examined.

A familiarization paradigm, where a fixed number of training trials are presented to children in order to teach them new words, is a technique that is often used in the field. In a study by Oviatt (1980, 1982) 15- and 17-month old children were able to learn the name of a live animal that was being taught to them. This was demonstrated as children looked longer at the animal when asked to find it, and did not look at the animal when asking about a novel distracter label. Although this study demonstrated word learning after minimal exposure, word learning may have been facilitated by the use of live events, and the presence of socio-pragmatic cues such as joint attention. Furthermore the limitations of the study do not allow us to make strong conclusions regarding the ease with which children can acquire new words, as the experimenters did not include adequate control trials.

Woodward, Markman and Fitzsimmons (1994) examined the same issue, taking care to overcome the limitations present in the studies by Oviatt (1980, 1982). Woodward et al. (1994) were able to teach a novel label for an object to 13- and 18-month-olds after only 2 training trials. Learning was demonstrated in a comprehension task, where children were asked to perform an engaging activity using the labelled toy. Interestingly, when tested 24 hours later, children continued to demonstrate knowledge of the word. This study thus provides evidence that children are capable of word learning after only a few trials. However, in contrast to the current experiment, children were taught the novel labels in an interactive fashion, while playing with an experimenter. This methodology, although not as tightly controlled, does demonstrate high ecological validity. Perhaps word-learning under these circumstances is attributable to the interactive and social nature of the tasks. Therefore although we may have expected rapid word learning to occur under the present experimental conditions, an interactive context may be a necessary feature to allow for word learning.

This hypothesis may be further confirmed by a word-learning task using a preferential looking paradigm conducted by Graham and Poulin-Dubois (1998). Eighteen-month old infants learned two labels for either novel animals, or novel vehicles when they were presented as static pictures. It should be noted that the same images as in the present study were used. Children were able to learn these words after each was presented a total of 4 times. However, in this experiment, the parents were given a script and participated in the labelling of the events. Therefore although 18-month old infants were able to learn the linguistic labels taught for a given object, it is possible that the interactive cues facilitated word learning during this particular instantiation of the preferential looking paradigm.

There is evidence however that the preferential looking paradigm can successfully be used to teach novel words with a minimum of exposure. Poulin-Dubois and Forbes (2000) successfully taught 21-month-old infants labels for actions, after only 2 training trials. This supports the view that children are able to map a word to its referent after very few exposure trials. However, this study does not allow us to determine how early fast mapping comes into play. Indeed it may be that this ability only begins operating around 21 months, at least with regards to actions. The current experiment failed to demonstrate the presence of a fast mapping ability at 18 months. Perhaps developmental changes occurring between the ages of 18 and 21 months allow children to learn verbs at a much faster pace. Although, one would expect this developmental change to be increases in vocabulary, this was unrelated to task performance in the current study. Alternatively, failure to provide evidence for fast mapping may simply be a limitation of our methodology. In order for fast mapping to occur at a younger age, socio-pragmatic cues to guide their word learning may be necessary.

Given the current comparison with other lexical training studies in the field, it appears that teaching children new words may be particularly difficult when the word-learning context is stripped of socio-pragmatic cues. However, the decision to test word learning with the preferential looking paradigm was motivated by a desire for a tightly controlled study. Furthermore, the nature of our question limited us to computer-generated stimuli, as it would have otherwise been difficult to demonstrate the motion events depicted in the study. The experimental question therefore did not lend itself to an interactive teaching paradigm. Although it appears that these modifications may facilitate word learning.

A study by Schafer and Plunkett (1998) raises doubt on the necessity of socio-pragmatic cues for word learning. In their study, 15-month-old infants were able to learn two labels for two stationary objects, after 6 presentations for each word. Pre-vocabulary spurt children were thus able to learn labels for novel objects using this paradigm after a very short exposure time. However, one significant element that differentiates this study from others discussed is sensitivity to the child's interests. Specifically, the presentation of the training trials was only begun when the child was paying attention. The experimenter could thus ascertain that the child was attending and processing the information presented, therefore increasing the likelihood of word learning. Presenting and labelling images when the child is ready and attuned to them may facilitate the acquisition of the new label. This method guarantees that the child maximizes the brief exposure time he receives.

Ascertaining that the child has indeed processed what is being presented is another method used in lexical training studies. A modified habituation paradigm is a procedure that has been used successfully in order to teach infants novel words. In this paradigm, infants are presented with the labelled event until they lose interest, as defined by a drop in looking time below a set criterion, or when they reach a maximum of trials. This procedure allows the experimenters to ascertain that the child has had enough opportunities to process the event that is being presented. In the habituation paradigm, it is the infant that controls how often the trials will be presented, based on their individual levels of interest. This procedure has been used to successfully teach 14-month-olds two labels for two moving objects (Werker et al., 1998). Furthermore, this procedure has also allowed Casasola and Cohen (2000) to demonstrate learning of a label for an action in 18-month-olds. Similar to the Schafer and Plunkett (1998) study, the success of this paradigm appears to be due to sensitivity for the infant's interest. By presenting events contingently with the child's interest, the possibility for word learning is maximized, as the amount of exposure received to the presented labels is determined by the child's needs.

The use of a modified habituation paradigm in the current study might help to overcome children's limited exposure to the test stimuli, allowing each child to process the presented information at their own pace. With this paradigm, learning of the word-event pairing would be assessed by examining children's looking time at the original label paired with the opposite event. If children increased their looking time to the screen, this would indicate that they were surprised by the current pairing, as they would have had indeed learned the previous association. The major disadvantage of this methodology is that the current experimental hypothesis would remain untestable. If children trained using a habituation paradigm, were presented with a mismatch event (where the original object-motion pairing was dissociated), their looking time to this event would be difficult to interpret. Children's looking time at the mismatch event would likely reach a ceiling, as the particular event presented would be novel. This paradigm would not successfully allow us to examine whether children learning a novel label for an object in motion would interpret it as referring to the action or the object. Perhaps a fusion of the two paradigms would be the ideal methodology to test the current question. An infant-controlled preferential looking paradigm would tailor the exposure of the events to the individual child, allowing the child to learn the word-event contingencies that were presented.

