Word Learning in Infancy: Cross-Linguistic and Inter-Task Comparisons

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ABSTRACT

Word Learning in Infancy: Cross-Linguistic and Inter-Task Comparisons

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The purpose of the current thesis was to explore the mechanisms involved in children's early word learning. In the first paper, the issue of cross-linguistic word learning was examined. The question of interest was whether the type of language a child is acquiring influences his or her interpretation of a novel label for an event. The study sought to test whether children acquiring languages that emphasize more nouns or more verbs, would be guided by their linguistic input, in their interpretation of a label for an object in motion. An infant-controlled habituation paradigm was used to teach two labels for two different events to children acquiring English, French, and Japanese. English and French place a greater emphasis on nouns, whereas Japanese tends to emphasize verbs. Eighteen- to 20-month-olds' interpretation of this event was tested using a switch design, where the original label-object-motion combination was manipulated. Despite differences in the children's linguistic input, both groups of children interpreted the object as being the referent of the novel label.

The second paper further explored the nature of children's word-event associations, by its relationship with other standard word-learning measures. Towards this purpose, English- and French-speaking children who had participated in the first experiment at the age of 18 months were invited into the laboratory at 24 months to participate in a standard fast-mapping task. The relationship between children's

performance on the habituation task at 18-months and their performance on the fast-mapping task at 24-months was examined. Furthermore, the relationship between children's performance on both tasks and their concurrent and longitudinal vocabulary was also explored. Eighteen-month-olds' ability to form a word-event association was related to their comprehension of familiar words at 24 months. Furthermore, the data also suggested that children's ability to form a word-object association was related to their vocabulary size at 18 and 24 months. These findings emphasize the continuity in children's word-learning abilities as measured by different experimental procedures. Together, these two papers highlight the role of cognitive and perceptual factors in early word learning, and also emphasize the underlying continuity in children's word-learning.

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Chapter 1. General Introduction

Long before children begin formal education, they have become proficient speakers of their native language. Indeed, regardless of children's overall intelligence or environmental stimulation, their vocabulary expands, as they effortlessly acquire new labels. Data examining children's linguistic development indicate that a typically developing child will reach the first word milestone around his or her first birthday. By the time the child is 18 months, he or she will have a vocabulary of 50 words, and will begin using two-word combinations. Children's vocabulary will continue to expand such that at 2-years of age, they will have a vocabulary of 200 words, and will begin forming three word sentences at around 30 months (Capute, Palmer, Shapiro, & Wachtel, 1986).

Children's rapid lexical development becomes even more impressive 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 a linguistic signal. Attaching the label to the appropriate referent becomes a formidable task when one considers 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. For example, when a parent points to a foraging squirrel and labels it, the child can potentially infer that the referent is the entire squirrel, the squirrel's tail, the squirrel's colour, or the action of collecting nuts. Given the complexity of word learning, how children come to accomplish such a task becomes an important question. This issue has fascinated parents and philosophers alike, and a number of theoretical proposals have offered explanations for the word-learning phenomenon.

The constraint view postulates that children are guided by constraints or word-learning biases, which assist them in linking words to objects, actions, and events, by limiting the number of items they can attend to as labels (Markman, 1989, 1994). Equipped with a series of biases and/or constraints, children are able to make sense of the myriad of possibilities a label can refer to, as their biases help narrow down the scope of possibilities considered, and allow them to attach a label to the appropriate referent. One such constraint is the whole object assumption, which states that when hearing a new word, children are likely to attach the label to the whole object, and not to the object's properties, shape, or motion (Markman, 1989). The presence of such constraints has received support from empirical research (Baldwin, 1989; Landau, Smith, & Jones, 1988; Markman, 1989; Soja, Carey, & Spelke, 1991). Additional assumptions have also been postulated and scientifically supported. For example, the "taxonomic assumption" (Markman & Hutchinson, 1984) purports that children apply novel words to objects of the same category. In addition, the "mutual-exclusivity assumption" (Markmam, 1989) argues that children prefer to attach a single label per object. Nonetheless, evidence of such constraints does not necessarily help answer the question of how infants acquire novel words, particularly as proponents of this view are careful not to argue that these constraints are innate.

In contrast, the social-pragmatic view argues that children turn to the cues provided by their parents in order to resolve the word-learning problem (Akthar & Tomasello, 2000). They place the bi-directional nature of parent-child interactions as the driving force behind word-learning. They provide evidence suggesting that parents are attuned to the child's interest and intent, supplying the words for the relevant object, action, or event (Bloom, 1993, 2000). Infants, in turn, monitor adult's attentional cues when mapping words. As children become more socially and linguistically adept, parents increase the level of linguistic complexity in their interactions, therefore providing them with gradually more mature linguistic forms (Hulit & Howard, 2006). Tomasello (2001; Tomasello & Barton, 1994) argues that linguistic constraints are not necessary to break the language barrier, because the child develops the ability to understand the intention of others, and therefore understand the parents' communicative intent. By embedding the child in a rich socio-pragmatic context, there is no need to postulate biological preparedness to learn a language.

An associationist account of word learning has also been proposed, placing the emphasis on children's attentional mechanisms and memory processes as facilitating language acquisition. They argue that children are equipped with the capacity to detect, extract, and encode regularities from their environment, and that this ability is used in service of word learning (Saffran, Aslin, & Newport, 1996). The language acquisition literature provides ample evidence demonstrating that infants are pattern detectors, and as such are able to extract the distributional properties of the language they are acquiring (Marcus, Vijayan, Bandi Rao, & Vishton, 1999). Proponents of the associationist account find support for their theory in data suggesting that children are influenced by perceptual saliency and are attuned to frequency co-occurrences between words and referents, which helps promote word-learning (Smith, 1995, 1999, 2000; Samuelson & Smith, 1998; Plunkett, 1997).

Similarly, the cognitive view emphasizes the importance of nonlinguistic mental capacities in word learning, such as children's ability to categorize objects, or their theory of mind abilities, that is, their understanding of other's intentions, desires, and beliefs (Flavell, 1999). They argue that children's word learning ability is simply a product of their emerging cognitive abilities, and do not postulate a separate process for word learning (Gopnik & Meltzoff, 1997). Specifically, they argue that children make use of general cognitive skills to help them resolve the word-learning problem, and that the child's cognitive maturation helps explain their linguistic development (Hulit & Howard, 2006). Proponents of this view point to research demonstrating contiguity between children's emerging linguistic and cognitive abilities as evidence for this theory. Indeed, children's vocabulary spurt coincides with their improvement in basic-level categorization skills (Poulin-Dubois & Graham, 2006). Furthermore, there is a co-occurrence between children's ability to grasp the symbolic nature of labels and the emergence of symbolic play (Casby & Corte, 1987; Lyytinen, Poikkeus, & Laakso, 1997; Spencer, 1996). In addition, children's appreciation of the fact that language can help them accomplish tasks appears to coincide with their understanding of how to use tools to solve a problem (Gibson, 1993). The concurrent emergence of corresponding cognitive and linguistic abilities provides support for the cognitive account of word learning.

Overall, the word learning literature abounds with theories that aim to shed light on the word learning phenomenon, and that appear to have some explanatory power. Nonetheless, these theories have their critics, as they are unable to account for all of the word learning data. The emergentist coalition model of word learning has recently been proposed as an account that can reconcile the diverse evidence available in the word-learning literature (Hollich et al., 2000). This model posits that other accounts simply provide "snapshots" of the word learning process, and do not provide a detailed account of the word-learning phenomenon across development (Hirsh-Pasek, Golinkoff, Hennon, & Maguire, 2004; Hirsh-Pasek, Golinkoff, & Hollich, 2000; Golinkoff, Hirsh-Pasek, & Hollich, 1999). The emergentist coalition model proposes a complex and multi-faceted account of word learning, incorporating the use of "social, attentional, cognitive, and linguistic" cues (Hirsh-Pasek et al., 2004). They argue that children make use of a "coalition of cues" as they move towards word learning. Importantly, the impact these cues have on the child's linguistic development is weighted over the course of development. The emergentist-coalition model holds that novice word learners are guided by associative mechanisms such as frequency and perceptual salience to begin the word learning process. They eventually come to attend to social cues around them, as their theory of mind develops. Finally, children are able to deduce word-learning principles from the available information they have, further facilitating the word learning process. They emphasize that these principles are not given "a priori" to the word learner, but that the children work towards deducing these principles. This view therefore integrates the models of word learning provided by a number of theoretical accounts. Longitudinal research tapping into these emerging and developing abilities has provided concrete evidence supporting the validity of this account (Hollich et al., 2000).

The current thesis aims to examine the role of cognitive factors in word learning, between 18 and 24 months, a critical period in vocabulary development. The first paper is focused on the issue of word-mapping, and explores whether cognitive and perceptual factors influence children's ability to form a word-event association, or whether instead they are influenced by the regularities present in their linguistic input. Researchers have traditionally postulated that it is universally easier for young children to acquire labels for objects rather than actions, and point to the preponderance of nouns in children's early vocabulary as evidence for this claim (Gentner, 1982; Gentner & Boroditsky, 2001). However, recent cross-cultural research has questioned this view, arguing that the linguistic structure of a language will influence how children interpret a novel label for a referent (Choi & Gopnik, 1995; Tardif, Gelman, & Xu, 1999). In the first paper, this issue is examined more closely, by examining word learning in children acquiring languages that are structurally and syntactically quite different: English, French, and Japanese. Whereas English and French place a strong emphasis on nouns, Japanese emphasizes verbs. The main focus of this paper is to explore whether these linguistic differences influence children's interpretation of a novel label in the absence of syntactic or socio-pragmatic cues. In order to address this question, 18- to 20-month-old English-, French-, and Japanese-speaking children were taught a novel label for an object in motion. This was achieved using the infant-controlled habituation paradigm, a computerized procedure that is sensitive to the individual child's learning speed, ascertaining that all children learned the label. The study sought to examine how the children would interpret this novel label across linguistic groups. The question of interest was whether the different linguistic groups would be influenced by the same cognitive processes and attach the label to the object, or whether they would be influenced by their linguistic input and attach the label to the aspect of the event typically emphasized by their linguistic environment.

The second paper examines possible continuities between English- and French-speaking children's ability to acquire a word label in a habituation task at 18-months and their word learning in a fast-mapping task at 24-months. There is a strong body of research demonstrating a predictive relationship between infants' performance on visual discrimination and memory tasks using a habituation paradigm, and their later linguistic and cognitive abilities (Kavšek, 2004; McCall & Carriger, 1993; Mitchell & Colombo, 1997). In the current paper, we wished to pursue this issue further, by examining the relationship between children's information processing abilities in a language-based habituation task, and their later ability for non-ostensive word-learning. This study therefore explored the relationship between children's performance on the two word-learning tasks, in addition to examining the relationship with both concurrent and longitudinal vocabulary. This appears to be the first attempt in the word learning literature to measure the continuity between children's word-mapping abilities between 18 and 24 months, through the use of two different tasks tapping into the same ability. By examining the relationship between children's performance during a word-learning habituation task, and later fast-mapping, this study sought to provide insights into the nature of lexical development. Together, the two papers presented in this dissertation aim to explore the impact of cognitive vs. linguistic factors on children's word-learning, as well as gain insight into the potential continuities in children's information processing abilities that may help propel word learning.

Chapter 2.

A Cross-Linguistic Study of Word-Mapping in 18- to 20-Month Old Infants

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Contribution of Authors

This section will document the contributions of the first author in the article entitled, "A cross-linguistic study of word-mapping in 18- to 20-month old infants." The first experiment took place in the Cognitive Development laboratory at Concordia University, Montreal. The first author created the animation events using the Macromedia Director program, and then devised the administration orders and programmed the events into the habituation software. The first author drafted the recruitment letters, consent forms, and parent questionnaires for this study, in addition to recruiting the participants. A total of 43 participants were tested in this study: 23 were tested by the first author and 20 were tested by a research assistant. The first author also wrote letters to parents thanking them for their participation and informing them of the test results.

The second experiment was conducted in the laboratory of Dr. Yuriko Oshima-Takane, at the Tokyo University of Social Welfare, in Isesaki City, Japan. The first author assisted in setting up the experimental room, ensuring that the test situation was comparable to the first study. The first author adapted the animation events to Japanese. The first author tested a total of 60 participants, including children who participated in a pilot study. Japanese-speaking research assistants explained the study procedures to parents, while the first author was involved in the administration of the experiment and the live coding of children's looking times.

In both experiments, the first author entered the data into an SPSS spreadsheet, and conducted the analyses. Research assistants blind to the study hypothesis conducted inter-rater reliability tests on the coding and ensured that the data entry was accurate.

The paper was written by the first author, and both the second and third author offered comments and revisions.

Abstract

The current study was designed to examine whether infants acquiring languages that place a differential emphasis on nouns and verbs, focus their attention on actions or objects in the presence of a novel word. An infant-controlled habituation paradigm was used to teach 18- to 20-month-old English-, French, and Japanese-speaking infants novel words for events in which novel objects engaged in jumping and bouncing motions. Infants were habituated to 2 word-event pairings and then presented with new combinations that involved a familiar word with a new object or action, or both. All children mapped the novel word to the object rather than the action. These findings support the importance of cognitive and perceptual cues in early word learning.

A Cross-Linguistic Study of Word-Mapping

in 18- to 20-Month Old Infants

Nouns form the majority of children's early vocabulary, and are typically acquired earlier than other word classes (Bates et al., 1994; Bloom, 1998; Goldfield, 1993; Nelson, 1973). Studies have confirmed the presence of a noun bias in languages other than English, such as French (Bassano, 2000; Poulin-Dubois, Graham, & Sippola, 1995), Italian (Caselli et al., 1995), Spanish (Jackson-Maldonado, Thal, Marchman, Bates, & Gutierrez-Clellen, 1993), and Hebrew (Dromi, 1987; see also Bornstein et al., 2004).

Proponents of a cognitive account for the early appearance and dominance of nouns have argued that a range of perceptual and conceptual factors make object labelling the default assumption in the presence of a novel label. For example, it has been argued that it is easier for young children to acquire nouns than verbs because early nouns typically refer to physical objects, perceptually distinct and coherent units that are stable and consistent across time and context (Gentner, 1982; Gentner & Boroditsky, 2001). Similarly, Bloom (2000) maintains that because infants naturally carve up the world into objects (Spelke, 1994; Spelke, Phillips, & Woodward, 1995), it logically follows that object labels will have a privileged role in word learning. Linguistic constraints, such as the whole object assumption, have also been postulated as guiding infants through the language acquisition process, therefore explaining the prevalence of nouns in infants' early vocabularies (Baldwin, 1989; Landau, Smith, & Jones, 1988; Markman, 1989; Soja, Carey, & Spelke, 1991; Woodward & Markman, 1998; see also Golinkoff, Shuff-Bailey, Olguin, & Ruan, 1995).

In contrast to noun learning, the task involved in learning verbs is a cognitively more complex one. Verbs refer to relations within events that unfold over time. Moreover, there are often a multitude of different components in which an event can be conceptualized, including the path, the manner, the result, and the instrument (Talmy, 1985). The great variability in the way languages choose to lexicalize a particular event, in contrast to the direct word-to-world mapping possible with object words, also speaks to the basic status of objects over actions (Choi & Gopnik, 1995; Gentner, 1982). Based on this variability, Gentner and Boroditsky (2001) postulated a *division of dominance* hypothesis proposing that words vary along a continuum of cognitive vs. linguistic dominance. On the cognitive end of the continuum lie words that refer to perceptually individuated items (i.e., concrete nouns), whereas words that cannot "exist independently of language" are at the linguistic end of the continuum (i.e., determiners and conjunctions). Verbs lie somewhere in the middle, as languages vary in the way they choose to lexicalize and package the same event (Choi & Gopnik, 1995; Gentner, 1982)[1]. Consequently, it is argued that in order to learn verbs, children require a greater familiarity with their language (see Golinkoff, Hirsh-Pasek, Mervis, & Frawley, 1995 for more details), as well as knowledge of nouns to help bootstrap the acquisition of verbs (Gentner & Boroditsky, 2001). These theories, therefore, substantiate the preponderance

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[1] For example, English can simultaneous express manner and motion such as "The bottle rolled into the cave." In contrast, one must say: "La botella entró en la cueva, rodando" (The bottle entered the cave, rolling), as Spanish does not allow for the simultaneous expression of both manner and motion. However, Spanish does permit its speakers to simultaneous express motion and path, as in "La botello cruzó el canal" (The bottle moved-across the canal; O'Grady, 1996).

of nouns in the early stage of lexical development, providing further support for the facility children have in acquiring object labels.

Proponents of a linguistic account for the universal lag in verb learning suggest that infants' early word learning biases will reflect the linguistic input to which they are exposed, calling attention to the fact that the structural properties of languages differ in their emphasis on nouns. Indeed, cross-linguistic research provides a unique insight into the universality of the noun bias. For example, in English, names for objects are most likely to be the loudest element of a sentence (Messer, 1981), and to be found in sentence final position (Goldfield, 1993). These characteristics of English are likely to make nouns particularly salient, and therefore easier for children to detect (Slobin, 1973). This is in sharp contrast to S-O-V languages like Korean and Japanese. The linguistic structure of these languages places greater emphasis on verbs, as typical sentences will have verbs in the final position (Slobin, 1973). This pattern has been confirmed in studies examining parents' input to children (Au, Dapretto, & Song, 1994). In addition, verbs are further highlighted in the input, since null argument languages[2] like Korean, Japanese, and Mandarin, allow for nominal ellipsis (the ability to omit the subject when it is evident from the context), and thus verbs can stand on their own in an utterance (Guerriero, Cooper, Oshima-Takane, & Kuriyama, 2001; Oshima-Takane, in press). Therefore, the syntactic characteristics of languages differ in their emphasis on nouns or verbs. In addition, the pragmatic aspects of languages also influence this distinction. For example,

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[2] We use the term "null argument language" rather than "pro-drop language" to indicate a language that allows omissions of subject and object arguments, because we do not make any specific assumptions as to whether or not the omitted argument is a "zero pronoun."

Korean mothers are more likely to discuss activities and to use more action words with their child, relative to English-speaking mothers (Choi & Gopnik, 1995).

Studies examining language acquisition in Korean- (Choi, 2000; Choi & Gopnik, 1995; Gopnik & Choi, 1990, 1995) and in Mandarin-speaking children (Cheng, 1994, as cited in Caselli et al. 1995; Gelman & Tardif, 1998; Tardif, 1996; Tardif, Shatz, & Naigles, 1997) provide some evidence supporting the hypothesis that the presence of the noun bias is influenced by the child's linguistic input, and is not due to the privileged status of object labels. Choi and Gopnik (1995) examined the vocabulary composition of nine Korean-speaking children when interacting with their mother at home, from the ages of 14 to 22 months. They observed that verbs and nouns had equal prominence in children's vocabularies. In a similar study, Tardif, Gelman, and Xu (1999) compared the vocabulary of 20-month-old infants learning English and Mandarin. Although nouns were found to be 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. It should be noted that some studies report discrepant findings, these differences however may be explained by methodological factors (Au et al., 1994; Gentner, 1982; Kim, McGregor, & Thompson, 2000; Tardif et al., 1999). Overall, these studies suggest that when the syntactic and pragmatic aspects of a language emphasize verbs, verbs appear early on in the young child's vocabulary.

The literature on the acquisition of Japanese also appears to have generated mixed findings with regard to the composition of early vocabulary. The linguistic structure of Japanese, typically an S-O-V language, emphasizes verbs, as they are presented in sentence final position (Hakuta & Bloom, 1986; Kuno, 1986). In addition, Japanese is part of a family of languages that allow speakers to omit the subject and object when it is evident from the context (Imai, Haryu, & Okada, 2002; Guerriero et al., 2001). As mentioned previously, this linguistic structure is likely to increase the prominence of verbs in the sentence, making verbs easier to identify, therefore possibly exerting an influence upon children's acquisition of words (Choi & Gopnik, 1995). There is also some evidence to suggest that Japanese-speaking mothers use fewer nouns than American mothers and are likely to emphasize social routines when speaking to their infants (Clancy, 1986; Fernald & Morikawa, 1993). Parental report data indicate that Japanese children produce a preponderance of nouns over verbs in their vocabulary, which is in line with the findings from other languages discussed previously (Murata, 1984, as cited in Fernald & Morikawa, 1993; Ogura, Yamashita, Murase, & Mahieu, 1999; Yamashita, 1995, 1999). Naturalistic studies however, demonstrate greater variability in young Japanese speakers' vocabulary. The noun bias was supported in a study examining 31 Japanese-speaking infants between the ages of 12- and 24-months (Ogura, 2002; Ogura et al., 1999). However, Ogura and colleagues report that verbs dominate the vocabulary of Japanese children, after they have acquired a lexicon of 21 words or more. Interestingly, upon examination of children's individual production patterns (Ogura, 2002; Ogura et al., 1999), Oshima-Takane (in press) reported that the majority of children at the one-word stage revealed a balance of nouns and verbs in their vocabulary, in contrast to Ogura's group findings. Miyata, Oshima-Takane, and Nisisawa (2003) also provided some evidence suggesting that a balance of nouns and verbs in the child's vocabulary is characteristic of the early phase of language acquisition in Japanese (Oshima-Takane, in press).

The review of the current literature challenges the assumption that nouns are easier to learn than verbs since children acquiring languages that emphasize verbs do not always show evidence of a noun bias. The inconsistent findings that exist within the same language, as well as across a group of languages prevent us from drawing definitive conclusions on children's default assumption in early word learning. In order to draw inferences on the word learning process, a more direct approach is to compare noun and verb learning to assess whether noun learning is privileged over verb learning. To our knowledge, only a few studies have included both nouns and verbs in a word learning task. In one of the first attempts to conduct such a comparison, Schwartz and Leonard (1984) taught novel labels for objects and actions to English-speaking infants, ranging in age from 12.5- to 15.5-months, and followed them until they were 16 to 18 months. In the noun condition, children were presented with an unfamiliar object performing a familiar action, whereas the verb condition consisted of a familiar object performing an unfamiliar action. Although children acquired the label for the novel object more easily than the novel action, confounding factors (e.g., differential exposure, task demands) limit the conclusiveness of these findings. However, similar studies have replicated this finding, even after controlling for sentence position, stress, and phonology (Camarata & Leonard, 1986; Camarata & Schwartz, 1985; Schwartz & Leonard, 1982). In a recent study, English-speaking children who were taught novel labels for objects and actions were found to learn three times more nouns than verbs (Childers & Tomasello, 2002). Golinkoff, Hirsh-Pasek, Bailey, and Wenger (1992) also found that English-speaking children can generalize newly acquired nouns at 28-months, whereas they can only generalize verbs 6 months later, at 34-months. Similarly, Rice and Woodsmall (1988) demonstrated that it was easier for English-speaking 3- and 5-year olds to learn object words than action words. When infants succeeded in acquiring a novel verb, they were conservative when applying the label to the appropriate referent. Indeed, Kersten and Smith (2002) demonstrated that 3.5- to 4-year-old English-speaking children attend to both a novel object and motion when acquiring a novel verb presented in a syntactic frame, whereas adults were able to ignore the novel object (Kersten & Smith, 2002). Both children and adults were willing to ignore the motion of an object in a noun extension condition. A study by Imai, Haryu, and Okada (2005) suggests that Japanese-speaking children also find verb learning harder than noun learning. Both 3- and 5-year-olds were able to generalize a new noun to an event in which the same object underwent a different motion as opposed to an event in which a new object underwent the same motion. However, only 5-year-olds were able to generalize new verbs to events with new objects and the same motions. The 3-year-old children could only generalize the label to a novel event when the original object-action pairing was maintained, and only the agent differed. Imai and her colleagues concluded that verb learning is more difficult than noun learning even for Japanese children who are acquiring a language that should facilitate verb learning (see Imai, Haryu, Okada, Lianjing, & Shigematsu, 2006, for similar data with Chinese- and English-speaking children).

While research with preschoolers has shown that they extend newly learned nouns to new instances more readily than newly learned verbs, no studies have investigated whether object labelling is, in fact, children's default assumption in word learning. Using an infant-controlled habituation procedure, Werker, Cohen, Lloyd, Casasola, and Stager (1998) found that by 14 months of age, infants are able to learn a word-object association, noting however that this association was only formed when the image of the object was presented in motion. Using the same infant-controlled habituation procedure as in Werker et al. (1998), Casasola and Cohen (2000) demonstrated that it was only at 18 months that infants who were taught a label for a causal action (a Lego car pushing or pulling a can) were able to learn the pairing between label and action. Finally, Childers and Tomasello (2002) have also shown that 2.5-year-old children learned object-noun associations much better than action-verb associations with a standard forced-choice procedure. Although these studies suggest that action-word associations are more difficult to learn than object-word associations, none of them has directly examined infants' initial word-mapping assumption when given a choice between an object and an action as the referent of a novel word. Motion has been found to facilitate infants' object-word mapping in young infants but it has not been contrasted with object as a potential word referent in past research (Werker et al., 1998). In addition, to our knowledge, no research to date has examined word-mapping across typologically different linguistic groups in children younger than 3 years (Imai et al., 2005).

The goal of the present set of experiments was to examine infants' default assumption when presented with a novel word using an experimental paradigm that pitted an object against an action as the possible referent of the word. In contrast to previous research, this study directly compared infants' facility in forming a word-object versus a word-action association. An infant-controlled habituation paradigm was used to teach labels for animal- and vehicle-like objects engaged in jumping and bouncing motions to

Japanese-, French-, and English-speaking infants. The question of interest was how would children interpret a novel word, when it was equally likely to refer to an object or action. It was postulated that if features of the linguistic properties of the mother tongue, rather than conceptual factors, guide word-mapping, English- and French-speaking infants will be more likely to map the word to the object, whereas the Japanese-speaking infants will be more likely to map the word to the motion. On the contrary, if the cognitive simplicity of objects makes words for objects more readily accessible, then all children should attach the word to the object when presented with a novel word for an object in motion, regardless of the language they are acquiring.

Experiment 1

In the first experiment, 18-month-old English- and French-speaking infants were tested on their ability to form an association between a word and an object in motion. Infants were habituated to two animated events, each of them paired with a novel word, and then their understanding of these event-word pairings was tested with trials that maintained the pairings or presented novel combinations. The test trials were based on a switch design, which has been successfully used to assess infants' comprehension of novel object and action words (Casasola & Cohen, 2000; Werker et al., 1998; Younger & Cohen, 1986). Test trials consisted of a new event-word pairing, a new word-object pairing, and a new word-motion pairing. Nonsense words were presented in isolation to measure children's word-mapping default assumption. It was expected that 18-month-old infants would show no preference between the two possible interpretations if they do not have an object or an action mapping bias. However, they would show greater facility in discriminating a word-object switch than a word-motion switch if they are biased to map a novel word to an object instead of an action.

Method

Participants. Twenty-four children (17 boys and 7 girls), with a mean age of 18.33 months (17.67-18.93 months) participated in the experiment. All children were living in a city in Eastern Canada, and were recruited from birth lists provided by a provincial government health office. Parents first received a letter detailing the nature and purpose of the study (Appendix A). They were later contacted by telephone to determine whether they were interested in participating. Children received a personalized certificate of merit to thank them for their participation.

All children had a minimum of a 35-week gestation period and did not suffer from any auditory or visual problems as reported by their parents. Parental education and occupation indicated that families were primarily middle class. Children were from either English- ($n = 16$) or French-speaking ($n = 8$), monolingual families as the sample was drawn from a city where English and French are the two official languages (Appendix B). Because French-speaking children also develop nouns before verbs (Bassano, 2000), the sample was considered homogeneous for the purpose of the present study. Some children were also exposed to a second language at a maximum of 35% of the time (French or English $n = 4$, Spanish $n = 1$, Romanian $n = 1$, and Slovak $n = 1$). Another group of 18 children (9 boys and 9 girls) were tested, but were excluded from the final sample because of experimenter error ($n = 2$), fussiness ($n = 4$), or because they did not meet the habituation ($n = 2$), or testing criteria (defined below; $n = 10$).

Stimuli and materials. Computer-animated clips were created featuring characters that moved following two different motion paths. The characters were simple, brightly colored line drawings of an animal-like figure and a vehicle-like figure that had been used in a previous lexical training study (Graham & Poulin-Dubois, 1999). The drawings were digitized using an Abaton Scan 300/Colour Scanner, and later modified using Adobe Photoshop 2.01 software. The static images were animated using Macromedia Director 6.5 (1998) for Macintosh software, and then exported into QuickTime™ movies. For one motion event, the character appeared from the left, moved towards a wall, jumped over the wall, and exited on the right of the screen. This will be referred to as the jumping event (see Figure 1). The other motion event consisted of the character appearing from the left, moving until reaching a wall, bouncing off the wall, and exiting the stage on the left again. This will be known as the bouncing event (see Figure 2). The wall was a dark blue rectangle located in the middle right of the screen. All events were presented on a light blue background with a green "floor." Each event lasted a total of 9 seconds, and was repeated 3 times within a single trial. A green screen, which descended on the scene for one second, separated the repetitions of the events. A single trial could last up to a maximum of 30 seconds. To control for salience effects, the speed, height, and duration of both motions were equivalent across movies. The features and dynamic components of the two events had been found to be equally attractive in a separate study with 18-month-olds (Katerelos & Poulin-Dubois, 2000).

The novel words used in this study were monosyllabic bare novel words (*neem /nim/* and *lif /lif/)*, and abide by the phonotactic and phonological rules of both French and English. These novels labels were used in a study by Werker et al. (1998), and chosen

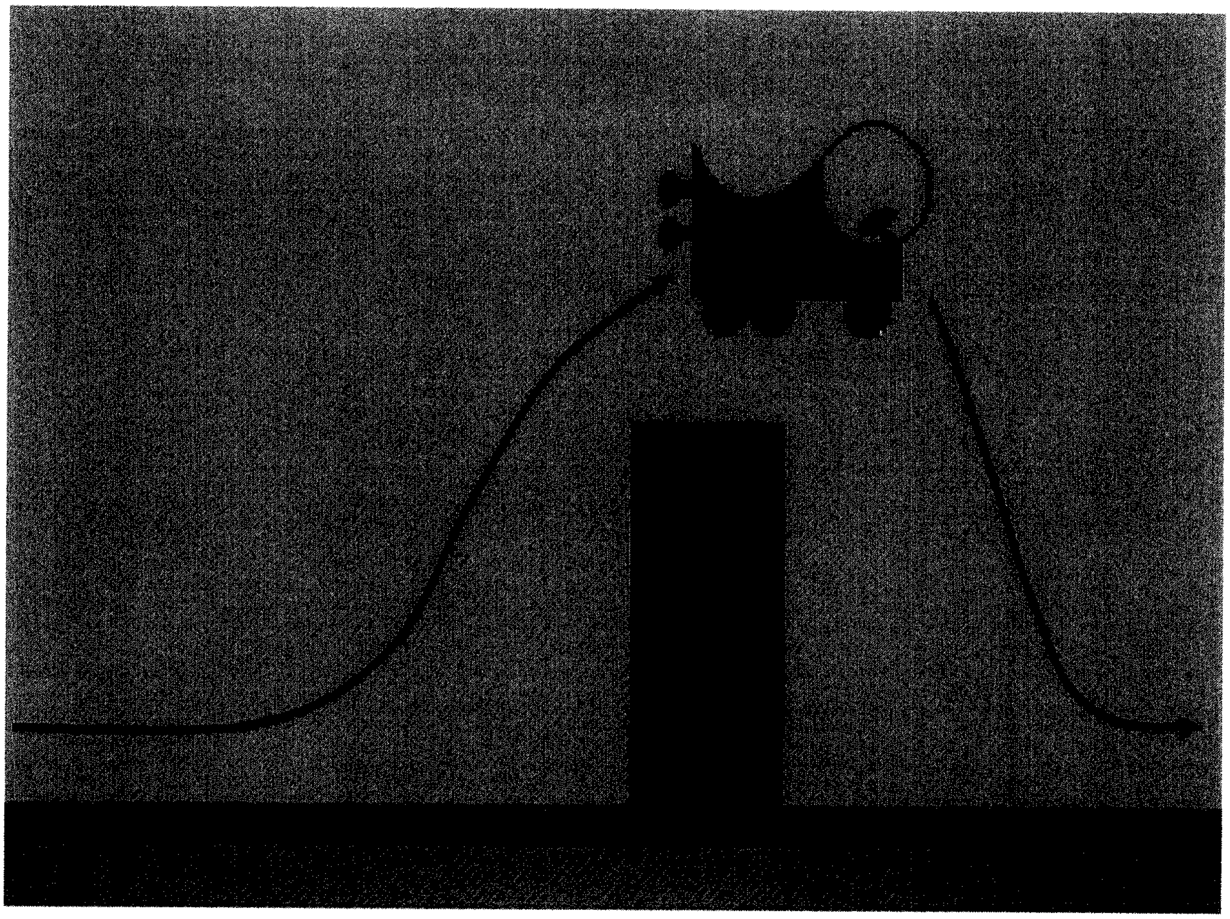

Figure 1. Still frame from the vehicle jumping event.

because they are phonetically distinct. The labels were recorded by a female voice using child-directed speech, then digitized with Sound-Edit 16 version 2.07 software. The labels were heard twice during the event, once before the action (at 2 seconds), and once after the action had begun (at 6 seconds), because of evidence suggesting that this is most helpful for word learning (Tomasello & Kruger, 1992). During an entire trial, a label was heard up to a maximum of 6 times.

The MacArthur-Bates Communicative Development Inventory (MCDI): Words and Sentences, a parent report measure of early vocabulary, was used to obtain an estimate of vocabulary size (Fenson et al., 1994). An adaptation in Canadian French was used with the French-speaking participants (Frank, Poulin-Dubois, & Trudeau, 1997).

Apparatus. The events were presented on an Apple Multiple Scan 720 Display 16-inch (40.64 cm) monitor, at a 640 x 480 resolution, that was situated 117 cm away from the child. Enjoy-Multimedia Speakers EP 691 were placed on either side of the monitor. The experimenter and the experimental set-up were hidden from the child's view by a black curtain that had an opening for the computer screen and speakers. The presentation of the events was controlled by an OS 9.2-G3 computer. The Habit© program created by the Leslie Cohen Infant Cognition laboratory (version 7.8; Austin, University of Texas) was used to present events on the monitor, record looking times, and calculate when children met the habituation criteria. It should be noted that the coder was blind to the events presented on screen, although the sound could be heard, as it was necessary for the experimenter to turn off the attention getter, in order to present the next event. A Sony EVO-120 video camera was placed above the monitor, and focused on the child's face. The camera was connected to a Sony Trinitron (PVM 8020) colour video

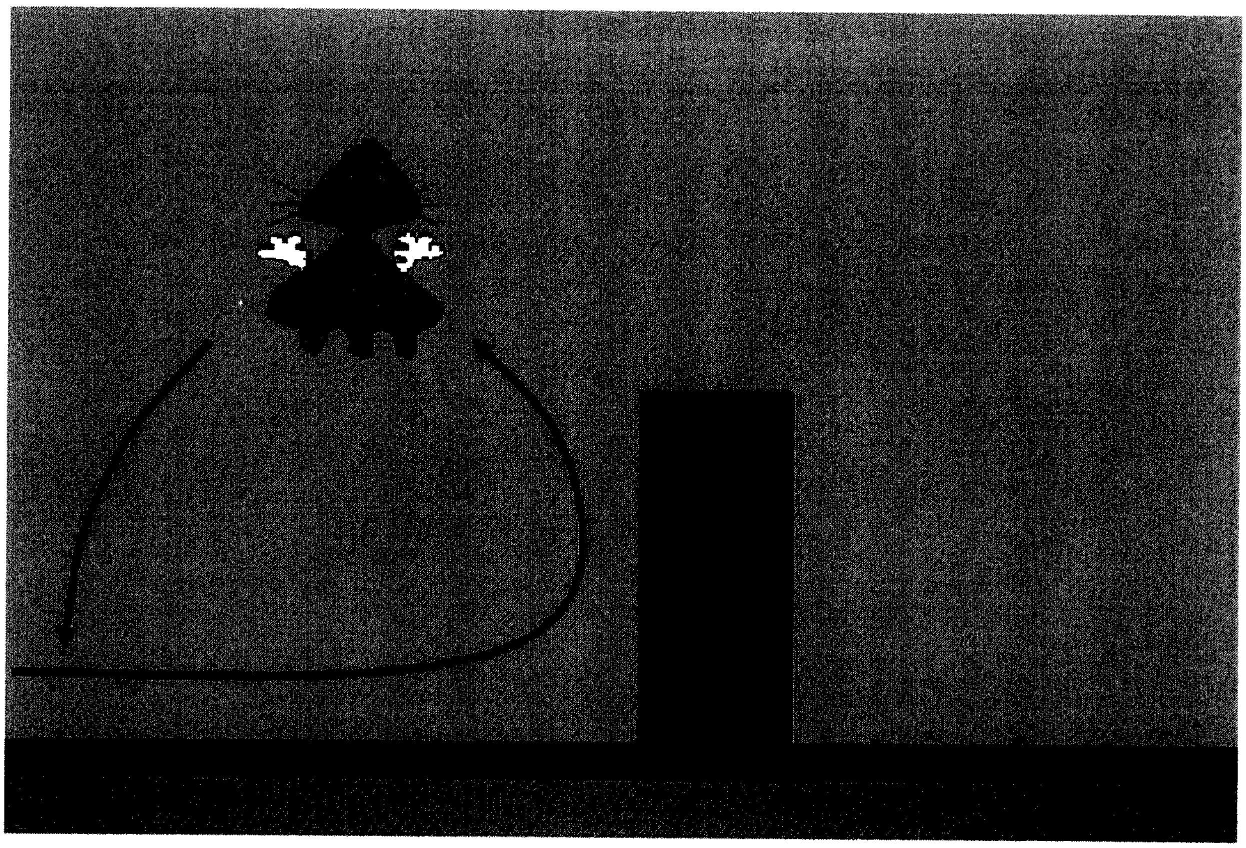

Figure 2. Still frame from the animal bouncing event.

monitor, allowing the experimenter to receive a clear and close-up image of the child's face, from where the child's looking times could be coded. In order to conduct inter-rater reliability, all testing sessions were videotaped.