Related to this last point, children may have had difficulty learning the particular word-event contingency in the current study, due to quick and brief training trials that may have been insufficient for learning to occur. In the present study, 18-month-olds heard the label paired with the event a total of 6 times for each word-event pairing. In addition, it should be noted that each trial lasted for a total of 9 seconds. Infants thus had 9 seconds in order to observe each particular event, adding up to a total of 18 seconds per event. To examine whether children did indeed have sufficient exposure to the test events, it is necessary to compare the exposure provided in this study to others in the field that have taught a labelled event using a fixed set of trials.

The current training trials do not appear to deviate from what others have offered in the field. In a study by Graham and Poulin-Dubois (1998), children heard the linguistic label repeated twice, during an 8 second trial. Furthermore, each word-object training trial was presented 4 times, thus 18-month-old infants in this study heard the word-object pairing 8 times. In comparison, Schafer and Plunkett (1998) taught children a novel label for an object after 6 trials, which lasted a total of 2.5 seconds. Woodward et al. (1994) taught a novel label for an object to 13- to 18-

month olds, after only 2 training trials, where in total the label was repeated 9 times within 3 to 5 minutes. It therefore appears that the trial length, and the number of times each word-event pairing was heard in the current study does not explain children's difficulty in learning the label, as the training provided was comparable to that in other studies.

In this experiment, it was difficult to provide infants with additional exposure to the labelled events. The complex hypothesis under study required multiple testing trials. Therefore providing additional training trials would have increased the overall length of the experiment, and would have resulted in fatiguing the infants. This would have made it increasingly difficult for them to remain attentive for the entire duration of the study.

In contrast, a preset number of trials were presented to children. The disadvantage of this method is that if children did not receive enough time to observe and process the information, they forgo any opportunity to be exposed to the word-event association that was being taught. However, eliminating participants that did not observe each training trial for a minimum of 25% assures that infants in the final sample were indeed attentive during the training trials.

Yet another possibility that may explain children's inability to learn the information that was being presented, are the processing demands imposed on the infants by the current task. Infants were being presented with a novel animal and a novel vehicle, performing an animate or inanimate action, and they also heard a nonsense word that was labelling the event. As mentioned previously, each event was only seen twice by the child, during which three repetitions of the label were heard.

Such complexity of information may have exceeded the demands placed on infants by other lexical training studies. In particular, studies typically present children with stimuli that do not differ on all the above-mentioned dimensions. Graham and Poulin-Dubois (1998), presented infants with novel labels, however their stimuli were somewhat simplified, considering that the objects were stationary, and children were presented with either an animate or an inanimate object. Similarly, in Schafer and Plunkett (1998), the objects were stationary, and animacy was not a variable of interest in that study. In Poulin-Dubois and Forbes (2000), although children were required to process a complex action, the novelty of the stimuli was minimized, as it was presented with people undergoing the action, allowing the child to focus on the label and the action being presented. Although Casasola and Cohen (2000) did in fact present children with a more complex array of stimuli, it was only the action that changed from trial to trial, as the agents themselves remained constant. Furthermore, in Werker et al. (1998), although children were presented with an animate and an inanimate object, as well as a novel label, infants did not need to process a motion path, as the objects were moving in place. In comparison, the current study may have strained the processing abilities of 18-month–old infants, who were being presented with an array of new information. This stimuli may have had further exhausted their processing abilities, as the children had limited exposure to the events. The possibility of a processing overload may have been further compounded by the fact that 18-month-old infants observed these events on both screens during the training phase. This allowed infants the opportunity to become accustomed to parallel screens. In addition, during the testing phase, infants were required to look at the simultaneously presented events for a period of 9 seconds. Casasola and Cohen (2000) argue that: "It may be difficult for children in the one-word stage of word learning to attend to and process two different transient, dynamic events simultaneously, especially when these events are presented with a novel language label" (p.9). Thus it appears that perhaps infants were unable to process all of the various information presented. In order to ease the processing demands of the current task, it may have been preferable to present the training trials on a single alternating screen, such as in Poulin-Dubois and Forbes (2000). This would allow children to focus their attention on a single screen. Furthermore, by randomly alternating the presentation among screens, this would ensure that children would not simply associate a particular event with a specific screen. Yet another possibility to alleviate the processing demands would be to test children on their comprehension of one of the two labels that were taught. This would allow the experiment to be shorter, as only half of the testing trials would be administered. This in turn, would provide the opportunity to present more training trials to the infants, thus increasing their opportunities to learn the word-object pairing.

Difficulty distinguishing among the events may be another possibility for why infants were unable to learn the words that were being taught. The current jumping and bouncing motions were created to be equivalent on height and speed of motion, in order to control for any saliency effects that may influence performance on the testing trials. The current stimuli were adjusted, after pilot data with a different bouncing motion, conducted on 14-to 24-month-old infants revealed a trend towards the jumping event, regardless of condition. In the present experiment, although the saliency of the motion was controlled for, the events may have now become too similar. Examining whether children can indeed differentiate the two events would be an important step in determining why infants were unable to learn the label for the event. The differences between the jumping and the bouncing motion may have been overly subtle for 18-month-old infants. Casasola and Cohen (2000) conducted precisely such a control condition in their experiment, when their results showed that 14-month-old infants were unable to learn the word-action label presented. They tested whether the infants could differentiate the pulling and pushing actions for which labels were being taught, by replacing the verbal prompts with instrumental music. They demonstrated that infants were able to distinguish between the two events thus ruling out the hypothesis that the events were too similar. Such a procedure is thus an important step in ascertaining that infants are indeed differentiating between the presented events, in order to learn a separate label for each of them.

In addition, the current study differed from other lexical training studies, in that the linguistic label that was being taught to infants, was not an isolated verbal prompt, but a word embedded within the context of a sentence. This allowed the learning context to be as naturalistic as possible. In contrast, other word learning studies often present the label in isolation (e.g. Casasola & Cohen, 2000; Schaffer & Plunkett, 1998; Werker et al., 1998). The question arises as to whether those studies are teaching infants new words, or whether the tasks are inherently non-linguistic, as the child may be forming a simple association among the sound patterns and the object it is paired with (Woodward et al, 1994). It remains to be determined whether these studies are any different from those demonstrating that 13-month-old infants can easily learn to associate a sound with a particular object (Woodward & Hoyne, 1998). It is indeed questionable whether word-learning studies where the label is presented in isolation are equivalent to studies where the label is taught within a syntactic context. Perhaps, presenting a word in isolation may be simpler for the child to learn. However, it is unclear whether the child is indeed learning a "word" in the linguistic sense. However, in the studies reviewed previously, those presenting the words as being embedded within a linguistic context, also provided the child with other socio-pragmatic cues. These socio-pragmatic cues may indeed be critical for word learning to occur. The importance of these cues is confirmed by research examining the importance of joint attention and gaze in word learning (Baldwin, 1991; Tomasello, Strosberg, & Akhtar, 1996). In the current study, the fact that the verbal prompt was presented by a loudspeaker may have interfered with infants' ability to learn words, as the prompt was stripped of the necessary socio-pragmatic cues. The infants may have found the voice from the loudspeaker as being bizarre, particularly since there was no one to reinforce the verbal prompt. A future instantiation of the current experiment may indeed require that an experimenter label the items being presented, in order to allow for learning to take place. This can be done in a similar fashion, as in Graham and Poulin-Dubois (1998), where the parents were given a script, and were asked to label the object as well. Such a measure would ensure that infants do indeed learn the label that is being presented.

In summary, the results of this study suggest that 18-month-old infants were unable to learn a label for a novel object, undergoing an animate or inanimate motion.

Based on the current review of the literature, it appears that infants did not receive enough exposure in order for learning to take place. Studies providing infants the ability to control how often they see the stimuli, as well as allowing for more socio-pragmatic cues in the teaching phase of the labels may facilitate word learning.

References

Anglin, J. (1993). Vocabulary development: A morphological analysis. Monographs of the Society for Child Development, 58 (10, Serial No. 238).

Au, T. K., Dapretto, M., & Song, Y. (1994). Input vs. constraints: Early word acquisition in Korean and English. Journal of Memory and Language, 33, 567-582.

Baldwin, D. A. (1989). Priorities in children's expectations about label reference: Form over color. Child Development, 60, 1297-1306.

Baldwin, D. A. (1991). Infants' contribution to the achievement of joint reference. Child Development, 62, 875-890.

Bates, E., Bretherton, I., & Snyder, L. (1988). From first words to grammar: Individual differences and dissociable mechanisms. Cambridge, England: Cambridge University Press.

Bates, E., Dale, P., & Thal, D. (1995). Individual differences and their implications for theories of language development. In P. Fletcher & B. MacWhinney (Eds.), The handbook of child language (pp. 96-151). Oxford, England: Blackwell.

Bavin, E. L., Wales, R. J., & Kelly, H. (1999). Preferential looking: Testing structural knowledge. In C. Rovee-Collier, L. Lipsitt, & H. Hayne (Eds.), Advances in Infancy Research: Vol. 12 (pp. 319-335). Hillsdale, N.J.: Erlbaum.

Bertenthal, B. I. (1993). Infants' perception of biomechanical motions: Intrinsic image and knowledge-based constraints. In C. Grandrud (Ed.), Visual perception and cognition in infancy: Carnegie-Mellon symposia on cognition (pp. 175-214). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bertenthal, B. I., & Davis, P. (1988). Dynamical pattern analysis predicts recognition and discrimination of biomechanical motions. Paper presented at the annual meeting of the Psychonomic Society, Chicago, Illinois.

Bertenthal, B.I., Profitt, D.R., Spetner, N.B., & Thomas, M.A. (1985). The development of infants' sensitivity to biomechanical motion. Child Development, 56, 531-543.

Bloom, L. (1973). One word at a time: The use of single-word utterances before syntax. The Hague: Mouton.

Bloom, L. (1993). The transition from infancy to language: Acquiring the power of expression. Cambridge, England: Cambridge University Press.

Bloom, L. (1998). Language acquisition in its developmental context. In W. Damon, D. Kuhn, & R. Siegler, (Eds.), Handbook of Child Psychology, Volume 2: Cognition, Perception and Language. New York: Wiley & Sons.

Bloom, L., Tinker, E., & Margulis, C. (1993). The words children learn: Evidence against a noun bias in children's vocabularies. Cognitive Development, 8, 431-450.

Bowerman, M. (1974). Learning the structure of causative verbs: A study in the relationship of cognitive, semantic and syntactic development. Papers and Reports on Child Language Development, 8, 142-178.

Brown, R. (1958). How shall things be called? Psychological Review, 65, 14-21.

Burnham, D. K. (1987). The role of movement in object perception by infants. In B. E. McKenzie & R.H. Day (Eds.), Perceptual development in early infancy: Problems and issues (pp. 143-172). Hillsdale, NJ: Erlbaum.