Procedure and design. Families were first greeted in a reception area where the nature and the purpose of the study were explained. While the parents completed the consent form, demographic questionnaire, and MCDI, the experimenter played with the child, in order to allow him or her the opportunity to become comfortable. Children were tested in a quiet and dimly lit room. During the study, children were seated on a clip-on chair attached to a table, while their parents sat in a chair directly behind them. However, if the child became fussy, they were permitted to sit on the parent's lap. Parents were instructed not to speak and interact with their child during the study (Appendix C).

An infant-controlled habituation paradigm was used to teach children novel labels for objects in motion. Children were presented with the 2 different habituation events up to a maximum of 20 trials, or until they met a habituation criterion. The habituation criterion was reached when children's looking time at the last 4 trials was 50% less than their looking time at the first 4 trials. Infants were then presented with four test trials in order to determine how they construed these event-label pairings. The test trials were based on a switch design. The baseline trial preserved the original event-label pairing, and children's looking times to the other test trials were compared to it. The other three test trials consisted of presenting children with events where one of the elements was switched. More specifically, the word-switch trial consisted of one of the original labels paired with a different event, and was used to determine whether the word-event association had been learned by the infants. The other two test trials were used to determine whether children had attached the label to the object or the motion. These test trials consisted of the original label paired with the same object undergoing a different motion, and the original label presented with a different object undergoing the same motion (see Table 1 for an example of the design). Children were presented with all four test trials.

Infants were assigned to 8 possible presentation orders. The event-label pairing was counterbalanced such that half of the children heard */lif/* paired with the animal bouncing event whereas the other half heard the label */nim/*. In addition, the habituation events were presented in a semi-random order, where half of the children saw the animal bouncing first, and the other half saw the vehicle jumping first. The presentation of the habituation trials was constrained such that an event could not appear more than twice in a row. In the test phase, half of the infants were tested on their learning of the animal bouncing event, whereas the other half were tested on the vehicle jumping event. The presentation of the baseline trial and word-switch test trial were fixed but the object-switch and motion-switch test events were counterbalanced across participants. It should be noted that counterbalancing all test trials would have resulted in presenting the action switch trial as the first test trial or immediately after the baseline trial for a subset of the sample. In these cases, infants might have looked less at the action-switch trial simply due to boredom, because the action switch trial did not differ from the baseline or habituation trial during the first few seconds of the event. Thus, a perfectly counterbalanced design could have artificially increased the likelihood of observing an object bias.

Table 1

Sample Design of Trial Presentation for Experiment 1 and 2

	Video	Experiment 1 Audio	Experiment 2 Audio
Habituation trials	Animal bouncing	*/nim/*	*/seta/*
	Vehicle jumping	*/lif/*	*/moke/*
Test trials			
Baseline	Animal bouncing	*/nim/*	*/seta/*
Word switch	Vehicle jumping	*/nim/*	*/seta/*
Object switch	Vehicle bouncing	*/nim/*	*/seta/*
Motion switch	Animal jumping	*/nim/*	*/seta/*

A particular trial ended whenever children looked away from the screen for longer than one second. An attention getter was used to redirect children's attention to the screen for presentation of the next trial. The attention getter was comprised of a black screen, with a green disc that expanded and contracted in time with a "bing" sound, at a rate of once per second. To control for fatigue, children were presented with a novel event at the end of the habituation study. This event consisted of a geometric figure moving across the screen in a linear fashion, while a small part of the figure was simultaneously moving in and out. Children's relative looking times at this event allowed us to rule out the possibility that infants' looking times were due to fatigue.

As mentioned previously, children were excluded from the final sample if they did not meet a series of criteria. More specifically, children who did not look at the word-switch trial for longer than 2.25 seconds were excluded, as it was impossible for them to differentiate between the habituation and the test trial before the label was uttered ($n = 8$). In addition, children who recovered interest to the baseline test event (looked for 20 seconds or more of the total trial length) were also excluded as they were judged not to have fully processed the habituation events ($n = 2$).

Inter-rater reliability. Inter-rater reliability was randomly conducted on 20% of the original sample. Pearson product moment correlations were computed and the mean inter-rater reliability was $r = .99$ (range = .99-1.00).

Results

The dependent variable measured was children's cumulative looking time to the test events. Data screening was conducted to check for normality, outliers, and homogeneity of variance. A score was considered to be an outlier if it was 3 standard deviations away from the mean, and these data were adjusted by bringing them within 3 standard deviations using a criterion of z = +/-3.00 (Stevens, 1992). There were two such outliers in this data set. The final analyses were conducted based on these adjusted scores.

Before examining children's looking time to events, it was important to ascertain that children were not fatigued, and that they had learned the event-label associations. A paired *t* test comparing children's looking time to the first habituation block (mean of the first 4 trials) relative to the last habituation block (mean of the last 4 trials) was conducted. The analysis indicated that children habituated to the events, as their looking time to the last habituation block (M = 8.3 s, SD = 2.7) had significantly decreased during the habituation phase, as compared to their looking time to the first habituation block (M = 19.2 s, SD = 6.3), $t(23) = 13.38$, $p < .05$ (one-tailed)[3] Another *t* test was conducted to ascertain that children were not fatigued. Children's looking time on the post-test trial (M = 12.52 s, SD = 7.6) was significantly higher than their looking time on the baseline trial, (M = 5.14 s, SD = 4.5), $t(23) = 3.73$, $p < .05$ (one-tailed). Children's recovered interest to the post-test event indicated that they were not fatigued at the end of the study.

Although children of French- and English- speaking families were included in the sample because there was no reason to expect a language effect, we conducted a 4 x 2 (Trial x Language Group) ANOVA, where trial was a repeated measures factor. The analysis revealed a significant main effect of trial $F(3, 66) = 6.84$, $p < .05$ (Appendix D). However, because there were no other significant main or interaction effects, further

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[3] One-tailed tests were used for all the paired comparisons because our hypotheses were directional and a difference in the other direction is no more interesting than no difference at all. The level of significance was $p = .05$ for all statistical tests used in the present study.

analyses were conducted on the combined data without separating them by language group. The main analysis examined which aspects of the events infants had associated with the labels. A 4 x 2 (Trial x Sex) analysis of variance was conducted, where trial was a repeated measures factor comparing children's looking time at the baseline, word-switch, object-switch, and motion-switch event. Sex was included as a between subjects factor due to traditional gender differences in the language acquisition literature (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Reznick & Goldfield, 1992; Woodward, Markman, & Fitzsimmons,1994). There was a significant main effect of trial $F(3, 66) = 6.63, p < .05$ (Appendix E). Multiple t tests with Bonferroni correction[4] revealed that children looked longer at the word-switch trial ($M = 13.54$ s, $SD = 9.92$), than at the baseline trial ($M = 5.14$ s, $SD = 4.54$), $t(23) = 3.61, p < .05$ (one-tailed). This indicated that infants successfully associated the label with the original event, as they noticed a violation in the event-label pairing. Similarly, infants looked significantly longer at the object-switch trial ($M = 8.21$ s, $SD = 6.56$) compared to the baseline trial, $t(23) = 2.33, p < .05$ (one-tailed). In contrast, infants' looking time at the motion-switch trial ($M = 7.41$ s, $SD = 5.4$), did not differ from their looking time to the baseline trial, $t(23) = 1.53, p > .05$ (one-tailed; see Table 2). Together, these analyses indicate that infants preferentially associated the label to the object, as opposed to the action.

These findings were corroborated with a comparison to chance (50%) of preference scores, calculated as a proportion of looking time on each of the three critical

[4] The chosen level of significance ($p = .05$) was divided by the number of comparisons (3) for Bonferroni correction in the present study ($p = .016$), because there were three comparisons of interest, baseline vs. word switch, baseline vs. object switch, baseline vs. action switch.

test trials in comparison to the baseline trial (e.g., looking time on word-switch / [looking time on word-switch + looking time on baseline]). This measure takes into account the increase in looking time relative to the baseline trial, for each individual child. Indeed, children's mean preference score for the word-switch event ($M = 0.69$, $SD = 0.23$) was significantly higher than chance, $t(23) = 3.99, p < .05$ (one-tailed). Children's preference score for the object-switch trial (looking time on object-switch/ [looking time on object-switch + looking time on baseline]; $M = 0.61$, $SD = 0.19$) was also significantly higher than chance $t(23) = 2.92, p < .05$ (one-tailed), whereas their preference score for the motion-switch trial was not (looking time on motion-switch/ [looking time on motion-switch + looking time on baseline]; $M = 0.58$, $SD = 0.25$), $t(23) = 1.61, p > .05$ (one-tailed). Children's total vocabulary ranged from 2 to 180 words ($M = 45.7$, $SD = 40.6$).

Discussion

As expected, data from the first experiment confirm that when presented with a new label and an event, infants learn this association easily (Casasola & Cohen, 2000). More importantly, when motion and object are pitted against each other as potential referents for a novel word, in the absence of any morphosyntactic cue that could help disambiguate the word, infants prefer to map the word to the object. This finding is consistent with both cognitive and linguistic hypotheses, as both theories make the same predictions for children acquiring French or English, two languages that emphasize object labels. A more valid test of the two competing hypotheses would require conducting the same experiment on children acquiring a language that places an emphasis on action labels. In this case, although the cognitive account would predict that infants would preferably associate the label with the object, the competing linguistic account would

Table 2

Average Looking Time (s) to Test Trials in Experiment 1 and 2

	Average Looking Time (s)							
	Baseline		*Word-switch*		*Object-switch*		*Action-switch*	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Experiment 1	5.14	0.93	13.54	2.02	8.21	1.34	7.41	1.10
Experiment 2	4.66	0.62	8.44	1.60	8.84	1.49	7.54	1.51

predict that the child would be biased to associate the label to the action, or pay attention to the entire event as a whole. Japanese-speaking infants were tested in the second experiment. If infants are guided by cognitive and perceptual properties, it was hypothesized that they would show facility in discriminating a change in object rather than a change in action. Alternatively, if the linguistic structure of the language influences the way children process events, Japanese-speaking infants should show more sensitivity to a change in the label-action association than to a change in the label-object association.

Experiment 2

Method

Participants. Twenty-five children (10 boys and 15 girls), with a mean age of 19.94 months (19.0-20.89 months) participated in the experiment. Children were recruited from health centers in a Japanese town located North-West of Tokyo. The nature and purpose of the study was explained to the parents, and appointments were later set-up with those interested in participating. Families received a videotape of their visit in order to thank them for their participation (Appendix F).

All children had a minimum of a 35-week gestation period, and reportedly did not suffer from any auditory or visual problems. The children's native language was Japanese, and none were exposed to a second language. Parental education and occupation indicated that mainly middle class families participated in the study. In addition, another 20 children (10 boys and 10 girls) were tested, but were excluded from the final sample because of experimenter error ($n = 1$), fussiness ($n = 8$), not meeting the habituation criteria ($n = 2$), remaining interested in the baseline trial ($n = 6$), or not meeting the testing criteria ($n = 3$; see experiment 1 for details).

Stimuli. All the stimuli were identical to those used in experiment 1, with the exception of the novel words. *Moke /moke/* and *seta /seta/* were used in this study as these sounds abide by the phonotactic and phonological rules of Japanese.

Apparatus. The experimental set-up was as similar as possible to that of Experiment 1. The events were presented on a Sony Trinitron Multiscan flat-panel E230 17-inch (43.18 cm) monitor (640 x 480 resolution), which was 117 cm away from the child. The experimenter and the experimental set-up were hidden from the child's view with the help of a 155 x 155 cm black wooden panel. The panel had an opening for the video camera that was placed 20 cm above the monitor. Sony SRS-Z750PC speakers were placed behind a mesh opening on the wooden panel, directly above the monitor. The experimenter controlled the presentation of the events using a MAC OS9.2-G4 computer. A Sony DCR-TRV17K digital camera was placed above the monitor, which was connected to an AIWA TV-14GT33 television set, allowing the experimenter to receive a clear and close-up image of the child's face. In order to conduct inter-rater reliability, all testing sessions were videotaped.

Procedure and Design. The procedure and design of the habituation task remained identical to those in Experiment 1 (Table 1). Because no validated Japanese adaptation of the MCDI was available at the time of data collection, vocabulary scores are unavailable for this group.

Inter-rater reliability. Inter-rater reliability for the habituation task was randomly conducted by a blind coder on 20% of the original sample. Pearson product moment correlations were computed, and the mean inter-rater reliability was $r = .99$ (range = .99-1.00).

Results

Data screening was conducted to check for normality, outliers, and homogeneity of variance. There were no outliers present in this data set. A first analysis determined whether the Japanese children processed the events that were presented to them. A paired *t* test compared children's looking time to the first and last habituation block (mean of the first 4 trials and last 4 trials respectively). The analysis indicated that children habituated to these events, as their mean looking time to the first habituation block ($M = 20.5$ s, $SD = 5.7$) was significantly higher than their looking time to the last habituation block ($M = 7.9$ s, $SD = 2.8$), $t(24) = 16.56$, $p < .05$ (one-tailed). Furthermore, a paired *t* test was also conducted to test for fatigue effects. There was a significant difference between children's looking time on the post-test trial ($M = 9.11$ s, $SD = 7.2$) and on the baseline trial ($M = 4.66$ s, $SD = 3.09$), $t(24) = 2.75$, $p < .01$ (one-tailed). Thus, results on the test trials cannot be attributed to a fatigue effect at the end of the experiment.

As in the previous experiment, the main analysis consisted of a 4 x 2 (Trial x Sex) analysis of variance, where trial was a repeated measures factor comparing children's looking times to the baseline, word-switch, object-switch, and motion-switch trials. The analysis of variance only revealed a main effect of trial, $F(3, 69) = 3.03$, $p < .05$ (Appendix G). Multiple *t* tests (with Bonferonni correction) revealed that children looked longer at the word-switch trial ($M = 8.44$ s, $SD = 7.99$), than the baseline trial ($M = 4.65$ s, $SD = 3.09$), $t(24) = 2.36$, $p < .05$ (one-tailed), therefore indicating that children did indeed associate the label with the event it was originally paired with. In addition, children's looking time at the object-switch trial (M = 8.84 s, SD = 7.46), was significantly longer than their looking time at the baseline trial, $t(24) = 2.57, p < .05$ (one-tailed), whereas there was no difference in children's looking times at the baseline and motion-switch trials (M = 7.54 s, SD = 7.56), $t(24) = 2.08, p > .05$ (one-tailed). This pattern of results suggests that children developed an association between the object and the novel label (see Table 2).

Children's preference score for the word-switch trial was significantly different from chance ($M = 0.60, SD = 0.18$), $t(24) = 2.81, p < .05$ (one-tailed), as was their preference score for the object-switch trial ($M = 0.59, SD = 0.23$), $t(24) = 2.07, p < .05$ (one-tailed). In contrast, their preference score to the motion-switch trial was not significant, ($M = 0.55, SD = 0.20$), $t(24) = 1.30, p > .05$ (one-tailed). These findings are consistent with the overall pattern reported by paired the t tests.

Discussion

The results of Experiment 2 indicate that infants learning Japanese preferably map a novel label to an object, when they are presented with a label for an object in motion. Thus, despite the linguistic differences of English, French, and Japanese, infants learning those languages react similarly in a word-mapping situation that is stripped of socio-pragmatic and morphosyntactic cues. Given that the structure of Japanese places an emphasis on verbs, the current findings provide support for the conceptual account of word-mapping. It should be pointed out that although the Japanese infants were about a month older than the Canadian sample in Experiment 1, cross-linguistic research on vocabulary development in Japanese and American children has reported that 19-month-old American infants have a significantly larger vocabulary than Japanese infants of the same age. Furthermore, American children have a larger object vocabulary size than Japanese infants (Fernald & Morikawa, 1993). This suggests that, despite the slight age difference, the current comparison provides a stringent test of the object bias.

General Discussion

Although labels for objects might be easier for young infants to acquire due to perceptual and cognitive factors, the structure of a language and the input the child is exposed to might also determine which categories of words will be the first to be produced and the most frequent in the early lexicon. The current set of experiments adopted an approach that departed from previous studies, in order to collect a more direct measure of children's word-mapping by examining children's tendency to attach a label to an object or an action when stripped of linguistic or socio-pragmatic cues. An infant-controlled habituation procedure was used to teach novel labels for events, and a switch design was used to determine whether 18- to 20-month-old infants would form a word-object or a word-action association. Although word-object and word-action associations have been investigated before in infants in this age range, this study is the first to test infants' default assumption in a word-mapping task. Overall, the results of the two experiments demonstrated that when presented with a label for an object in motion, English-, French-, and Japanese-speaking infants construed the label as referring to the object. These findings provide support for the role of cognitive and perceptual factors in early word-mapping given the facility with which children formed a word-object association over a word-action association.

Although the current findings emphasize the role played by universal perceptual and cognitive constraints in the word-mapping process (object concepts) it is important to consider alternative interpretations of the data. A possible criticism is that children dishabituated to the object-switch trial and not to the motion-switch trial, because the two objects were more easily discriminated than the two actions. Thus, any change in the object-label pairings would be easier to detect than changes of action-label associations. We believe that this "lean" interpretation is unlikely for many reasons. First, Casasola and Cohen (2000) demonstrated that 18-month-old infants were able to associate a label with a pulling vs. a pushing motion taught during the habituation phase. This required infants to distinguish between two subtle changes in direction where a Lego toy either pulled or pushed a can across a screen. Another source of evidence for infants' ability to discriminate between subtle differences in motion events comes from a recent study in which 14-month-olds were able to learn an association between two objects and two linear motions, which had only minor differences in change of path (Rakison & Poulin-Dubois, 2002). Finally, the pairs of objects and pairs of motions used as stimuli were presented to 18-month-old infants in a control experiment with a preferential looking paradigm. Infants looked equally at each object and at each motion, confirming a similar attractiveness across the pairs (Katerelos & Poulin-Dubois, 2000). Taken together, this evidence suggests that children did not dishabituate to the motion-switch trial simply because they did not notice the change in action.