Casasola, M., & Cohen, L. B. (2000). Infants' association of linguistic labels with causal actions. Manuscript submitted for publication.

Cheng, S. W. (1994). Beginning words of three children acquiring Mandarin Chinese. Manuscript submitted for publication.

Choi, S., & Gopnik, A. (1995). Early acquisition of verbs in Korean: A cross-linguistic study. Journal of Child Language, 22, 497-529.

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

Dromi, E. (1993). The mysteries of early lexical development. In E. Dromi (Eds.), Language and cognition: A developmental perspective (pp. 32-60). Norwood, NJ: Ablex.

Fenson, L., Dale, P. S., Reznick, J. S., Thal, D., Bates, E., Hartung, J. P., Pethick, S., & Reilly, J. S. (1991). MacArthur Communicative Development Inventories. San Diego: San Diego State University.

Fenson, L., Dale, P.S., Reznick, J. S., Bates, E., Thal, D. J., & Pethick, S. J. (1994). Variability in early communicative development. Monographs of the Society for Research in Child Development, 59 (5, Serial No. 242).

Forbes, J. N., & Poulin-Dubois, D. (1997). Representational change in young children's understanding of familiar verb meaning. Journal of Child Language, 24, 389-406.

Frank, I., Poulin-Dubois, D., & Trudeau, N. (1997). Inventaire MacArthur du Développement de la Communication: Mots et Énoncés. (Available from Diane Poulin-Dubois, Concordia University, PY-170, 7141 Sherbrooke St. W., Montreal, Qc, H4B 1R6).

Gentner, D. (1978). On relational meaning: The acquisition of verb meaning. Child Development, 49, 988-998.

Gentner, D. (1981). Some interesting differences between verbs and nouns. Cognition and Brain Theory, 4, 161-178.

Gentner, D. (1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. Kuczaj (Eds.), Language development: Language, cognition and culture. Hillsdale, NJ: Erlbaum.

Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months of age. Cognition, 56, 165-193.

Golinkoff, R. M., Hirsh-Pasek, K., Cauley, K. M., & Gordon, L. (1987). The eyes have it: lexical and syntactic comprehension in a new paradigm. Child Language, 14, 23-45.

Golinkoff, R., Harding, C., Carlson, V., & Sexton, M. E. (1984). The infant's perception of causal events: The distinction between animate and inanimate objects. In L. P. Lipsitt & C. Rovee-Collier (Eds.), Advances in Infancy Research: Vol. 3 (pp.145-151). New York: Ablex.

Gopnik, A. (1982). Words and plans: Early language and the development of intelligent action. Journal of Child Language, 9, 303-318.

Gopnik, A., & Meltzoff, A. N. (1986). Words, plans, things and locations: Interactions between semantic and cognitive development in the one-word stage. In S. Kuczaj & M. Barrett (Eds.), The development of word meaning (pp. 199-223). New York: Springer-Verlag.

Graham, S. A. (1995). The role of lexical principles in infants' acquisition of object words. Unpublished doctoral dissertation, Concordia University, Montreal, Canada.

Graham, S. A., & Poulin-Dubois, D. (1998). Infants' reliance on shape to generalize novel labels to animate and inanimate objects. Journal of Child Language, 26, 295-320.

Hampson, J. (1989). Elements of style: Maternal and child contributions to the referential and expressive styles of language acquisition. Unpublished doctoral dissertation, City University of New York.

Huttenlocher, J., Smiley, P., & Charney, R. (1983). Emergence of action categories in the child: Evidence from verb meanings. Psychological Review, 90, 72-93.

Johnson, M. (1987). The body in the mind: The bodily basis of meaning, imagination, and reasoning. Chicago: University of Chicago Press.

Landau, B., Smith, L. B., & Jones, S. S. (1988). The importance of shape in early lexical learning. Cognitive Development, 3, 299-321.

Leslie, A. M. (1982). The perception of causality in infants. Perception, 11, 173-186.

Leslie, A. M. (1988). The necessity of illusion: Perception and thought in infancy. In L. Weiskrantz (Ed.), Thought without language (pp. 185-210). Oxford, England: Clarendon.

Lieven, E., Pine, J., & Barnes, H. (1992). Individual differences in early vocabulary development: Redefining the referential-expressive distinction. Journal of Child Language, 12, 395-423.

MacNamara, J. (1972). Cognitive basis of language learning in infants. Psychological Review, 79, 1-13.

MacNamara, J. (1982). Names for things. Cambridge, MA: MIT Press.

Mandler, J. M. (1992). How to build a baby II: Conceptual primitives. Psychological Review, 99, 587-604.

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

Markman, E. M. (1989). Categorization and naming in children: Problems of induction. Cambridge, MA: MIT Press.

McCune-Nicolich, L. (1981). The cognitive basis of relational words in the single word period. Journal of Child Language, 8, 15-34.

McDonough, L., & Mandler, J. M. (1991, June). Differentiation of globally-defined categories in 9- and 11-month olds. Poster presented at the meeting of the American Psychological Society, Washington, DC.

Messer, D. J. (1981). The identification of the names in maternal speech to infants. Journal of Psycholinguistic Research, 10, 69-77.

Molina, M., Spelke, E.S., & King, D. (1996, April). The animate-inanimate distinction in infancy: Sensitivity to distinction between social interactions and object manipulation. Poster session presented at the International Conference on Infant Studies, Providence, RI.

Naigles, L. G., & Kako, E. T. (1993). First contact in verb acquisition: defining a role for syntax. Child Development, 64 (6), 1665-1687.

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

Nelson, K. (1982). The syntagmatics and paradigmatics of conceptual development. In S. Kuczaj (Ed.), Language development: Vol. 2. Language, thought, and culture (pp. 335-364). Hillsdale, NJ: Erlbaum.

Nelson, K., Hampson, J., & Shaw, L. (1993). Nouns in early lexicons: Evidence, explanations, and implications. Journal of Child Language, 20, 61-84.

Oakes, L.N., & Cohen, L.B. (1995). Infant causal perception. In C. Rovee-Collier & L. P. Lipsitt (Eds.), Advances in infancy research: Vol. 9 (pp. 1-54). Norwood, NJ: Ablex Publishing Corporation.

Oviatt, S. L. (1980). The emerging ability to comprehend language: An experimental approach. Child Development, 51, 97-106.

Oviatt, S. L. (1982). Inferring what words mean: Early development in infants' comprehension of common object names. Child Development, 53, 274-277.

Pine, J. (1992). How referential are "referential" children? Relationship between maternal reports and observational measures of vocal composition and usage. Journal of Child Language, 19, 75-86.

Pine, J. M., Lieven, E. V. M., & Rowland, C. (1996). Observations and checklist measures of vocabulary composition: What do they mean? Journal of Child Language, 23, 573-589.

Poulin-Dubois, D. (1999). Infants' distinction between animate and inanimate objects: The origins of naive psychology. In P. Rochat (ed.), Early social cognition: Understanding others in the first months of life (pp. 257-280). Hillsdale, N.J.: Lawrence Erlbaum Associates.

Poulin-Dubois, D., & Forbes, J. N. (2000). Toddlers infer agents' intention to solve the verb "packaging problem." Manuscript submitted for publication.

Poulin-Dubois, D., & Shultz, T. R. (1988). The development of understanding of human behavior: From agency to intentionality. In J.W. Astington, P.L. Harris, & D.R. Olson (Eds.), Developing theories of mind (pp. 109-125). Cambridge, England: Cambridge University Press.

Poulin-Dubois, D., Frank, I., Graham, S. A., & Elkin, A. (1999). The role of shape similarity in toddlers' lexical extensions. British Journal of Developmental Psychology,17, 1-16.

Poulin-Dubois, D., Lepage, A., & Ferland, D. (1996). Infants' concept of animacy. Cognitive Development, 11, 19-36.

Premack, D. (1990). The infants' theory of self-propelled objects. Cognition, 36, 1-16.

Quine, W. (1960). Words and objects. Cambridge, MA: MIT Press.

Reznick, J. S. (1990). Visual preference as a test of infant word comprehension. Applied Psycholinguistics, 11, 145-166.

Rochat, P., & Striano, T. (1999). Social cognitive development in the first year. In P. Rochat (Ed.), Early social cognition: Understanding others in the first months of life (pp. 257-280). Hillsdale, N.J.: Lawrence Erlbaum Associates.

Schafer, G., & Plunkett, K. (1998). Rapid word learning by fifteen-month-olds under tightly controlled conditions. Child Development, 69 (2), 309-320.

Slater, A. (1989). Visual memory and perception in early infancy. In A. Slater & G. Bremner (Eds.), Infant development (pp. 43-72). Hove, UK: Lawrence Erlbaum Associates.

Soja, N. N., Carey, S., & Spelke, E. S. (1991). Ontological categories guide young children's induction of word meaning: Object terms and substance terms. Cognition, 38, 179-211.

Spelke, E.S., Phillips, 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.

Swingley, D., Pinto, J. P., & Fernald, A. (1999). Assessing the speed and accuracy of word recognition in infants. In C. Rovee-Collier, L. Lipsitt, & H. Hayne (Eds.), Advances in Infancy Research: Vol. 12 (pp. 257-277). Hillsdale, N.J.: Erlbaum.

Tardif, T. (1996). Nouns are not always learned before verbs: Evidence from Mandarin speakers' early vocabularies. Developmental Psychology, 32 (3), 492-504.

Tardif, T., Gelman, S. A., & Xu, F. (1999). Putting the "noun-bias" in context: A comparison of English and Mandarin. Child Development, 70, 620-435.

Tomasello, M. (1992). First verbs: A case study of early grammatical development. Cambridge, England: Cambridge University Press.

Tomasello, M., & Farrar, J. (1986). Object permanence and relational words: A lexical training study. Journal of Child Language, 13, 495-505.

Tomasello, M., & Todd, J. (1983). Joint attention and lexical acquisition style. First Language, 4, 197-212.

Tomasello, M., Strosberg, R., & Akhtar, N. (1996). Eighteen-month-old children learn words in non-ostensive contexts. Journal of Child Language, 23, 157-176.

Werker, J. F., Cohen, L. B., Lloyd, V. L., Casasola, M., & Stager, C. L. (1998). Acquisition of word-object associations by 14-month-old infants. Developmental Psychology, 34, 1289-1309.

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

Woodward, A. L., & Hoyne, K. L. (1998). Infants' learning about words and sounds in relation to objects. Child Development, 70 (1), 65-77.

Woodward, A. L., & Markman, E. M. (1998). Early Word Learning. In W. Damon, D. Kuhn, & R. Siegler, (Eds.), Handbook of Child Psychology, Volume 2: Cognition, Perception and Language. New York: Wiley & Sons.

Woodward, A. L., Markman, E. M., & Fitzsimmons, C. M. (1994). Rapid word learning in 13- and 18-month-olds. Developmental Psychology, 30 (4), 553-566.

Appendix A

Questionnaire on Language Exposure

S#______

Questionnaire on Language Exposure

Child's Name: ______________________________

Date: ______________________________

Language(s) spoken to child *:

Percentage of time child spends with this person (or at this place) during a typical week:

Mother: ____________________	____________________
Father: ____________________	____________________
Babysitter: ____________________	____________________
Daycare: ____________________	____________________
Other: ____________________	____________________

* If a particular person speaks more than one language to the child, please indicate the percentage of time they use each language.