The current findings provide evidence that a word-object association is easier than a word-action association, however a comprehensive theory of word learning would need to account for how children may switch from being able to easily acquire object labels to acquiring action words just as readily. The emergentist-coalition model of word learning provides us with an integrative model of word learning (Hollich et al., 2000). They argue that children are able to take advantage of the various types of cues available to them, specifying that each cue takes on a different level of significance across the various stages of language acquisition. The information children acquire at each stage of development in turn, allows them to devise word-learning principles thereby providing an additional guide through the language acquisition process. Indeed, there is evidence to suggest that children's emerging ability to attend to socio-pragmatic information may be particularly important in allowing them to detect and label actions in a linguistic context. For example, Tomasello and Akhtar (1995) demonstrated that 27-month-old children are able to use adults' pragmatic cues to determine whether a label presented with a novel object performing a novel action refers to the object or action. Pragmatic cues in the situation (novelty to the conversation, or adult gaze) guided children in attaching the label to the appropriate referent. Children can also attach a label to the appropriate referent by monitoring the adult's intention and gaze direction, even if the child cannot immediately see the labelled item (Baldwin, 1993a, 1993b), or if the adult finds the referent after the child has heard the label (Tomasello & Barton, 1994; Tomasello, Strosberg, & Akhtar, 1996). These findings suggest that infants are attuned to the pragmatic context, and can easily overthrow the object bias in accord with the socio-pragmatic cues being presented. In the absence of such cues, as in the present "sound booth" experiments, infants seem to fall back on a default assumption that a new label preferentially maps onto a novel object rather than onto a novel action.

In summary, the present study provides the first evidence that, like English- and French-speaking infants, Japanese infants under two years of age map a novel word onto an object when given a choice between an object and an action as its referent in a controlled laboratory procedure. The results suggest that a mapping task with bare words provided a tool to capture early default word-mapping assumptions, therefore documenting a tendency to attach a novel label to a novel object in English-, French-, and Japanese-speaking infants. The present findings are particularly important, given that a linguistic account would have predicted that the syntactic and structural cues present in the Japanese language should facilitate a word-action association in Japanese infants (Choi & Gopnik, 1995; Tardif et al., 1999). The data provide credence to the privileged status of object words, due to their conceptual and perceptual simplicity relative to action words. Nonetheless, previous research points to the important influence of the pragmatic and structural aspects of a language. It is suggested that the object bias might be a default assumption (Woodward, 2000; Woodward & Markman, 1998), that is overridden early by pragmatic and syntactic cues in some languages (e.g., Korean and Japanese) and a little bit later in others (e.g., English and French; Tomasello & Barton, 1994; Tomasello et al., 1996). A recent study with an interactive preferential looking paradigm suggests that even English-speaking children can interpret a novel word embedded in a noun frame as referring to an object and one embedded within a verb frame as referring to an action by 18 months of age (Echols & Marti, 2004). It would be interesting to replicate the present experiment by providing English-and Japanese-speaking infants with pragmatic or morphosyntactic cues to the bare word, as well as with young word learners acquiring other null argument languages such as Korean and Mandarin. Such a study would show the relative weight of linguistic, cognitive, and pragmatic cues used by word learners in the early word-mapping process.

Chapter 3.

A Longitudinal Study of Word Learning: Interrelations Between Word-Event Association, Fast Mapping, and Vocabulary

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Contribution of Authors

This section will document the contributions of the first author in the article entitled, "A Longitudinal Study of Word Learning: From Word Mapping to Fast Mapping." The experiment took place in the Cognitive Development laboratory at Concordia University, Montreal.

The first author selected the test stimuli, created the test administration orders, in addition to writing the recruitment letters, parental consent, and questionnaire forms. In addition the first author recruited and tested a total of 33 participants for this study. The first author also watched the recording of the testing session, in order to code children's object choice across all trials. She then entered the data into an SPSS spreadsheet and conducted the analyses. An independent research assistant was involved in conducting inter-rater reliability on the coding and ensured that the data entry was accurate. The first author also wrote result letters to parents thanking them for their participation and informing them of the test results.

The paper was written by the first author, and the second provided comments and revisions on drafts.

Abstract

The current paper examined the issue of continuity in children's word learning. The relationship between 18-month-olds' performance on a word-event association task using a habituation procedure and their performance on a fast-mapping task at 24 months was explored. Furthermore, the relationship with concurrent and longitudinal vocabulary was also examined. The results suggested that children's ability to form a word-event pairing at 18 months was related to their ability to comprehend familiar words at 24 months. There was also evidence suggesting that children's ability to form a word-object association is related to their vocabulary at 18 and 24 months. This study is the first to demonstrate a link between vocabulary and word mapping assessed with a habituation paradigm.

A Longitudinal Study of Word Learning:

Interrelations Between Word-Event Association, Fast Mapping, and Vocabulary

When children hear a novel word, they are presented with the formidable task of mapping this label to the appropriate referent, while ruling out the myriad of plausible alternatives available to them (Quine, 1960). Given this potential puzzle, explaining young children's ability to learn new words with minimal effort and feedback has been one of the fundamental questions of the language acquisition literature. Lexical training tasks have been useful in simulating young infants' word learning process, thereby providing invaluable insight into this phenomenon. Furthermore, studies with toddlers using word disambiguation tasks, have demonstrated the facility with which they can acquire a label without ostensive teaching, thus expanding our understanding of this process. The current study sought to examine whether there is continuity in children's word learning ability across a lexical training and a word disambiguation task used at two different developmental stages, in order to gain a deeper understanding of the underlying mechanisms involved in children's word learning.

The literature on early development abounds with lexical training studies demonstrating that very young children are able to learn words quickly, under the appropriate conditions. For example, by providing children with an interactive and contextually engaging word learning context, Woodward, Markman and Fitzsimmons (1994) demonstrated rapid-word-learning in infants as young as 13 months. In their study, an experimenter interacted with children in a play context, presenting them with a novel label for an object. After having heard the word-object association a total of nine times across two training trials, 13- and 18-month-old infants demonstrated comprehension of the label by performing an activity using the labelled toy. Interestingly, when tested 24 hours later, children continued to demonstrate knowledge of the word. In a similar study that minimized the task demands, Bird and Chapman (1998) demonstrated that when presented with a set of 3 toys, 13- to 16- month-olds' looks, points, and retrievals of the correct referent demonstrated that they had acquired the label after only 4 exposures.

Further research has emphasized that infants can learn word-object associations rapidly, even in a context stripped of socio-pragmatic cues. Schafer and Plunkett (1998) presented 15-month-old infants with two novel labels for two static objects using a preferential looking paradigm. The study demonstrated that infants were able to acquire the label for at least one of those objects, based on increased looking time towards the screen that matched the linguistic label previously paired with the object. Infants were thus able to acquire a label, after having heard the word-object association a mere six times. Similarly, Werker, Cohen, Lloyd, Casasola and Stager (1998) taught 8- to 14-month-old children a novel label for a novel object using an infant-controlled habituation paradigm. Children's acquisition of the word-object association was tested using a switch design, where they saw one of the original word-object pairings and a new word-object pairing. Fourteen-month olds' significant increase in looking time to the event that violated the original pairing demonstrated that they did indeed learn the association of the label with its designated object. Studies have also shown infants' ability to rapidly acquire a label for a novel action. Casasola and Cohen (2000) habituated children to two events where a nonsense label was attached to a causal action. Eighteen-month-olds were able to learn the pairing between label and action as demonstrated by their increased looking time to the event that violated the original pairing. Other research has demonstrated that older children are able to acquire novel labels for actions with fewer training trials (Poulin-Dubois & Forbes, 2002; Forbes & Poulin-Dubois, 1997).

Overall, current word learning research in experimental contexts provides evidence demonstrating the facility with which young infants can acquire new labels (see Woodward, 2004 for a review). Nonetheless, these lexical training experiments have been criticized for lacking ecological validity. Critics have argued that parents do not explicitly teach children all the words they are exposed to (Akhtar, Jipson, & Callanan, 2001; Bloom, 2000; Tomasello & Barton, 1994) Indeed, some findings suggest that children acquire new words at a rate of 6 per day, which exceeds the frequency at which parents teach infants new labels (Anglin, 1993). Studies have also demonstrated that children attend to and learn words from overheard speech (Akhtar et al., 2001). Furthermore, research has captured children's ability to learn words quickly within an experimental context, without ostensive training (Evey & Merriman, 1998). In a pioneer study by Carey and Bartlett (1978), an experimenter pointed to two trays and asked 3- and 4-year olds to "bring me the chromium one, not the red one, the chromium one." Children brought back to the experimenter the olive tray, correctly inferring that the novel word mapped onto the unfamiliar colour. When tested 1 and then 5 weeks later, children were able to remember something about the meaning of the word, such as that it names a colour (Carey & Bartlett, 1978). This phenomenon has been dubbed "fast mapping," describing it as children's ability to learn a new word without being given explicit information (Carey, 1978). Children's tendency to map the novel label to the novel object has also been labelled the disambiguation effect, because it is postulated that this process helps clarify the ambiguity of word meanings (Merriman & Bowman, 1989).

Numerous other studies have demonstrated that if a child hears a novel label, while presented with two objects, one of which is familiar and the other unfamiliar, then the child will reliably select the unfamiliar item as the referent for a novel label (Golinkoff, Hirsh-Pasek, Bailey, & Wenger, 1992; Hutchison, 1986; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Merriman & Schuster, 1991). Furthermore, it has also been demonstrated that children can generalize a novel label acquired during a fast-mapping task to a novel exemplar (Frank & Poulin-Dubois, 2005). After successfully performing in a standard fast-mapping task, children were prompted for the referent of the label during a generalization trial, where they saw two of the familiar items, a novel exemplar of the unfamiliar object seen in the fast-mapping trial, and a novel unfamiliar object that served as a distracter. Children's ability to extend the novel label to the novel exemplar was significantly above chance. Thus, it appears that the fast-mapping phenomenon is an important process that encourages children's vocabulary growth, and provides insight into how children make sense of the linguistic information they are exposed to.

Despite controversy surrounding the underlying process involved, demonstration of children's fast-mapping abilities is a robust finding (Golinkoff et al., 1992; Hutchinson, 1986; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Merriman & Schuster, 1991). Indeed, fast mapping has been demonstrated in young children, ranging in age from 1;5 to 2;6 depending on the methodological variables, such as providing corrective feedback, limiting the number of test items, and ensuring an engaging test phase

(Dollaghan, 1987; Evey & Merriman, 1998; Golinkoff et al., 1992; Graham, Poulin-Dubois, & Baker, 1998; Merriman & Bowman, 1989; Merriman & Marazita, 1995; Merriman & Schuster, 1991; Mervis & Bertrand, 1994). Furthermore, other studies have ruled out the possibility that this effect may simply be attributed to object novelty (Hutchinson, 1986; Merriman & Bowman, 1989; Merriman & Schuster, 1991).

Overall, children's ability to conduct rapid word-referent mappings, without ostensive teaching, is a phenomenon that provides unique insight into the word learning process. Considering that fast mapping and lexical training tasks examine the processes involved in word learning, a relationship between a child's performance on these two different tasks and their vocabulary would be expected. Indeed, Mervis and Bertrand (1994) found a direct relationship between children's disambiguation ability and their productive vocabulary at 16 to 20 months, as measured by the MacArthur-Bates Communicative Development Inventory (MCDI; Fenson et al., 1991). The children who performed well on fast mapping tasks by mapping the novel label onto the novel object had significantly larger vocabularies than infants who did not. This finding was strengthened by a follow-up study, in which the children who had failed the fast-mapping task were followed longitudinally until they reached a vocabulary spurt (17 to 20 months), at which point they were retested on the task. These post-vocabulary spurt children were now able to fast-map, which led Mervis and Bertrand (1994) to argue that this ability emerges at the same time as children's vocabulary spurt. A similar study by Graham et al. (1998) supported these findings. Infants ranging in age from 16 to 22 months old were presented with two familiar items and one unfamiliar item, and then prompted with both a known and novel label. They found that infants selected the novel object as the referent for the novel word for half the trials, which was more often then expected by chance alone. Furthermore, they confirmed Mervis and Bertrand's (1994) finding that children who showed evidence of fast-mapping had larger productive vocabularies. However, although all children who were able to demonstrate the disambiguation effect had large vocabularies, all infants with large vocabularies did not show this effect. The authors concluded that a vocabulary spurt is "necessary but not sufficient" for disambiguation. It seems that this ability is not present at the beginning of word learning but when it develops, it helps facilitate infants' word learning. A more recent study corroborated these findings, reporting that linguistically precocious two-year-olds (mean vocabulary of 596 words), were better that their peers (mean vocabulary of 337 words) at successfully mapping a novel label onto a novel object during a fast-mapping task (McGregor, Sheng, & Smith, 2005).

Although research examining children's word learning has found a significant relationship between children's performance on a fast-mapping task and their productive vocabulary, this finding has not been replicated when children's word learning has been assessed with the preferential-looking paradigm. A series of studies conducted by Hollich and colleagues (2000) using an interactive intermodal preferential looking paradigm failed to find a significant relationship between children's performance on an experimental word learning task and their linguistic abilities as measured by the MacArthur-Bates Communicative Development Inventory (MCDI). This non-significant finding has been reported, even when exploring the relationship between children's vocabulary and comprehension measures at 12-months, both comprehension and production measures at 19- and 24 months, as well as when correlating MCDI measures to children's looking times on training and test trials. Similar results have been reported in other studies using the preferential looking paradigm (Golinkoff, Hirsh-Pasek, & Alioto, 1998, as cited in Hollich et. al, 2000; Hirsh-Pasek & Golinkoff, 1996), as well as in interactive lexical training studies (Baldwin, Markman, Bill, Desjardins, & Irwin, 1996). Hollich and colleagues (2000) speculate that the lack of correlation is explained by a difference in what is being measured by the two methodologies. They argue that the MCDI captures a child's "static vocabulary," that is, the end product of word learning, whereas lexical training paradigms are designed to measure the word learning process. However, an alternative explanation may be due to the limitations of lexical training with a preferential-looking paradigm, that is conducted using a fixed number of trials, and does not take into account variability in children's learning speed. In contrast, an infant-controlled habituation paradigm tailors the presentation of training trials to a child's learning speed, ensuring that a particular child has had sufficient opportunity to attend to the stimuli. The infant-controlled nature of the habituation paradigm therefore provides a better indicator of individual differences, and may prove to be more fruitful when exploring the potential relationship between end-state vocabulary and word-learning.

Multiple studies have demonstrated a predictive relationship between infants' habituation and dishabituation patterns, and later language abilities (Bornstein & Ruddy, 1984; Fagan & McGrath, 1981; Fagan & Singer, 1983; Rose & Feldman, 1995; Rose, Feldman, & Wallace, 1992; Rose, Feldman, Wallace, & McCarton, 1991; Rose, Slater, & Perry, 1986; Ruddy & Bornstein, 1982; Slater, Cooper, Rose, & Morison, 1989; Thompson, Fagan, & Fulker, 1991). It has been argued that during the habituation task children are involved in discriminating, categorizing, generalizing, and constructing mental representations, and that these are precisely the cognitive processes that are involved in later language acquisition (Bornstein & Sigman, 1986, 1987; Fagan, 1984; Thompson et al., 1991). Others have suggested that infants' novelty preference may be indicative of a "precursor to verbal ability," and this may mediate the relationship between infant measures on habituation tasks and later cognitive performance (Rose & Feldman, 1995; Rose et al., 1992; Rose, Feldman, Wallace, & Cohen, 1991). A recent large-scale study by Colombo, Shaddy, Richman, Mainkranz and Blaga (2004) further demonstrated this underlying relationship between performance on a habituation task and later cognitive and linguistic abilities. Two hundred and twenty-six infants from age 3 to 9 months were tested on habituation and novelty preference measures, measuring their memory for slides of children's faces. Their vocabulary was subsequently assessed at 12, 18, and 24 months with the MCDI. Their findings were in line with that of previous research indicating that measures of infant attention were moderately correlated with later measures of cognitive and verbal ability. Children's novelty preference score was positively correlated to MCDI production scores. This finding lends credence to the idea that processes involved during habituation and dishabituation are related to children's underlying linguistic abilities. However, the current research is based on a relationship between information processing and memory abilities measured by the habituation task, and later language abilities. There does not appear to be any research reporting a relationship between infants' performance in a lexical training task using a habituation paradigm and their later language abilities. Research examining the relationship between children's performance on tasks with similar content promises to provide valuable insight into word learning. Furthermore, this line of research would also illuminate any potential continuities in children's word learning.

Given the literature demonstrating a moderate relationship between performance on cognitive measures based on the habituation paradigm and later linguistic abilities, the current study sought to explore a potentially stronger relationship between children's performance on a habituation task that requires learning a word-event pairing, and later lexical development. Towards this purpose, a group of 18-month-old children was administered a word-event association task, using the infant-controlled habituation procedure. Parents were also asked to complete the MCDI (As reported in Katerelos, Poulin-Dubois, & Oshima-Takane, 2003). At 24 months, children returned for a second visit, when a fast-mapping task and the MCDI were administered.

The first goal of the current study was to examine children's performance on the two word learning tasks. If both tasks measure the same underlying word learning ability, one would expect a significant relationship between a child's performance on these two tasks, allowing for converging findings from two different methodologies, at different time points. A second goal of this study was to explore the relationship between children's performance on these tasks and their vocabulary size. Overall, this study sought to provide a unique contribution to this research area by examining the concurrent and longitudinal relationship between tasks tapping into similar content.

Experiment 1

Eighteen-month-old infants were presented with two animated events using the infant-controlled habituation paradigm (Katerelos et al., 2003). Each event consisted of a novel word paired with an unfamiliar object in motion. Infants' understanding of these event-word pairings was tested using a switch design (Casasola & Cohen, 2000; Werker et al., 1998; Younger & Cohen, 1986). Test trials consisted of a new event-label pairing, a new object-label pairing, and a new motion-label pairing. It was expected that infants would successfully form an association between the label and event, and would therefore detect a violation in the event switch test trials.

Method

Participants. Twenty-four children (17 boys and 7 girls), with a mean age of 18.33 months (17.67-18.93 months) participated in the experiment. Children were born at full-term (35-weeks), and did not suffer any health problems as reported by their parents. All children were recruited from birth lists provided by a government health office. Families were contacted through a letter detailing the nature and purpose of the study, that was followed-up by a telephone call in order to determine their interest in the study. The current sample was mainly middle class, as based on their education and occupation. A personalized certificate of merit was given to all children, in order to thank them for their participation. Children were primarily exposed to either an English- (n = 16) or French-speaking (n = 8) environment. Some children were also exposed to a second language at a maximum of 35% of the time (French or English n = 4, Spanish n = 1, Romanian n = 1, and Slovak n = 1). Eighteen children (9 boys and 9 girls) were excluded from the final sample due to experimenter error (n = 2), fussiness (n = 4), or because they did not meet the habituation (n = 2), or testing criteria (defined below; n = 10).