Age started hearing English: ____________________

Age started hearing French: ____________________

Age started hearing other(s): ____________________

Time child wakes up: ____________________

Time child goes to bed: ____________________

Time napping per day: ____________________

Appendix B

Letter Sent to Participants

March 13, 2000

Dear Parents,

Our research team is currently conducting research on the development of understanding of language and people's behavior. This research is funded by the Natural Sciences and Engineering Research Council of Canada. The Commission d'Accès à l'Information du Québec has kindly given us permission to consult birthlists provided by the Régie Régionale de la Santé et des Services Sociaux de la Région de Montréal-Centre. Your name appears on the birthlist of October 1998, which indicates that you have a child of an age appropriate for our study.

At the present time, we would like to invite you and your infant to participate in a research study which we are currently conducting. This study is looking at how infants come to acquire new words and how infants come to understand that others perform purposeful actions.

In the first part, your child will be presented with a variety of computer animated events (e.g., an object jumping across the screen) on two computer monitors, while hearing a nonsense label. Your child will then be asked to find the labeled item. In the second part, we will show your child a number of interesting toys (e.g., Sesame Street characters, Winnie the Pooh). We will ask your child to place one of two toys in a butterfly net and we will measure whether your child chooses to give the toy desired by the experimenter. During this study, your child will sit in a child seat and you will be seated directly behind him/her.

Participation may involve either one or two 30 minute visits to our research center at the Loyola Campus of Concordia University in NDG, at a time that is convenient for you and your child. We would be happy for you to visit on any day of the week, including week-ends. Free parking is available on the campus. You will receive a Certificate of Merit for Contribution to Science for your child for your participation. All results and information are kept strictly confidential, and a summary of the results of our study will be mailed to you once it is completed.

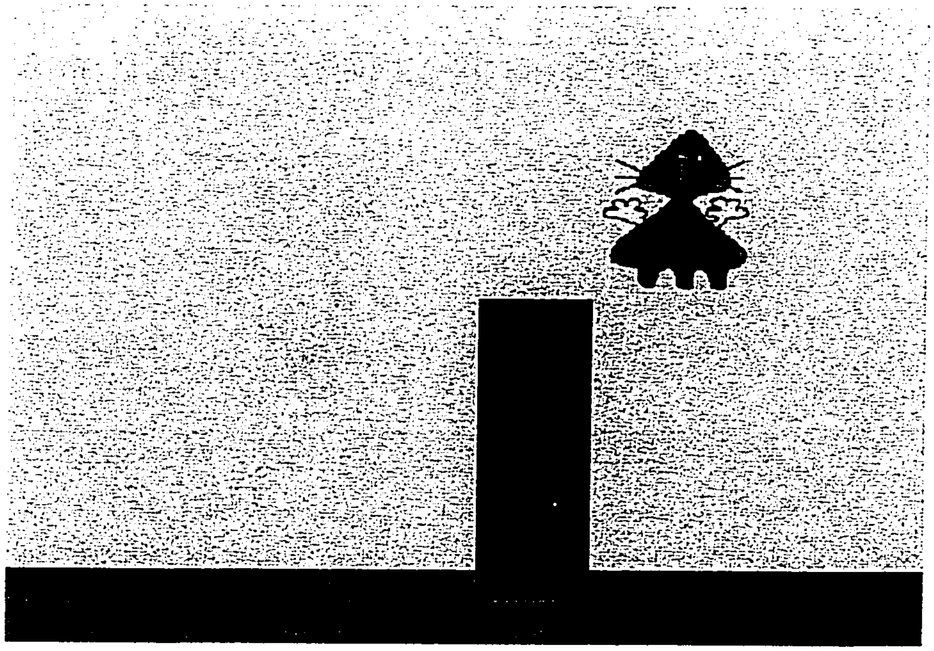
For the purposes of this study, we are looking for infants who are 18 months of age, and who do not have any visual or hearing difficulties. If you are interested in having your child participate in this study, please contact Paula Bennett or Marina Katerelos at 848-2279. For any further information you can contact Dr. Diane Poulin-Dubois at 848-2219. We will try to contact you by telephone within a few days of your receipt of this letter.

Thank you for your interest and collaboration.

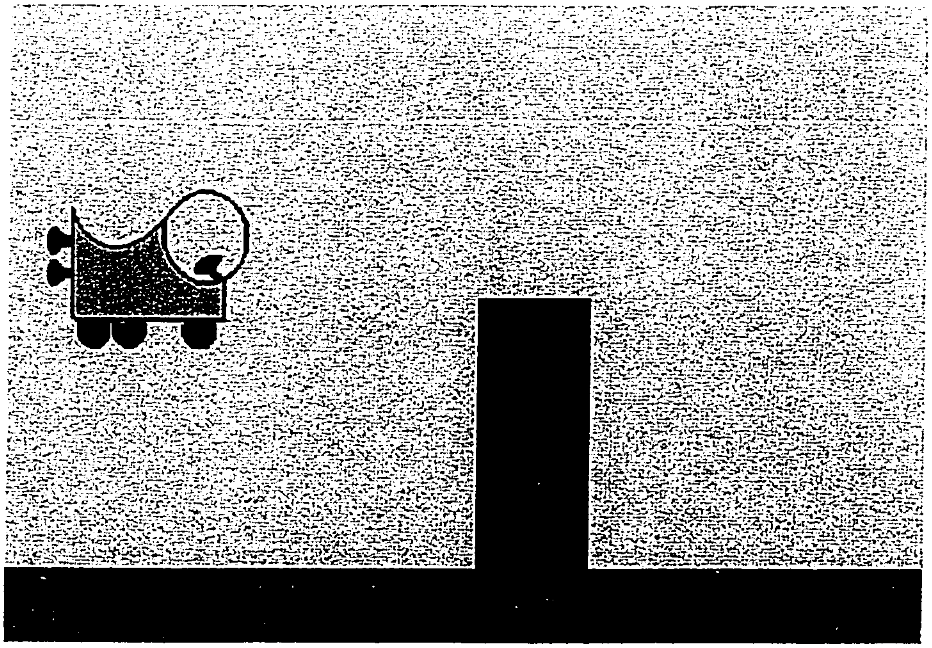
Diane Poulin-Dubois, Ph.D.	Paula Bennett, M.A.	Marina Katerelos, B.A.
Associate Professor	Ph.D. Candidate	Master's Candidate