Vocabulary measure. The MacArthur-Bates Communicative Development Inventory (MCDI): Words and Sentences (Fenson et al., 1991), or the Canadian French adaptation (Frank, Poulin-Dubois, & Trudeau, 1997) was given to parents to complete, in order to an obtain estimate of vocabulary size. Vocabulary data was available for 20 children at 18 months. Their vocabulary ranged from 2 to 180 words ($M = 45.7$, $SD = 40.6$).

Stimuli and materials. Children were presented with 9 seconds long computer-animated events created in Macromedia Director 6.5 (1998). The events consisted of an animal-like figure and a vehicle-like figure engaging in two different motion paths. Characters appeared from the left of the screen, and they either jumped over, or bounced off a blue wall on the centre of the screen. These events were repeated a total of 3 times, within a single trial that lasted a maximum of 30 seconds. A green screen separated the repetitions of the events (Katerelos et al., 2003). Two phonetically distinct novel words, */nim/* and */lif/* (Werker et al., 1998), that follow the phonotactic and phonological rules of both French and English were paired with these events. The labels were uttered by a female voice using child-directed speech, recorded with Sound-Edit 16 version 2.07 software. The label was heard 2 seconds into the event before the jumping or bouncing action, and then again at 6 seconds, while the action was underway.

Apparatus. Children were seated 117 cm away from an Apple Multiple Scan 720 Display 16-inch (40.64 cm) monitor paired with Enjoy-Multimedia Speakers EP 691, which presented the events. A Sony EVO-120 video camera placed above the monitor provided the experimenter with a close-up image of the child's face, which was displayed on a Sony Trinitron (PVM 8020) colour video monitor. The experimenter recorded children's looking times to the events using the Habit© program (version 7.8; Leslie Cohen Infant Cognition laboratory, University of Texas at Austin), that controlled the presentation of the events, and calculated when children met the habituation criteria. The program was run on an OS 9.2-G3 computer. A black curtain hid the experimenter and experimental set-up from the child. (Katerelos et al., 2003)

Procedure and design. Children and their parents first arrived in a reception area, where the purpose of the experiment was explained. Children played with the experimenter during a brief "warm-up" period, in order to ensure that the child was feeling at ease. Parents' questions were fully answered, and they were asked to complete the consent form, demographic questionnaire and MCDI. The testing took place in a quiet and dimly lit room. Children were seated on a clip-on chair attached to a table, while their parents sat directly behind them. If children became fussy, they were seated on their parents' lap. All parents were instructed not to speak and interact with their child during the study.

Infants were tested using an infant-controlled habituation paradigm. They were presented with two different habituation events that consisted of a novel label paired with an object in motion. Habituation events were presented until the infant met the habituation criterion (when children's looking time at the last 4 trials was 50% less than their looking time at the first 4 trials), up to a maximum of 20 trials. When children looked away from the screen for longer than one second, the trial ended, and an attention getter helped redirect children's attention to the screen for presentation of the next trial. At the end of the habituation phase, the test phase was administered, in order to determine how infants construed these event-label pairings. The test trials consisted of four events based on a switch design. The baseline trial preserved the original event-label pairing, whereas the other three test trials consisted of presenting children with events where one of the elements was switched. The word-switch trial consisted of one of the original labels paired with a different event. The object-switch trial consisted of the original label paired with a different object undergoing the same motion, and the motion-switch event consisted of the original label presented with the same object undergoing a different motion. There were 8 possible presentation orders, where the event-label pairings, the presentation of the habituation and test-events were presented in a semi-random fashion.

It should be noted that children were excluded from the final sample if they did not meet a series of criteria. Children were excluded if they did not look at the word-switch trial for longer than 2.25 seconds, as it was impossible for them to differentiate between the habituation and the test trial before the label was uttered ($n = 8$). In addition, children who recovered interest to the baseline test event (looked for 66.6% or more of the total trial length) were also excluded as they were judged not to have fully processed the habituation events ($n = 2$).

Results

The analysis of interest examined how children had construed the event-label pairing. A 4 x 2 (Trial x Sex) analysis of variance was conducted, where trial was a repeated measures factor comparing children's looking time at the baseline, word-switch, object-switch, and motion-switch event. There was a significant main effect of trial $F(3, 66) = 6.63$, $p < .05$. Multiple t tests with Bonferroni correction revealed that children looked longer at the word-switch trial ($M = 13.54$ s, $SD = 9.92$), than at the baseline trial ($M = 5.14$ s, $SD = 4.54$), $t(23) = 3.61$, $p < .05$ (one-tailed). This finding indicates that children recognized the violation in the event-label pairing, suggesting that they successfully associated the label with the original event. Similarly, infants looked significantly longer at the object-switch trial ($M = 8.21$ s, $SD = 6.56$) compared to the baseline trial, $t(23) = 2.33$, $p < .05$ (one-tailed). In contrast, infants' looking time at the motion-switch trial ($M = 7.41$ s, $SD = 5.4$), did not differ from their looking time to the baseline trial, $t(23) = 1.53$, $p > .05$ (one-tailed). Together, these analyses indicate that infants preferentially associated the label to the object, as opposed to the action.

Discussion

The current findings replicate previous studies, demonstrating children's ability to acquire word-event associations using an infant-controlled habituation paradigm. Furthermore, these findings demonstrate that infants will preferentially map a novel label to a new object, rather than a new motion. These findings emphasize children's facility in acquiring labels for objects, over labels for actions (Gentner, 1982; Gentner & Boroditsky, 2001).

Experiment 2

The first study is consistent with the literature in demonstrating that when given the opportunity to form a word-event pairing, infants are able to acquire a novel label for a novel object. Nevertheless, the literature often regards such word learning as a simple association that the child has formed between a label and an object, even though others argue that this process is a precursor to later word learning (Woodward, 2004). The question of interest is whether the ability to form a word-object association is indicative of word learning, and therefore continuous with children's fast-mapping abilities, that is, their ability for non-ostensive word learning. This study therefore sought to explore a possible continuity in children's word learning skills across experimental procedures appropriate for testing children's language at their respective stages of development.

More specifically, this study examined whether children's performance on a habituation task is predictive of later vocabulary, as well as the ability to fast map. If children's word learning performance in a habituation task is indeed tapping into general word learning abilities, than one would expect it to be related to their future performance on a standard fast-mapping task. The study also examined whether children's vocabulary size at 18 months would be related to their performance on a fast mapping task at 24 months. In addition, the relationship between children's vocabulary at the two time-points was also examined, as was the concurrent relationship between each of the word learning tasks and children's vocabulary (examining both the relationship between performance on a habituation task and their vocabulary - as measured by the MCDI - at 18 months, and the relationship between fast-mapping and vocabulary at 24 months).

Method

Participants. Sixteen children (4 girls and 12 boys) with a mean age of 24.2 months (23.2 – 25.6 months) returned to participate in this study (Appendix H). Ten of those children were primarily Anglophone and six were primarily Francophone, and each was tested in his or her respective language. Another 3 children were tested, but excluded from the final sample because they had not successfully completed the habituation study at 18 months ($n = 2$), or refused to participate in the task ($n = 1$). The other 8 participants from the first experiment could not be contacted.

Stimuli and materials. Stimuli consisted of a variety of familiar and unfamiliar objects matched on size, colour, and salience. The items belonged to both animate and inanimate categories. Familiar items were selected based on words that appeared in children's early vocabulary (Dale & Fenson, 1996), and consisted of an elephant, a pig, a bear, a duck, an airplane, a cup, a couch, and a boat. The novel items consisted of a plastic cylindrical character with a face, a soft cone figure with a head, a large soft ball with a face, arms, and legs, and a plastic character with a face, spiky hair and big shoes, as well as a strainer, part of a butter spreader, a balloon pump, and a can opener (see Figure 3). There were two exemplars of each item that varied in size and/or colour. A red tray was used to present the stimuli and a puppet was used to engage children in the task.

The novel labels used in this study were *mido*, *gavi*, *arco*, *kipen* for the English-speaking children and *pibord*, *muron*, *bouzin*, *tivette* for the French-speaking children (Frank & Poulin-Dubois, 2005).

Vocabulary measure. The MacArthur-Bates Communicative Development Inventory (MCDI): Words and Sentences (Fenson et al., 1991) or the French-Canadian adaptation (Frank et al., 1997) was given to parents to assess children's productive vocabularies. A completed vocabulary inventory was available for all children.

Procedure and design. Families were first brought into a reception room, where the procedure was explained to the parents and the children were given the opportunity to warm-up to the experimenter and the testing environment. The testing session was conducted in an adjacent room, equipped with a video-camera that recorded the child's responses. The child was seated in a booster seat in front of a large rectangular table. The parent was seated directly behind the child, and the experimenter sat across the table from the child. The parents were instructed not to point, label, or touch the toys, and to refrain from speaking to their child during the administration of the task.

A standard fast-mapping task modelled after Frank and Poulin-Dubois (2005) was administered to the infants. The task consisted of 4 trials, each comprised of a different

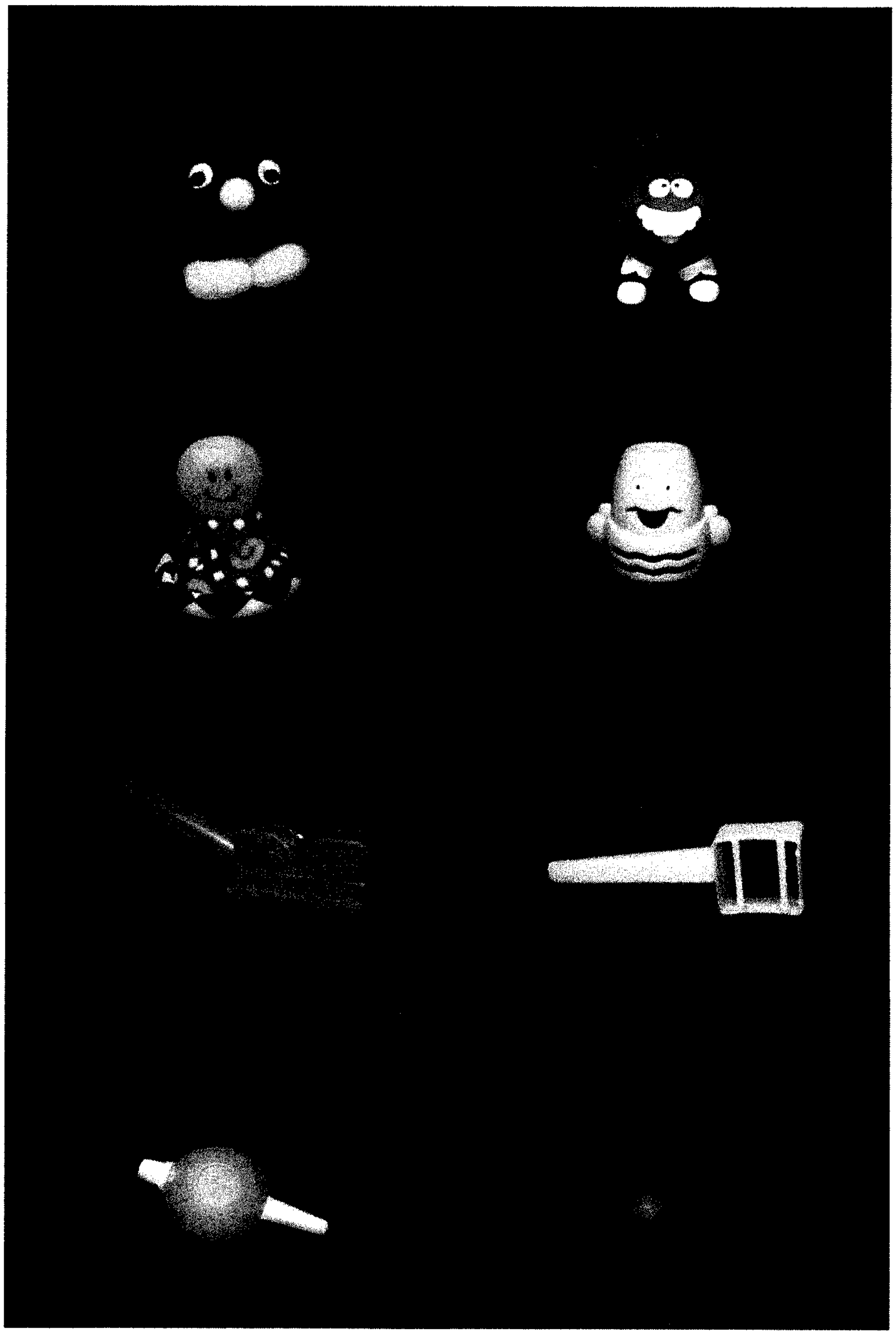

Figure 3. Unfamiliar stimuli used as target and distracter.

set of toys (see Table 3); for each set of items, a familiar, fast-mapping and generalization question was asked. At the beginning of the experimental session, the child was first introduced to a puppet named Thomas, and he or she was invited to play a game where they would "teach Thomas new things." During the familiarization period, all six toys of a particular set were placed on the tray and presented to the child. The familiarization period lasted 60 s, or until the child touched all of the items, after which the toys were taken away. The fast-mapping trial was then administered, starting with the presentation of three items on a tray: two familiar items and one novel. For the familiar word, infants were asked to show the puppet a familiar item, whereas for the fast-mapping question infants were prompted with a novel label. If the child did not respond, the question was repeated a maximum of three times. Once the child responded, the toys were removed and hidden from view. The toys were then repositioned on the tray, in order to ask the next question. After the child was prompted with a familiar and novel label, infants were presented with three new toys for the generalization trial. That set included a new exemplar of the familiar item that had not been labelled previously, a new exemplar of the novel item, and an unfamiliar distracter item. This procedure was repeated for the other 3 sets of toys (Appendix I). Across all trials the puppet was used to direct the child's attention to all three items by saying: "Look at these. Look at this and this and this." The puppet then prompted the child for an item, by asking: "Show me a [label]." The child was thanked for selecting a toy, and was praised for his participation after all toys were removed. If a child asked for the name of an unfamiliar object, the experimenter responded that she did not know what it was. Similarly, if a child

Table 3

Objects and Nonsense Labels Used in Each Phase of the Fast-Mapping Task (Sample Administration Order)

Phase	Familiar objects (unlabelled)	Familiar objects (labelled)	Unfamiliar objects	Distracter objects	Target word
Trial 1 Familiar and Fast-Mapping	elephant	pig	plastic cylindrical character with a face		mido/ pibord
Generalization	elephant		plastic cylindrical character with a face	a soft cone figure with a head	
Trial 2 Familiar and Fast-Mapping	airplane	cup	can opener		gavi/ muron
Generalization	airplane		can opener	part of a butter spreader	
Trial 3 Familiar and Fast-Mapping	bear	duck	a large soft ball with a face, arms and legs		arco/ bouzin
Generalization	bear		a large soft ball with a face, arms and legs	a plastic character with a face, spiky hair and big shoes	
Trial 4 Familiar and Fast-Mapping	boat	couch	strainer		kipen/ tivette
Generalization	bear		strainer	balloon pump	

interpreted the unfamiliar item as a known item, they were told that this was not the label for it.

Participants were randomly administered one of four different orders. Across the four orders, every label was paired with each set of objects. The order of presentation of familiar and fast-mapping trials was counterbalanced across participants, with the exception of the first trial, which was always a familiar trial. Across the familiar trials, half of the children were prompted for one of the familiar items, and the other half were prompted for the other item. In addition, the target referent for the familiar, fast-mapping and the generalization questions could not appear in the same position twice in a row. The position of the different exemplars on the tray was also counterbalanced across the familiar/fast-mapping and generalization trials. Similarly, the unfamiliar items presented during the fast-mapping and generalization trials were also counterbalanced across orders, such that the novel item presented to half of the children during the fast-mapping phase, became the distracter item in the generalization phase for the other half of the children.

Coding. The primary coder examined children's responses from the videotapes. The object first pointed or touched was generally considered the referent of the word. However, if a child touched the target toy and labelled it correctly, this was accepted as the child's response, regardless of the item that was first touched. When a child touched a toy before the question was asked, this data was excluded from the analysis. A second experimenter coded 25% of the sample, and reliability was calculated at 98% agreement between coders.

Results

Fast-mapping task. Children's performance on the fast-mapping task was examined by comparing the mean percentage of correct choices on each of the four trials to chance (33%). Children's performance was calculated based on a proportion of the total number of trials the child completed. For the familiar trial, this analysis indicated that children successfully identified the familiar item that was requested more often than expected by chance ($M = 66.15\%$, $SD = 29.42\%$, $t(15) = 4.51, p < .05$). Children's mean performance on the fast-mapping trial failed to approach significance ($M = 38.54\%$, $SD = 31.31\%$; $t\ (15) = 0.71, p = .49$; see Figure 4). When examining each fast-mapping trial separately, it becomes evident that children performed differently across trials: on the first trial 36% of the children selected the novel item as the target referent. On the second trial, 37% of the children made a correct selection, and on the third trial it was 31% of the children that made a correct selection. This is in contrast to the fourth trial, where 53% of children made the correct choice. It thus appears that children performed better on the last trial, suggesting a possible learning effect. Their performance on the generalization trials also failed to approach significance ($M = 46.35\%$, $SD = 30.30\%$, $t\ (15) = 1.77, p = .10$).