Appendix C

Sample Frames from Animal Jumping and Vehicle Bouncing Events



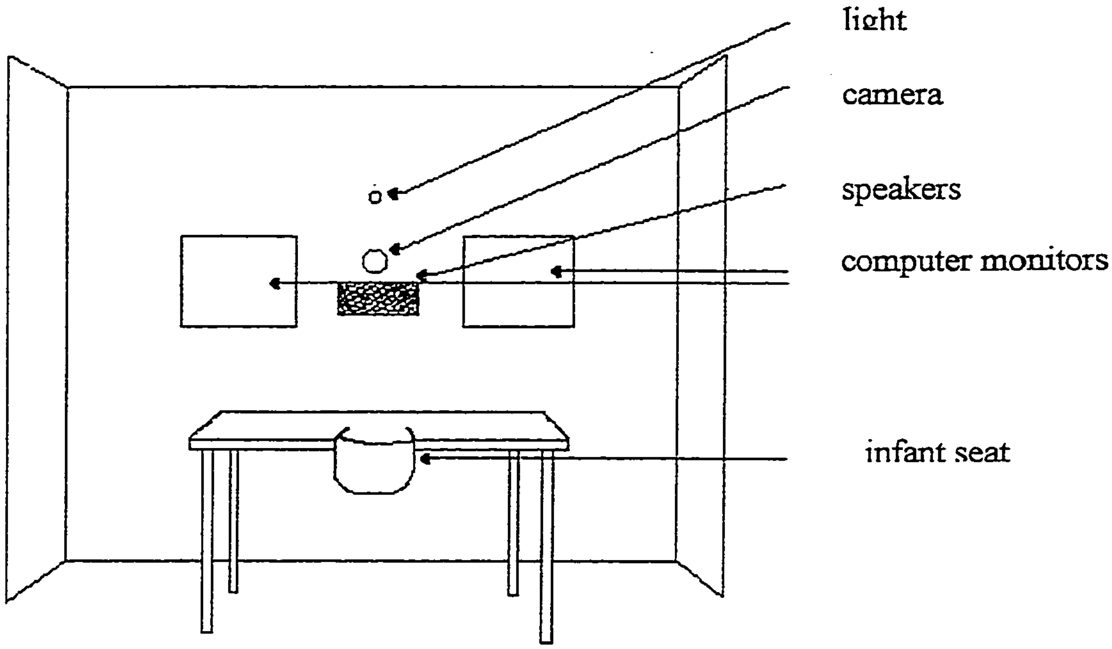
Sample Movie Frame from Animal Jumping Event.



Sample Movie Frame from Vehicle Bouncing Event.

Appendix D

Diagram of Apparatus


light
camera
speakers
computer monitors
infant seat

Appendix E

Consent Forms for Experimental and Saliency Group

Parental Consent Form

In this study, we are examining the role of motion on infants' word learning. Specifically, we are interested in discovering how infants understand words labelling moving objects in the world. To test this, we will present your child with a variety of animated events (e.g., an object will jump across the screen) on two computer monitors. Your child will be hearing various labels during the presentation of the events. Afterwards, to assess their interpretation of the events, they will be asked to find the labelled item. We will be videotaping the session to measure the amount of time your infant looks at each event. You will be asked to remain silent and neutral during the session. The videotapes, and data obtained from the tapes, will be kept strictly confidential after the experiment.

Diane Poulin-Dubois, Ph.D.	Marina Katerelos, B.A.
Associate Professor	M.A. Candidate

The nature and purpose of this study have been satisfactorily explained to me and I agree to allow my child to participate. I understand that we are free to discontinue participation at any time without negative consequences and that the experimenter will gladly answer any questions that might arise during the course of the research.

Date	Parent's signature
Date	Experimenter's signature

S#_____

Participant Information

Please answer the following general information questions about your child. All your responses will be kept confidential.

Child's Name: ____
(first and last name)

Date of Birth: ____
(month/day/year)

Gender: _________ Language(s) spoken at home: ______________________

Address: ____

____

Postal Code: ____

Telephone: ______________________ (home) ______________________ (work)

______________________ (work)

Mother's Name: ____________________ Father's Name: ____________________

Occupation: ____________________ Occupation: ____________________

Education: ____________________ Education: ____________________
(highest level attained) (highest level attained)

Birth weight: ____________________

Circle one: First Born, Second Born, Third Born, Other (please specify) _____

Length of pregnancy: ____________________ weeks

Was your child born on time? Y/N If not, how early or late? ____________

Were there any complications during the pregnancy? ____________________

____

Has your child had any major medical problems? ____________________

____

Does your child have any hearing or vision problems? ____________________

____

Does your child have any siblings? Yes / No

If yes, how many brothers: ____________________ Ages: ____________

sisters: ____________________ Ages: ____________

S#______

Parental Consent Form

In this study, we are examining the attractiveness of motion events for infants. We will present your child with a variety of animated events (e.g., an object will jump across the screen) on two computer monitors. To assess their preference for an event we will be videotaping the session to measure the amount of time your infant looks at each event. You will be asked to remain silent and neutral during the session. The videotapes, and data obtained from the tapes, will be kept strictly confidential after the experiment.

Diane Poulin-Dubois, Ph.D.
Associate Professor

Marina Katerelos, B.A.
M.A. Candidate

The nature and purpose of this study have been satisfactorily explained to me and I agree to allow my child to participate. I understand that we are free to discontinue participation at any time without negative consequences and that the experimenter will gladly answer any questions that might arise during the course of the research.

______________ Date

______________ Parent's signature

______________ Date

______________ Experimenter's signature

Would you be interested in being contacted for future studies with your children? Y / N

S#______

Participant Information

Please answer the following general information questions about your child. All your responses will be kept confidential.

Child's Name: ____
(first and last name)

Date of Birth: ____
(month/day/year)

Gender: ________ Language(s) spoken at home: ____________________________

Address: ____

____

Postal Code: ____

Telephone: ____________________ (home) ______________________ (work)

______________________ (work)

Mother's Name: ___________________ Father's Name: ____________________

Occupation: ______________________ Occupation: ______________________

Education: ______________________ Education: ________________________
(highest level attained) (highest level attained)

Birth weight: ___________________

Circle one: First Born, Second Born, Third Born, Other (please specify) _____

Length of pregnancy: __________________ weeks

Was your child born on time? Y/N If not, how early or late? ____________

Were there any complications during the pregnancy? __________________________

____

Has your child had any major medical problems? ____________________________

____

Does your child have any hearing or vision problems? _________________________

____

Does your child have any siblings? Yes / No

If yes, how many brothers: _______________________ Ages: _______________

sisters: _______________________ Ages: _______________

Appendix F

Instructions Given to Parents

Instructions for Parents

1. When we enter the room where we will be doing the study, please seat your child in the baby seat and sit behind your child in the chair provided.

2. Before we begin the task, please ensure that your child has no toys or food, as these items may be distracting.

3. During the study, please do not interact with your child. Please do not point at the computer screens or speak to your child.

4. As you will be sitting behind your child, you will be able to see what is being presented to your child but not where your child is looking. Although this may be frustrating, please do not move to try to see your child's reactions during the study.

5. Children often look away from the computer screens from time to time during the study. If your child turns to look at you, please **ONLY** smile at him/her. Your child will probably turn to look at the computer screens after a moment.

6. If your child becomes very fussy or starts to cry, we will stop the study so that you can comfort him/her.

Appendix G

Outline of Design for Each Order

Order 1

Slave	audio	Master
car	car	dog
car	dog	**dog**
cat jump	fep	cat jump
truck bounce	gop	truck bounce
truck bounce	gop	truck bounce
cat jump	fep	cat jump
cat jump	gop	**truck bounce**
truck jump	fep	cat bounce
cat bounce	gop	truck jump
truck bounce	fep	**cat jump**

Order 2

Slave	audio	Master
dog	car	**car**
dog	dog	car
truck bounce	fep	truck bounce
cat jump	gop	cat jump
cat jump	gop	cat jump
truck bounce	fep	truck bounce
truck bounce	gop	**cat jump**
cat bounce	fep	truck jump
cat jump	fep	**truck bounce**
truck jump	gop	cat bounce

Order 3

Slave	audio	Master
car	dog	**dog**
car	car	dog
cat jumping	gop	cat jumping
truck bounce	fep	truck bounce
cat jumping	gop	cat jumping
truck bounce	fep	truck bounce
cat bounce	fep	truck jump
truck bounce	gop	**cat jump**
truck jump	gop	cat bounce
cat jump	fep	**truck bounce**

Order 4

Slave	audio	Master
dog	dog	car
dog	car	**car**
truck bounce	gop	truck bounce
cat jumping	fep	cat jumping
truck bounce	gop	truck bounce
cat jumping	fep	cat jumping
truck jump	fep	cat bounce
cat jump	gop	**truck bounce**
truck bounce	fep	**cat jump**
cat bounce	gop	truck jump

Appendix H

ANOVA Source Tables

Table H1. Source Table for Analyses on Match Trials (Event X Screen X Sex ANOVA).

Source	df	F
	Between subjects	
Sex	1	.572
Within-group error	17	(.935)
	Within subjects	
Event	1	.098
Event x Sex	1	.514
Within-group error	17	(.935)
Screen	1	.623
Screen x Sex	1	.009
Within-group error	17	(1.969)
Event x Screen	1	.048
Event x Screen x Sex	1	1.234
Within-group error	17	(3.238)

Note. Values in parentheses represent mean square errors.

Table H2. Source Table for Analyses on Match Trials for High Vocabulary Children (Event X Screen X Sex ANOVA).

Source	df	F
	Between subjects	
Sex	1	.384
Within-group error	7	(.960)
	Within subjects	
Event	1	.151
Event x Sex	1	.733
Within-group error	7	(.694)
Screen	1	5.290
Screen x Sex	1	.897
Within-group error	7	(1.383)
Event x Screen	1	.929
Event x Screen x Sex	1	.578
Within-group error	7	(3.663)

Note. Values in parentheses represent mean square errors.

Table H3. Source Table for Analyses on Mismatch Trials (Event X Screen X Sex ANOVA).

Source	df	F
	Between subjects	
Sex	1	.827
Within-group error	16	(1.694)
	Within subjects	
Event	1	.207
Event x Sex	1	.461
Within-group error	16	(2.662)
Screen	1	.436
Screen x Sex	1	.269
Within-group error	16	(3.534)
Event x Screen	1	.783
Event x Screen x Sex	1	.019
Within-group error	16	(1.453)

Note. Values in parentheses represent mean square errors.