Vocabulary development. The children had a mean vocabulary of 39 words (n= 13; range = 2–96; SD = 29. 69) at 18 months and a mean vocabulary of 262 words (n= 16; range = 30-526; SD = 164.83) at 24 months. In order to examine the relationship between children's performance on language measures at 18 and 24 months, children's total vocabulary was examined based on the MCDI report ($n = 13$). As expected, infants' total vocabulary at 18 months was significantly correlated with their total vocabulary at 24 months, $r(11) = .59, p < .05$; one-tailed (see Table 4). It should be noted that all

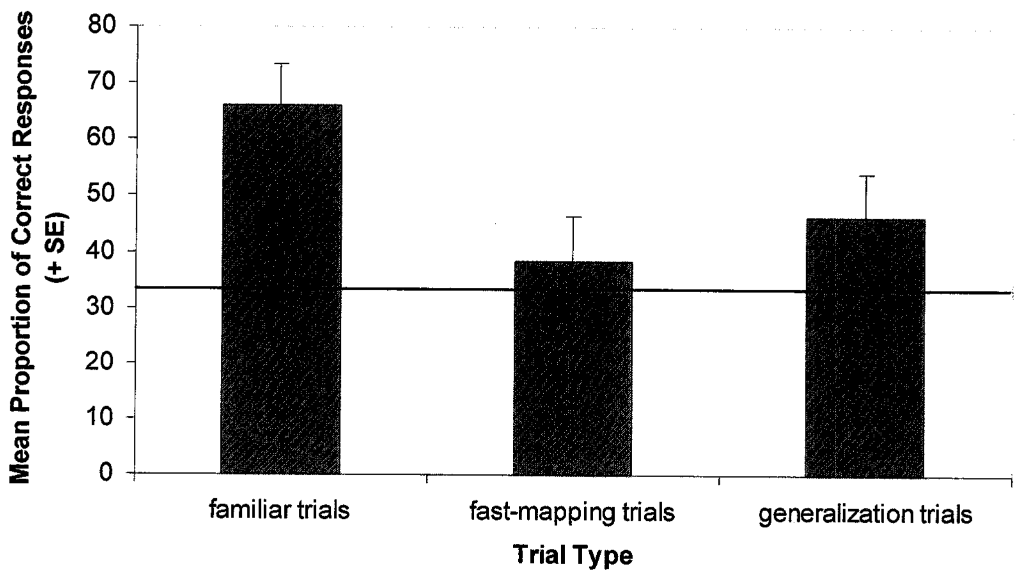

Figure 4. Means (+ *SE*) for proportion of trials for which children made a correct response (n = 16).

Table 4

Correlations Among Habituation Measures, Fast-mapping scores, and Vocabulary Size at 18 and 24 Months.

Variable	1	2	3	4	5	6
1. MCDI at 18 months						
2. MCDI at 24 months	.59 *					
3. Word preference score	.20	-.09				
4. Object preference score	.68 *	.35 †	___			
5. Total looking time during habituation	.25	.04	___	___		
6. Total number of habituation trials	.08	-.21	___	___	___	
7. Mean score on familiar trial	.38	.19	.41 †	.13	.14	.03
8. Mean score on fast-mapping trial	-.28	-.12	-.12	-.07	-.05	.12

Note: $n = 16$ (except for correlations with MCDI at 18 months, $n = 13$)

† $p \leq .10$ (one-tailed). * $p \leq .05$ (one-tailed).

correlations were conducted using a one-tailed test, because the relationship between the variables in question was hypothesized to be in a single direction.

Relationship between word-mapping in habituation and fast-mapping tasks. Children's performance on the word learning tasks at 18 months and 24 months was also explored (n = 16). Children's mean score on the fast-mapping task was an aggregate measure of children's overall performance on the four fast-mapping trials. Similarly, in order to look at children's word-learning abilities as measured by the habituation task, we examined the proportion of children's looking time to the word-switch trial relative to the baseline trial, (looking time on word-switch / [looking time on word-switch + looking time on baseline]). This measure takes into account the increase in looking time relative to the baseline trial, for each individual child, and will be referred to as the word preference score (Arterberry & Bornstein, 2002).

Overall, the results indicate that infants' mean performance on the fast-mapping trial and their performance on the habituation task, as measured by their word preference score did not correlate significantly ($r(14) = -.12$, $p = .32$). The relationship between children's fast-mapping performance and their reaction to the object switch trial ((looking time on object-switch / [looking time on object-switch + looking time on baseline]) referred to as the object preference score) in the habituation task was also examined, since both tasks involve mapping a label to an object. There was no relationship between infants' mean fast-mapping score, and their object preference score ($r(14) = -.07$, $p = .39$). However, there was a trend suggesting a significant correlation between children's mean performance on the familiar trials, and the word preference score ($r(14) = .41$, $p =$

.06). Finally, there was no relationship observed between infants' performance on the familiar trials and their object switch preference score ($r(14) = .13$, $p = .32$; see Table 4).

The relationship between infants' performance on the word-association task at 18 months and the fast-mapping task at 24 months was further explored by splitting infants into two groups by using the median word preference score of the group, and comparing the two groups on the fast mapping measures. Infants who scored above the median word preference score cutoff ($n = 10$) were more likely to correctly identify a familiar item, ($M = 80.00\%$, $SD = 22.97\%$), than infants below the word preference score median ($n = 6$, $M = 43.06\%$, $SD = 24.95\%$, $t(14) = -3.02$, $p < .05$). However, there was no difference between children above and below the word preference median on their fast-mapping trial performance ($t(14) = 0.30$, $p > .05$). When splitting the group on the object switch preference score median, there was no statistically significant difference between infants above and below the median on their familiar and fast-mapping trial performance.

In addition, the relationship between children's processing speed on the word-learning task at 18 months, and their subsequent performance on a fast-mapping task was explored. There was no relationship between children's performance on a fast-mapping trial and their total looking time during the habituation phase at 18 months ($r(14) = .05$, $p = .43$), as well as with the total number of trials completed during the habituation phase ($r(14) = .12$, $p = .34$). The lack of relationship between performance on the fast-mapping trials and habituation processing scores was echoed in the correlations between children's performance on the familiar trials and their total looking time during the habituation phase ($r(14) = .14$, $p = .31$), in addition to the correlation with the total number of trials presented ($r(14) = .03$, $p = .46$; see Table 4).

Relationship between performance on the fast-mapping task and vocabulary at 18 and 24 months. The relationship between infants' performance on the fast-mapping task, and their vocabulary at 18 months was also examined. The total sample was 13 children, from the children who participated in the habituation task and provided questionnaire data. The Pearson correlation between infants' performance on the familiar trials and their total vocabulary was $r(11) = .38, p = .10$. Children's performance on the fast-mapping trials and their total vocabulary at 18 months also revealed a non-significant relationship $r(11) = -.28, p = .18$ (see Table 4). This relationship was further examined by exploring the relationship between children's vocabulary size, and their performance on the last fast mapping trial. The vocabulary size of children who successfully completed the fast-mapping trial ($n = 8$; $M = 34.13$; $SD = 23.94$) and those who failed ($n = 6$; $M = 45.50$; $SD = 34.61$), did not differ significantly $t(12) = 0.73, p = .48$).

The relationship between infants' performance on the fast mapping task, and their concurrent vocabulary was examined. A Pearson correlation revealed a non-significant relationship between infant's performance on the familiar trials and their total vocabulary ($r(14) = .19, p = .25$). There was no significant relationship between children's performance on the fast-mapping trials and total vocabulary ($r(14) = -.12, p = .33$; see Table 4). In order to further pursue this question, children's performance on the last fast-mapping trial, where their performance was at its best was examined. A t test comparing the vocabulary of children who successfully performed on this last trial ($n = 8$, $M = 282.25$, $SD = 198.79$), and those who failed ($n = 7$; $M = 259.57$, $SD = 134.50$), did not indicate any significant difference in vocabulary size ($t(13) = 0.26, p = .80$).

SD = 167.4; *t*(14) = -1.51, *p* = .15), the difference at 18 months approached significance (*n* = 8; *M*= 26.9; *SD* = 23.3; *t*(11) = -2.02, *p* = .07).

Analyses were also conducted to examine the relationship between measures of children's processing speed during the habituation task at 18 months, and their vocabulary at 18 and 24 months. No significant relationship was found when correlating children's vocabulary at 18 months and their total looking time during the habituation phase (*r*(11) = .25, *p* = .21) or their total number of habituation trials (*r*(11) = .08, *p* = .39). A similar pattern was found when correlating the same measures with their vocabulary at 24 months (*r*(14) = .04, *p* = .45 and *r*(14) = .21, *p* = .22; total looking time during the habituation phase and total number of habituation trials respectively; see Table 4).

General Discussion

The aim of the present experiment was to explore the potential continuity in children's word learning abilities. This study examined the relationship between children's performance on a habituation task at 18 months requiring learning a word-event association with both concurrent and later vocabulary, as well as with children's performance on a fast-mapping task at 24 months.

Fast-Mapping Task

Firstly, it is important to compare children's performance on the current fast-mapping task with children's performance on other recent fast-mapping experiments. Children's performance on the familiarization trials (66%) indicates that they understood the task demands. Children's performance on the fast-mapping (39%) and generalization trials (46%) was comparable to what has been reported in studies using a similar fast-mapping task, so the small sample size may explain why their performance did not reach significance. More specifically, this becomes evident when comparing the current results to the task used by Frank and Poulin-Dubois (2005) on which the present study was modelled, that had a larger sample size. Twenty-seven-month-olds' performance on the fast-mapping trial was at 43%, as was their performance on the generalization trials (*n* =29). Furthermore, 35-month-olds' performance on the fast-mapping trial was at 56%, and 58% on the generalization trials (*n* =31). The results are also comparable to a study by Graham et al. (1998), where a sample of 30 20-month-old children showed a 51% success rate on the fast-mapping tasks.

Although the current findings fell just short of statistical significance, the variability in children's performance is in line with what has been reported in the literature (Golinkoff et al., 1992; Graham et al., 1998; Markman & Wachtel, 1988; Merriman & Bowman, 1989). For example, in the Frank and Poulin-Dubois study (2005), the standard deviations ranged from 34% to 42%. Evey and Merriman (1998) argued that this variability is due to the fact that young children (age 22 to 25 months) do not have a strong mapping preference, and are therefore inconsistent in selecting the unknown object when prompted with an unfamiliar label. In contrast, older toddlers are better at showing this type of mapping preference. Furthermore, significant individual variability is typical of children's language development (Fenson et al., 1994; 2000). The current task sought to explore this individual variability, in order to ensure that the pattern of results reported in the inter-task correlations is not due to a ceiling or floor effect on the fast-mapping task.

Fast-Mapping Task and Vocabulary

When exploring the relationship between performance on the fast-mapping trial and vocabulary, non-significant results were found both at 18 and 24 months. These findings appear to be surprising given that a relationship between fast-mapping and vocabulary, as measured by the MCDI, has been previously reported in the literature (Graham et al., 1998; Mervis & Bertrand, 1994, 1995). However, given that this relationship was observed in children around the vocabulary spurt phase of linguistic development, it is possible that these findings do not generalize to older children with a larger vocabulary size. Indeed, the children in the current study had a mean vocabulary of 262 words, which is well beyond the 50-word cutoff of the vocabulary spurt. Nonetheless, a relationship between 20-month-olds' fast-mapping ability and their vocabulary size was reported in the study by Graham et al. (1998), where children had a mean total vocabulary of 149 words. Moreover, studies with older children have reported significant correlations between children's fast-mapping abilities and their vocabulary development as measured by the Peabody Picture Vocabulary Test – Revised (Gray, 2004; Kay-Raining Bird, Chapman, & Schwartz, 2004), and therefore further research exploring the nature of this relationship is warranted. Alternatively, these non-significant findings may simply be attributed to the small sample size.

Habituation and Fast-Mapping Task

Analyses exploring the relationship between performance in the habituation and fast-mapping tasks indicated a relationship between children's performance on the familiar word test of the fast-mapping task and the word preference score of the habituation task. This suggests a relationship between children's ability to learn new words at 18 months, and their later ability to identify the referents of familiar words in an experimental context. These data seem to suggest that children's ability to form word-event associations is indicative of children's later word knowledge, perhaps suggesting that there may be an underlying process that helps develop children's lexicon. However, there were no significant findings indicating a relationship between children's performance on the habituation task, and their ability to fast-map. The lack of significant results given the previous literature demonstrating a relationship between early habituation measures and later linguistic abilities is somewhat surprising. However, the previous literature has been conducted with 3- to 12-month-old infants, demonstrating habituation and dishabituation to simple recognition or perceptual discrimination tasks, and later linguistic performance. This is the first study to explore the link between a habituation task measuring word-event pairings and later performance on a word-learning task. Nonetheless, a factor that may explain that lack of significant findings is that the sample that was followed-up at 24 months was a sub-sample of all of the children tested: only children who habituated in the study at 18 months were included. Children who were fussy, non-compliant or non-habituators were not followed-up, inadvertently truncating the population being studied, thereby reducing the potential variability in responses. High drop-out rates and participants that are excluded from the final sample is typical of research using a habituation paradigm, where they may at times exceed 50% of the total sample (Oates, 1998; Wachs & Smitherman, 1985). Although, it was logistically necessary to exclude these infants given that they did not yield any valid data, it nonetheless remains a problem that our variability was limited by their exclusion. In a study by Bell and Slater (2002), 4-month-old infants who were unable to complete a habituation task due to restlessness, fatigue or distress, continued to be non-completers when tested a week later. Furthermore, when tested at 13 months on a problem-solving task, non-completers were less likely to complete the task and also performed more poorly than infants who completed the task at 4-months. The authors therefore argue that an infant's inability to complete a task is influenced by non-random factors indicative of a child's inherent traits, that may influence their performance on such tasks (Bell & Slater, 2002). Future studies examining the potential continuities in children's word-learning abilities using a habituation task should include all infants tested in the longitudinal sample to ensure that the variability in children's performance is maximized.

Habituation and Vocabulary

Analyses were also conducted exploring infants' performance in the habituation task and their vocabulary measures at 18 and 24 months. A significant correlation indicated a relationship between infants' ability to attach a label to an object in a habituation task and their concurrent vocabulary. Furthermore, there was also a trend indicating that children's ability to attach a label to an object in a habituation task tends to be potentially related to their vocabulary at 24 months. This finding appears to provide evidence that children's tendency to map a label to an object may be predictive of vocabulary acquisition. The current experiment is the first to study the relationship between infants' word-learning in a habituation paradigm and concurrent vocabulary size. Previous studies that have attempted to explore the relationship between performance in a word-learning task and vocabulary have used the preferential-looking paradigm and have failed to find such a relationship (Hollich et al., 2000). The word-object mapping measure, which reflects the child's default assumption about a word referent, appears to provide an indication of the child's word-mapping skills, as evidenced by vocabulary size. The current data suggest that the ability to form an association between a label and an object is important in facilitating early lexical development. This seems to be particularly significant at 18-months, where infants' vocabulary is mostly comprised of nouns (Fenson et al., 1994).

Future Studies

The current study explored the issue of continuity in children's lexical development, and some interesting preliminary results were revealed. Children demonstrated a relationship between their ability to discern a word-event pairing, and their later ability to correctly select a referent of a familiar label. There is also evidence indicating that children's tendency to attach a label to an object in a habituation task is related to their vocabulary development. These findings may be providing potential insights into the lexical acquisition process, suggesting continuities between children's ability to attend to regularities in visually presented information, and their later word knowledge. Future studies would require that a larger longitudinal sample be tested to confirm these preliminary data, and further explore this potential relationship.

In order to better pursue continuities in the word-learning process, further longitudinal comparisons need to be made between tasks that tap into children's on-line processing. Ideally, designing a task that will be able to tap into children's emerging word-learning abilities at different ages would be best suited to explore this question. Nonetheless, exploring the continuities between the variety of tasks used in the literature to examine children's word-learning remains an important issue. A comparison between children's performance during a preferential-looking paradigm and their later fast-mapping ability may be an interesting avenue to pursue given the similarities between the two tasks, as children are required to attend to a target and inhibit a response to distracter items in both preferential-looking and fast-mapping tasks. Furthermore, a comparison between children's performance on a lexical training habituation task and later measures of cognitive development, including children's language comprehension and verbal intelligence, may also shed light into the continuities of children's linguistic development. Another potential avenue of research is to examine the relationship between children's performance in a habituation and/or fast-mapping task, and a concurrent speech sample of parent-child interactions. Such an approach may allow a more detailed exploration of the relationship between a lexical training task and naturalistic word learning, in addition to further comparisons with a child's end-state vocabulary. Overall, exploring the continuities in infant development remains an important research question, as findings in this area will enrich our understanding of the language acquisition process, as well as provide researchers with a greater appreciation of the processes tapped into by the methodologies currently in use.

Chapter 4. Conclusion

Summary of data

The current dissertation sought to gain a multi-faceted understanding of children's lexical development through the use of three different approaches: experimental laboratory-based tasks, a longitudinal design, and a cross-linguistic approach.

The first paper examined children's word mapping in a context stripped of morpho-syntactic and socio-pragmatic cues, in an effort to understand how cognitive processes guide children's default assumption about the referent of a novel word. English-, French-, and Japanese-speaking 18-month-old children were presented with a word for an object in action using an infant-controlled habituation task. Despite differences in the structural properties of the languages and the input provided to infants, all linguistic groups reacted to the paradigm in a similar fashion. When presented with a word for an object in motion, infants were guided by perceptual and cognitive cues in attaching the label to the object. This study offers an important contribution to the word mapping literature, as it provides evidence suggesting that cognitive and perceptual parameters appear to override properties of the linguistic input in the early stages of lexical development.

In the second paper, the continuity in children's word mapping processes was under study. More specifically, the nature of children's word mapping as assessed by the habituation task at 18 months of age was examined, by exploring its potential relationship with both concurrent and longitudinal measures of vocabulary size and fast-mapping abilities at 24 months of age. Preliminary results revealed a relationship between children's total vocabulary and their concurrent ability to demonstrate their lexical knowledge by providing the correct referent of a familiar label to an experimenter upon request at 24-months. Furthermore, longitudinal analyses indicated that children's ability to form a word-event pairing at 18-months, is related to their ability to correctly point out a familiar word referent at 24-months. In addition, children's ability to attach a word to an object during a habituation task appears to be related to their vocabulary size at 18- and 24-months. These preliminary data provide some evidence that children's word learning capacity is indeed being examined when measuring children's performance on a word-mapping task using the habituation paradigm. Furthermore, these data also offer some insight into the potential relationship between children's performance on word-learning tasks across a critical developmental period.

Contribution of thesis to literature

In the language acquisition literature, there has been a proliferation of research on early lexical development, based on naturalistic research and parental report of the child's vocabulary. The collection of children's spontaneous speech data has long been the standard method of studying children's language development (Hoff-Ginsberg, 2001). This type of research offers a rich database of information regarding a child's language skills, however, the type of words the child will produce is highly influenced by the context in which the speech sample is collected. Furthermore, naturalistic free-play data is limited by sampling constraints. For example, correct word use in a particular context does not necessarily reflect knowledge of the word (Imai, Haryu, & Okada, 2002).

Another invaluable tool used by researchers to assess children's vocabulary is the MacArthur-Bates Communicative Inventory (MCDI). The MCDI is a standardized inventory of words and word combinations typically produced by children, which is completed by the caregiver (Fenson et al., 1994). The MCDI has been demonstrated to be a useful measure of children's vocabulary, as there is strong correlation between children's vocabulary as measured by the MCDI and their vocabulary as captured in a spontaneous speech sample collected within the same time frame (Bates, Bretherton, & Snyder, 1988; Bornstein & Haynes, 1998; Dale, Bates, Reznick, & Morisset, 1989; Fenson et al., 1994; Reznick & Goldfield, 1994). Nonetheless, some studies have suggested that there may be a bias when examining data from parental report. In a study by Tardif, Gelman, and Xu (1999), the words children uttered during a recording session were compared to those reported by their mothers on a vocabulary checklist. They found that maternal report data and data collected from a play session were more similar for number of nouns than for the number of verbs. More specifically, it appeared that mothers were more likely to underreport the verbs their child produced (Tardif et al., 1999; see also Bloom, 1998; Pine, 1992; Pine, Lieven, & Rowland, 1996). This finding suggests that mothers may be more attentive to children's production of nouns, and thus provide inaccurate estimates of the verbs their children produce.

Overall it appears that although parental report and analyses of naturalistic speech samples provide invaluable information regarding a child's lexical abilities, these approaches have their limitations and offer an incomplete account of word learning. The current dissertation adopted an approach that departed from traditional research through the use of an experimental design, in order to collect a more direct measure of children's word learning processes, that was unaffected by methodological limitations such as a bias in parental report or the influence of context on infants' linguistic productions. The thesis speaks to the importance of experimental procedures in studying child language, as it offers unique insights into the underlying process of language acquisition.

The use of experimental procedures revolutionized the study of word learning, allowing researchers to gain access to children's underlying comprehension of a word (Carey & Bartlett, 1978; Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Schafer & Plunkett, 1998). Experimental studies allow researchers to explore children's word learning, beyond the data directly available from children's productive utterances and parental report of children's vocabularies, in order to gain an understanding of the way children acquire a novel label. More specifically, the use of the preferential-looking paradigm and the habituation paradigm provide insight into children's vocabulary comprehension, while minimizing task demands, therefore facilitating the study of word learning in young children (Golinkoff et al., 1987). Indeed, data obtained from experimental research may not always be in line with what would be expected from naturalistic studies. As mentioned previously, it has been argued that naturalistic approaches measure the end-state of word-learning, and do not provide information about the word-learning process itself (Hollich et al., 2000). A good illustration of the mismatch between a child's end-state vocabulary, and the process of word learning comes from the performance of the Japanese children in the first experiment. Indeed, given the preponderance of verbs over nouns in their linguistic input, in addition to the balance of nouns and verbs in their vocabulary as compared to their English-speaking peers (Oshima-Takane, in press), one would expect that perhaps these children would react differently within a habituation paradigm that required them to attach a label to an object or an action. By isolating and manipulating specific variables, experimental studies offer important insights regarding the unique role of these variables in facilitating children's word-learning. Experimental studies therefore provide an alternative perspective to the questions posed in the language acquisition literature, thereby offering a complementary set of data to the study of children's lexical development.

Another strength of the current research is that the present set of studies examined children at the beginning of the word learning process. This is in contrast to the majority of experimental studies in the word-learning literature where research has been conducted with older children, who are well on their way to becoming expert word learners (Berko-Gleason, 2005). The first paper examined 18- to 20-month-old children who were asked to interpret a novel word when presented with an event where they saw an object in motion. As discussed previously, the use of the infant-controlled habituation paradigm allowed for the examination of the lexical-acquisition process in the young infant, whereas otherwise task demands would have made it too difficult to explore the issue of early word learning. By examining younger infants we gain access to the process the child undergoes in order to attach the label to an appropriate referent, which may be in contrast to how an older child may react to such a paradigm. Studying young word-learners becomes particularly important when considering the emergent-coalition model of word learning, which predicts that the tools available to the novice word-learner trying to interpret a novel label would be quite different from those available to the expert word-learner (Hollich et al., 2000). Although the present thesis does not provide a direct test of the emergent-coalition model, it does offer some possible insight into underlying word-learning processes. In the current tasks, children were tested in contexts that were stripped of most of the cues that have been hypothesized to guide them in word mapping at that stage in lexical development. Nonetheless, the current data demonstrate that at 18-months, children are able to form word-event and word-object mappings. One possibility is that at 18-months, children are guided by the perceptual simplicity of objects, and fall back on associationist principles to form a word-object mapping, in the absence of socio-pragmatic and morpho-syntactic cues. These principles may form the building blocks of children's developing word learning strategies. Another possibility is that children make use of emerging lexical principles such as the "whole object assumption" and map the label onto the object in the absence of competing linguistic cues (Markman, 1989). Future research would need to tease apart these two possibilities, as well as observe the developmental time-course of these stages. In the fast mapping task administered at 24 months, children were provided with a task where neither associationist principles nor social-pragmatic cues were present to guide their word mapping. Children could only use lexical principles such as the "Novel name-Nameless Category principle" that postulates that children will map a novel word to an object for which they do not have a name (Mervis & Bertrand, 1994). Overall, this task appeared to be somewhat challenging for this age group, as few children where able to fast-map the novel label onto the novel object. However, the relative difficulty of the task, when compared to similar tasks in the field that provide children with socio-pragmatic cues and corrective feedback (Mervis & Bertrand ,1994), suggest that this principle is fragile at this age, and that children require additional information to successfully perform in a non-ostensive word-mapping task. It is possible that the use of socio-pragmatic cues may help children develop these lexical principles. Although the emergent-coalition model provides an account of word learning that integrates and synthesizes the major proposals of word learning, research is still necessary to shed light on the interrelationship between associationist principles, socio-pragmatic cues and lexical principles, as well as how children navigate through these word-learning "stages." Further research needs to explore children's ability to make use of a coalition of cues available to them in a specific word-learning situation, as well as the developmental course of these abilities, including whether these processes are driven by vocabulary or cognitive development. Continuing research with infants at the beginning of the language acquisition process, and refining the research tools available, becomes particularly crucial in order to gain further insights into language development.

Additionally, this dissertation used a longitudinal design to gain insight into the nature of the information gathered with an experimental word-mapping task at 18-months, by testing children's fast-mapping abilities at 24-months. Indeed, both tasks are designed to measure children's word-mapping abilities, and are used to study children's word learning, at their respective stages of development. By studying children's performance on these two word-mapping tasks, the study sought to gain a better understanding of the development of the word-mapping process. This study also aimed to gain a better appreciation of the processes measured during a habituation task, in an effort to develop a broader understanding of word learning. Furthermore, this dissertation explored the relationship between children's performance on two experimental tasks, relative to their concurrent and longitudinal vocabulary, in an effort to understand the relationship between word-mapping and vocabulary size. By using a longitudinal design to query the interrelationship among these tasks, researchers can obtain an enriched understanding of the task itself. Furthermore, a longitudinal design allows one to tap into the developmental aspects of word learning and move beyond the insights acquired during a specific developmental frame. The emergent-coalition model of word learning speaks to the importance of longitudinal research given that different processes take precedence in word learning at different points in the child's development. Longitudinal research therefore can offer insights into the influence of different factors across development, and helps theorists arrive at a more accurate account of word-learning.

The cross-linguistic approach of the current research project also offered unique insights into the universal aspects word learning. Researchers and theorists have emphasized the importance of cross-linguistic and cross-cultural research, in order to arrive at a universal account of word learning. Considering that all children acquire words, regardless of the language they are exposed to, a good theory of lexical development should be able to explain universal word learning that is not influenced by factors specific to a particular language (Hoff-Ginsberg, 2001). Given that research on early child language remains dominated by studies examining infants acquiring English, cross-linguistic research provides a broader perspective and therefore increases the generalizability of the conclusions. By studying the default word-learning assumptions of young infants' acquiring languages that place a differential emphasis on nouns and verbs, we can draw conclusions about the general aspects of word-learning that are not influenced by the specific factors of a particular language. Furthermore, the use of the same experimental paradigm to study word-learning in children acquiring different languages offers a unique perspective to word-learning, as it facilitates the study of word-learning while neutralizing possible cultural factors that can influence the findings. For example, cross-linguistic differences in what counts as a word, may influence comparisons of children's lexicons based on parental report (Yoshida & Smith, 2001). In addition, there might be cultural differences in parent-child interactions that may influence the types of words children produce in these contexts, thereby creating an additional confound (Choi & Gopnik, 1995). The use of the habituation paradigm to study word-mapping in English-, French-, and Japanese-speaking infants offered the possibility of accessing the word-learning abilities of children acquiring different languages, while minimizing the potential impact of cultural factors.

Future Directions

The study of word learning offers invaluable insights into the human mind, the nature of children's development and the interaction between cognition and culture. Nonetheless, there are important gaps in the literature, and theories abound in an effort to explain how the child develops from the level of acquiring single words, to syntactic and grammatical development, and the acquisition of a complex linguistic system. The emergent-coalition model of word learning offers a comprehensive account of language learning, however future research must be conducted to provide additional support for such a model. Furthermore, longitudinal research can help elaborate how children may come to place differential emphasis on cues across the lifespan. Research examining the process of word mapping in the same children over the course of time, could help provide this type of information. Although research isolating certain components of word learning is extremely useful in clarifying the relative influence of particular factors, research that begins to integrate different aspects of linguistic information will be an important direction for future research. Indeed, children do not learn language in a vacuum, and as such, research experiments need to determine the relative impact of multiple factors on word learning, in addition to any changes that may occur across development. Therefore research that isolates the various components that may help a child acquire a language provide us with invaluable information with regard to the potential building blocks of word learning, whereas research integrating a variety of word learning elements can also provide insight into the interrelationship of these factors. An important line of future research is to examine the impact of morphosyntactic cues on word-mapping for young infants, in addition to whether their impact may vary across development. For example, syntactic bootstrapping theories suggest that children's syntactic development serves to facilitate their lexical development (Naigles, 1996). Follow-up studies examining the relative influence of cognitive and morphological cues, across development, would help offer additional insights into this process. A current follow-up study, examining Japanese-infants' ability to acquire novel verbs presented within a syntactic frame, will help provide further information on the relative influence of syntactic cues on word learning (Oshima-Takane, Ariyama, Katerelos, & Poulin-Dubois, 2006).

Moreover, the impact of social cues also needs to be examined more closely, as research has emphasized the impact of social information on word learning. In a series of 12 studies, Hollich et al., (2000) demonstrated infants' developing ability to take advantage of referential cues for word learning. Infants were tested using the intermodal visual-preference paradigm, where they heard an experimenter say a novel word and provide them with referential cues directed towards one of two novel objects (e.g. eye gaze, pointing, handling). They found that both 19- and 24-month-olds were able to override an object's perceptual salience and attach a label to the item the experimenter was looking at. However, children's word learning strategies may be more fragile at 19 months, since infants' performance was negatively affected when the location of the target item was switched in the test phase. In contrast, although 12-month-old infants were sensitive to the experimenter's eye gaze, they were easily influenced by an item's perceptual salience. In order to acquire the novel label, 12-month-olds required an overlap of multiple cues, such as perceptual salience as well as referential cues from the experimenter directing their attention to the item (eye gaze, object handling and extensive training, such as 10 repetitions of the label, or 5 repetition in the space of 10 utterances). Woodward (2004) further demonstrated that thirteen-month-old infants were only able to learn a novel word when they saw a speaker look at the referent while labelling. Furthermore, additional research has emphasized children's sensitivity to the speaker's referential intent: Children aged 18- to 20-months-old are able to acquire a label for a novel object when the speaker attends to the object, whereas they fail to make such an association when the speaker is heard uttering a label, but is not attending to the target toy (Baldwin, Markman, Bill, Desjardins, & Irwin, 1996). Infants are therefore sensitive to a speaker's intention to label an item, which provides them with an important cue for word learning. Further research on the relative impact of social cues across development can also shed light into how children "crack the code" of word learning.

The current dissertation emphasized the importance of obtaining information through the use of multiple methodologies. Each approach provides unique information, and evidence obtained from a variety of methods will allow researchers to piece together a more comprehensive understanding of the phenomena. Further research should be conducted to help develop our understanding of the interrelationships among tasks and data. For example, by exploring the relationship between the word-mapping process in a habituation paradigm, a naturalistic speech sample, as well as parental report of the child's vocabulary, in addition to word-mapping using a fast-mapping task, researchers gain a broader understanding of the interrelationships involved. This provides researchers with the opportunity to understand the phenomena under study from a broader perspective. Furthermore, such research allows us to draw an understanding of developmental relationship among tasks, rather than during an isolated moment in time, in addition to understanding whether the tasks under study tap into the same processes. Moreover, cross-linguistic research is of crucial importance when examining the impact of different cues on word mapping, as this would shed light onto the universal aspects of word learning, and differentiate from cultural factors that may also promote word-mapping, but may not be a requirement.

Finally, an important area of future research is the study of individual differences. The current data indicated that there was variability in children's responses to both the habituation and the fast-mapping task. Further research should gain a better understanding of these individual differences and their meaning. The use of larger sample sizes will allow one to gain a better understanding of the meaning of individual variability in these tasks. By studying the variability in children's performance on these measures, one can gain a better grasp of its predictive power for later abilities of that nature. In particular, the possibility of developing diagnostic tasks would be an invaluable tool for parents and health professionals. The current tasks therefore offer the possibility of gaining an understanding the word-mapping phenomena, and developing prevention strategies that can be applied to children presenting atypical linguistic or cognitive development. Exploring the possible predictive value of the tasks, in addition to subsequent implications would be a helpful way to expand knowledge of early word learning, and help infants at a young age.

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Appendix A

Sample Recruitment Letter, Parent Consent Form,

Participant Information Form, and

Results Letter Sent to Participants' Families

in English (Experiment 1, Chapter 2)

August 2001

Dear Parents,

We would like to thank you for your recent participation in our study on infants' early understanding of animate beings and inanimate objects. These studies are still in progress and a letter describing the results will be sent to you as soon as they are available. At the present time, we would like to invite you to take part in research we are currently conducting on the development of language. 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 February 2000, which indicates that you have a child of an age appropriate for our study.

The present study is looking at how infants learn new words and whether they associate the new word with an object or an action. Your child will be presented with a variety of computer animated events (e.g., an object jumping across the screen) on a computer screen, while hearing a nonsense label. Your child will then be asked to find the labeled item. During the entire study, your child will be sitting in a child seat and you will be seated directly behind. You will also be asked to complete a word checklist in order to assess the size of your child's vocabulary. We will videotape your child's responses and all tapes will be treated in the strictest of confidentiality.

Participation involves one visit of approximately 30 minutes to our research centre on the Loyola Campus of Concordia University, located at 7141 Sherbrooke Street West. Appointments can be scheduled at a time convenient to you, including weekends. Free parking is available on the campus for our participants, and we will gladly reimburse any transportation expenses at the time of your appointment. For the purpose of the this study, we are looking for infants whose parents speak French or English at home, and who have no visual or auditory difficulties. If you are interested in having your child participate in this study, or would like further information, please contact Marina Katerelos at 848-2279 or Dr. Diane Poulin-Dubois at 848-2219. We will try to contact you by telephone after receipt of this letter.

Thank you for your collaboration,

Diane Poulin-Dubois, Ph.D.

Professor of Psychology

Marina Katerelos, M.A.

Ph.D. Candidate

(français au verso)

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 a computer screen. Your child will be hearing various labels during the presentation of these events. These films will be shown repeatedly until your child begins to lose interest in them. Afterwards, several different films will be shown. 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.

____
Diane Poulin-Dubois, Ph.D.
Professor

____
Marina Katerelos, M.A.
Ph.D. 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

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: ____________

November 2001

Dear Parents,

We would like to thank you for your recent participation in our study on infant word-learning. It is with pleasure that we are able to share the results with you at this time.

The experiment in which your child was a participant was designed to examine infants' strategy when hearing a word for the first time. Specifically, we were examining whether 18-month-old infants pay more attention to the object or the motion when presented with a novel label for a moving object.

As you may recall, your child was taught a nonsense label that was paired with an event in which an animal-like character bounced off a wall or with an event in which a vehicle-like object jumped over a wall. We were interested in determining whether infants could learn the word that was presented with a particular event. Furthermore, we examined what precisely they thought the label was referring to: the object or the motion. When infants' attention to these events had sufficiently decreased, they were then shown new films where either the label, the object or the action was now different. We measured how long infants looked at each new film, in order to determine their understanding of the label.

The results of our study suggest that 18-month-old children are able to learn a new label corresponding to an object performing an action. Furthermore, infants' pattern of looks at the particular events suggests that they attach the label to the object and not to the motion. This indicates that despite the saliency of the motion, infants will assume that a new label is referring to an object. This study therefore gives us a better understanding of the processes involved in children's rapid and effortless linguistic development.

We are currently interested in examining whether children's performance in the word learning study predicts their future vocabulary. We therefore wish to invite you to participate in a follow-up study looking at your child's linguistic development at the age of 24 months. You will be receiving a letter providing you with the details of this study in the upcoming months.

Thank you again for your interest in our study. Research on children's early cognitive development is only possible thanks to the contribution of time and effort by families like yours. If you would like any further information about the results of this study, or have any questions about issues concerning cognitive development, please do not hesitate to contact Marina Katerelos or Dr. Diane Poulin-Dubois.

Sincerely Yours,

Diane Poulin-Dubois, Ph.D.
Professor of Psyhology
telephone: 848-2219
email: dpoulin@vax2.concordia.ca

Marina Katerelos, M.A.
Ph.D. Candidate
telephone: 848-2279
email: mkater@vax2.concordia.ca

Appendix B

Sample Questionnaire on Language Exposure in English

QUESTIONNAIRE ON LANGUAGE EXPOSURE

This questionnaire will help us determine the amount of exposure your child receives to the languages he/she understands or speaks.

	How many hours does your child spend with *this person* during a typical week?	What language(s) does *this person* speak to your child?	If *this person* speaks to your child in more than one language, please indicate the percentage of time they use each of these languages. e.g. English (40%), French (60%)
Mother			
Father			
Babysitter			
Daycare worker			
Grandmother			
Grandfather			
Siblings			
other			

At what age did your child start hearing English? ______________________

At what age did your child start hearing ________________? ___________
Please fill in other language

At what age did your child start hearing ________________? ___________
Please fill in other language

At what time does your child wake up? ______________________________

At what time does your child go to bed? _____________________________

How much time does your child nap during a day? ______________________

Appendix C

Sample Instructions for Parents in English

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 screen 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 D

Analysis of Variance for Trial

(Baseline, Word Switch, Object Switch, Action Switch)

by Language Group (Experiment 1, Chapter 2)

Analysis of Variance for Trial (Baseline, Word Switch, Object Switch, Action Switch) by Language Group in Experiment 1 (Chapter 2)

Source	*df*	*F*
	Between subjects	
Language	1	0.79
S within-group error	22	(63.64)
	Within subjects	
Trial	3	6.84*
Trial x Language	3	0.58
Trial x *S* within-group error	66	(43.50)

Note. Values enclosed in parentheses represent mean square errors. *S* = subjects

* $p < .05$.

Appendix E

Analysis of Variance for Trial

(Baseline, Word Switch, Object Switch, Action Switch)

by Sex (Experiment 1, Chapter 2)

Analysis of Variance for Trial (Baseline, Word Switch, Object Switch, Action Switch) by Sex in Experiment 1 (Chapter 2)

Source	*df*	*F*
	Between subjects	
Sex	1	0.19
S within-group error	22	(65.36)
	Within subjects	
Trial	3	6.63*
Trial x Sex	3	1.23
Trial x *S* within-group error	66	(42.28)

Note. Values enclosed in parentheses represent mean square errors. *S* = subjects

* $p < .05$.

Appendix F

Parental Consent form in Japanese,

English Translation of Parental Consent Form,

Participant Information Form in Japanese. and

English Translation of Participant Information Form

(Experiment 2, Chapter 2)

研究協力のお願い

東京福祉大学では、お子さんの健やかなことばの発達支援を目的として、幼児のことばについての日本とカナダの国際比較調査を行っています。この調査にご協力いただける現在１歳半のお子さんとお母さんを探しています。ぜひ皆様のご協力をお願いいたします。

場所：　東京福祉大学
時間：　平日 午前か午後の１時間
協力いただく内容：

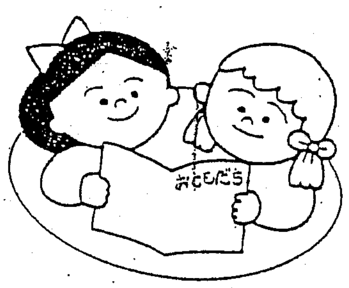
- お子さんが理解していることば、使っていることばを単語調査票でチェックしていただきます。（１０分程度）
- パソコン画面に映し出された動画をお子さんに見ていただきます。（５分程度）
- 大学の玩具を使って、親子で自由に遊んでいただきます。（３０分程度）

ご協力いただいた方には、お礼としてお子さんの自由遊び場面のビデオテープを差し上げます。

ご質問等は以下にご連絡ください。

東京福祉大学
「ことばの発達調査」プロジェクト
代表者：教授　大嶋百合子
分担者：講師　伊藤恵子

住所：伊勢崎市山王町 2020-1
電話：0270-20-3672(内線 3940、3934)
FAX：0270-20-3678



同意書

私、______________________ は、__________ とともに「ことばの発達」調査に協力することを同意します。

この調査については、以下のことが説明されました。

1）わたくしが問診表とことばのチェック・リストに記入する。

2）子どもがアニメ・ゲームとおもちゃゲームをする。ゲーム中のこどもの行動をビデオで録画する。

3）プレイルームで30分ほど親子の自由遊びをする。自由遊びをビデオにとり、研究協力のお礼としてそのビデオコピーがあとで送られる。

研究協力者は、研究中いつでも研究への協力をとりやめることができること、ビデオは完全に匿名で、研究の目的以外に使用されないという説明を受けました。また、私や子どものエピソードが研究報告に含められる場合は匿名し、協力者個人が特定されないという説明もうけました。

協力者氏名 ______________________________ ____年_____月_____日

署名 ______________________________ ____年_____月_____日

調査結果に関心のある方は、簡単な報告書をお送りいたします。

（　　）希望する　　（　　）希望しない

プロジェクトの研究者

氏名：　大嶋百合子　　署名__________________ ____年_____月_____日

氏名：　伊藤恵子　　署名__________________ ____年_____月_____日

氏名：　Marina Katerelos　　署名__________________　Date: __________________
Signature

Parental consent form (Japanese)

My child ____________ and myself____________agree to be involved in the research of "infants' word leaning." The following statements have been explained and I have agreed that:

1) I will complete the information sheet and the word check list.

2) My child will play the "Animation game" and "Toy game." The activity of my child during these games will be videotaped.

3) In the playroom, my child and myself will play freely for approximately 30 minutes, and our activities will also be videotaped. A copy of the video will be sent to each participants as a token of appreciation.

* I understand that we are free to discontinue our participation at anytime during the research.

* The contents of video will be kept anonymous and will not be used for any other purpose than the research.

* If a episode of my child and myself is being recorded on the research report our name will remain anonymous.

Name of participants: ________________________ ________ year_____ month _____ date

Signature: ________________________________ ________ year_____ month ____ date

If participants are interested in the research results, a copy of the brief research report can be sent to them. (Yes, I am / No, I am not)

Researcher:

Name: Yuriko Oshima Signature ____________________ year ____ month ____ date

Name: Keiko Ito Signature ____________________ year ____ month ____ date

Name: Marina Katerelos Signature ____________________ year _____ month ____ date

２００　年　月　日記入

氏　名：　　　　　　　　　　（　女　・　男　）

保護者氏名：

住　所：〒　　　　　　　　　　℡

連絡先：

出生日：　　　年　月　日　　　　（予定日：　　年　月　日）

在胎週数：　　週　　日

出生時体重：　　　g

家族構成：父　歳（　年　月　日生）　母　歳（　年　月　日生）

きょうだい（兄　歳・姉　歳・弟　歳・妹　歳）　（第　子）

その他家族（　　　　　　　　　　）

最終学歴：父（　　　）家で話す言語：日本語・その他（　　　）

母（　　　）家で話す言語：日本語・その他（　　　）

職業：父（　　　）パートの場合は（　日／週）

母（　　　）パートの場合は（　日／週）

日中の主な養育者：（　　　　）

妊娠中の状態：異常なし・異常あり（　　　　　　）

分娩の状態：　異常なし・異常あり(　　　　　　)

首のすわり：　生後　か月

歩き始め：　生後　か月

既往歴：

聴力：異常なし・異常あり（　　　　　　）

視力：異常なし・異常あり（　　　　　　）

心配なこと：

東京福祉大学　ことばの発達調査

この調査へご協力いただける方は、氏名と連絡先などを記入の上、係りの者にお渡しください。

該当するところに０をつけてください。

(　　) 調査に協力します。
(　　) 調査についてもっと詳しい説明をしてください。
(　　) 調査協力について数日後に回答します。

都合の悪い曜日に×をつけてください。

(　　) 月 , (　　) 火 , (　　) 水 , (　　) 木 , (　　) 金

保護者の方について

氏名：
住所：　　　　　　　　　　　　電話：

お子さんについて

氏名：　　　　　　　　　　性別：　　女・男
生年月日：

何かご質問等がおありでしたら以下にご記入ください。

_____ year____ month ___ date

Name of child:________________________________ Gender of child: (female / male)

Name of parents: ______________________________

Address: ______________________________ Telephone : __________________

Phone number where I can be reached during the day: ____________________

Birth date of child:______________________________ Term: _________________
year/month /date year/month/date

Birth weight: _________ g

Duration of pregnancy:_______ weeks ___ days

Family members : Father ____________ yrs. old Birth date: ____________________
year/month /date

Mother ____________ yrs. old Birth date: ____________________
year/month /date

Siblings: Older brother _____ yrs. old Older sister _____ yrs. old
Younger sister _____ yrs. old Younger brother _____ yrs. old

Other family members living at home: ______________________________

Education:
Highest level of education attained: father ______________________________
Highest level of education attained: mother ______________________________

Language:
language spoken at home by mother: Japanese / other language________________
language spoken at home by father: Japanese / other language________________

Occupation:
Mother: ____________ / part-time job _____days/wk
Father : ____________ / part-time job _____days/wk

Name of the main caregiver during day: ______________________________

Health:
Complication during pregnancy (normal / abnormal)

Any complication during delivery (normal / abnormal)

When was your child being able to hold head up? ______________________
year/month/date

When was your child begin able to walk ? ______________________
year/month/date

Child's medical history: ____

Child's hearing: (normal / abnormal)

child's vision: (normal / abnormal)

Any other concern with your child: ______________________________________

Appendix G

Analysis of Variance for Trial

(Baseline, Word Switch, Object Switch, Action Switch)

by Sex (Experiment 2; Chapter 2)

Analysis of Variance for Trial (Baseline, Word Switch, Object Switch, Action Switch) by Sex in Experiment 2 (Chapter 2)

Source	*df*	*F*
	Between subjects	
Sex	1	2.48
S within-group error	23	(78.19)
	Within subjects	
Trial	3	3.03
Trial x Sex	3	0.86
Trial x *S* within-group error	69	(34.61)

Note. Values enclosed in parentheses represent mean square errors. *S* = subjects

* $p < .05$.

Appendix H

Sample Recruitment Letter, Parent Consent Form,

And Results Letter Sent to Participants'

Families in English (Experiment 2, Chapter 3)

December 2001

Dear Parents,

We would like to take this opportunity to thank you for your recent participation in a study at Concordia University's Child Development Laboratory, which is funded by the Natural Sciences and Engineering Research Council of Canada. We are truly appreciative of your enthusiasm and commitment to research. As you may recall, the experiment in which you participated with your child at 18-months was examining how children learn new words. We discovered that 18-month-old infants are indeed able to learn a label for an animated event. This study offered important insights in understanding the processes involved in children's rapid linguistic development. This study also raised many new questions regarding the implications of these findings. Do children's word learning abilities predict their later language development? Does the child's pattern of word learning predict their vocabulary size at 25 months? These are questions that have never been examined previously, yet answering these questions will help illuminate the puzzle of children's effortless ability to acquire new words.

At the present time, we would like to invite you and your child to participate in this follow-up study that we are currently conducting. You and your child are ideal candidates to examine the continuity of children's linguistic development as you have already participated in the study on 18-month olds' word learning.

To examine your child's linguistic development, we have devised an interactive game. Your child will
be presented with a variety of familiar and unfamiliar objects. The experimenter will ask your child for a particular object. We are interested in knowing what object children will choose when being prompted with an unfamiliar word. We will also ask you to complete a checklist of your child's vocabulary. These tasks will allow us to compare children's vocabulary and word learning patterns to their behavior at 18 months.

Participation involves a 60-minute visit 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. In order to better accommodate you, free parking is available on campus. Your child will also receive a Certificate of Merit for Contribution to Science, to thank you for your participation. You will be with your child at all times during your visit. 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.

Again we would like to thank you for your long-standing interest in our work. It is with the help of families like yours that we can gain a better understanding of children's linguistic development. If you are interested in having your child participate in this study, please contact 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.

Diane Poulin-Dubois, Ph.D.	Marina Katerelos, M.A.
Professor of Psychology	Ph.D. Candidate

Parental Consent Form

In this study, we are examining infants' cognitive and language development. In the first task, we are interested in discovering infants' strategies for learning new words. To test this, your child will be presented with a variety of familiar and unfamiliar objects. The experimenter will ask your child for a particular object. We are interested in knowing what object your child will choose when prompted with an unfamiliar word

In the second task, we are examining infants' ability to categorise objects in the world around them, and the strategies they are most likely to use. To do this, we will model an action with a small toy, and then give your child the opportunity to repeat this action with two new toys.

You will be with your child at all times, however it is important that you remain silent and neutral during the session. The videotapes, and data obtained from the tapes, will be kept strictly confidential.

____
Diane Poulin-Dubois, Ph.D.
Professor

____
Marina Katerelos, M.A.
Ph.D. 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

February 2003

Dear Parents,

We would like to thank you for your participation in our study on infant cognitive development. We have recently completed the data analyses from this study and it is with pleasure that we are able to share the results with you at this time.

As you may recall, the experiment in which you participated when your child was 24-months-old was examining how children learn new words. Your child was presented with a variety of familiar and unfamiliar objects and asked to give one of the objects to a puppet. We were interested in determining what object children would choose when the experimenter made specific requests. In particular we examined what your child offered the experimenter when prompted with a nonsense label.

During this interactive game we found that 24-month-old children were able to give the correct object to the experimenter when asked for a familiar label. In addition, when children were prompted with a nonsense label, children correctly gave the experimenter the unfamiliar object. For example, if the experimenter asked the child: "Give me the *toma*," while presenting the child with a pig, an elephant, and a novel creature, 24-month-old children systematically selected the novel creature. Children therefore map the nonsense label onto the novel item. Unfortunately, they were not able to do this when novel exemplars of these toys were presented. It appears that children at this age have difficulty generalizing labels to different exemplars of the object. Nevertheless, this study demonstrates the ease and facility with which young children can acquire new words.

The second study in which you and your child participated was designed to determine whether infants have a concept of categories such as, for example, animals or vehicles. To test whether they have this ability, we modeled motions for them which were either animal-like (such as jumping over a block) or vehicle-like (such as going over a "daredevil"-type ramp). We modeled the animal-like motions with a typical animal (dog) and the vehicle-like motions with a typical vehicle (green sedan). After the modeling, we gave each infant the opportunity to imitate these motions with a choice of two new toys: a new animal and a new vehicle. If infants understand that the ability to carry out these motions can be generalized from one category member to another (even if they have not seen the new toy perform the motion), then they should be more likely to imitate the motion with the new toy that belongs to the same category as the modeling toy. On the other hand, if they have no such knowledge, infants would choose either toy, regardless of the appropriateness of their choice.

The results indicated that 24-month-old children used the appropriate toy statistically more often than the inappropriate toy to imitate the actions. This suggests an early understanding of categories such as animals and vehicles.

We would like to thank you again for your interest in our study. Research on children's early cognitive development is only possible thanks to the contribution of time and effort by families like yours. If you would like any further information about the results of this study, or have any questions about issues concerning cognitive development, please do not hesitate to contact Marina Katerelos or Dr. Diane Poulin-Dubois.

Sincerely Yours,

Diane Poulin-Dubois, Ph.D.
Professor of Psychology
telephone: 848-2219
email: dpoulin@vax2.concordia.ca

Marina Katerelos, M.A.
Ph.D. Candidate
telephone: 848-2279
email: mkater@vax2.concordia.ca

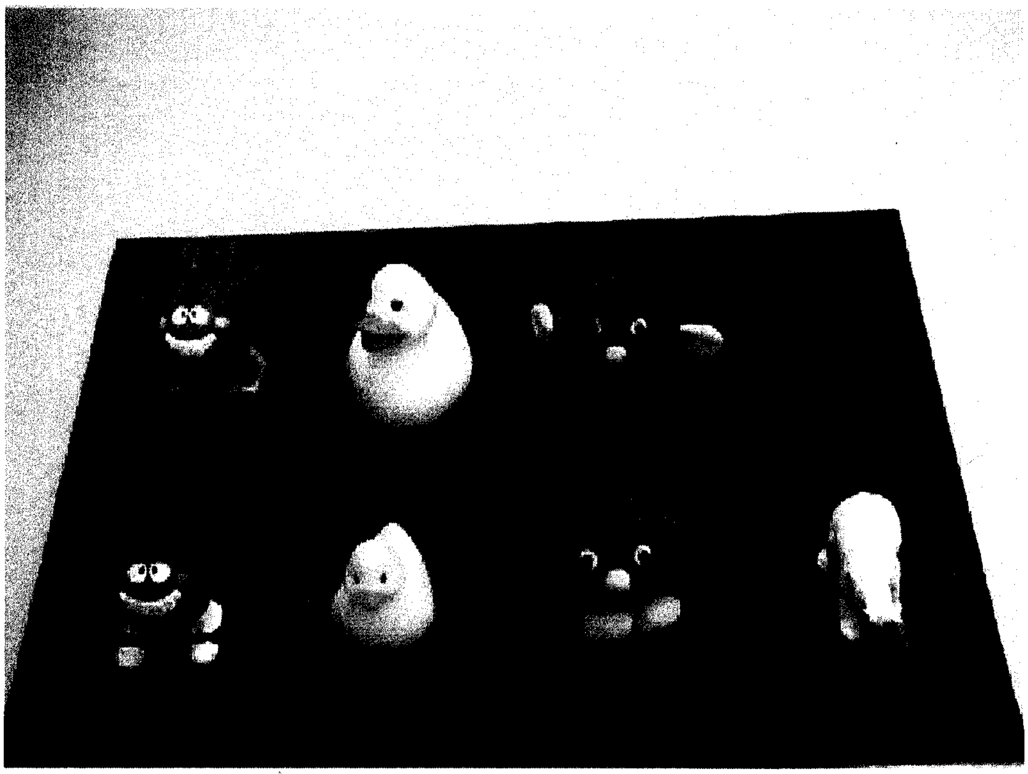
Appendix I

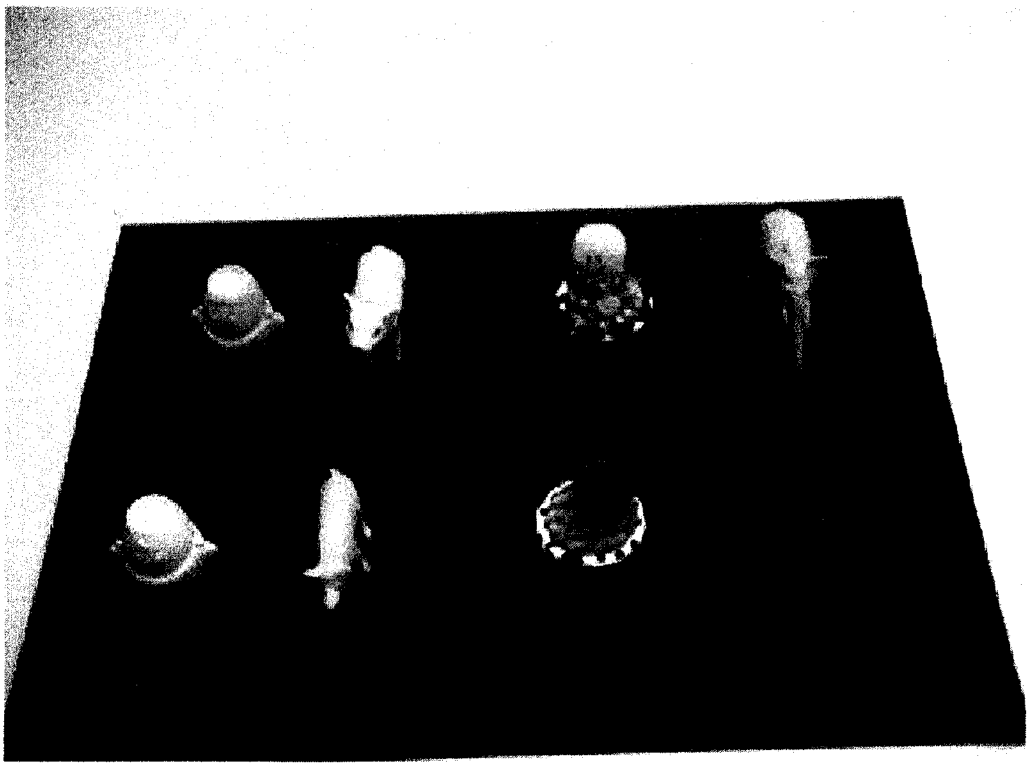
Stimuli Set Per Trial,

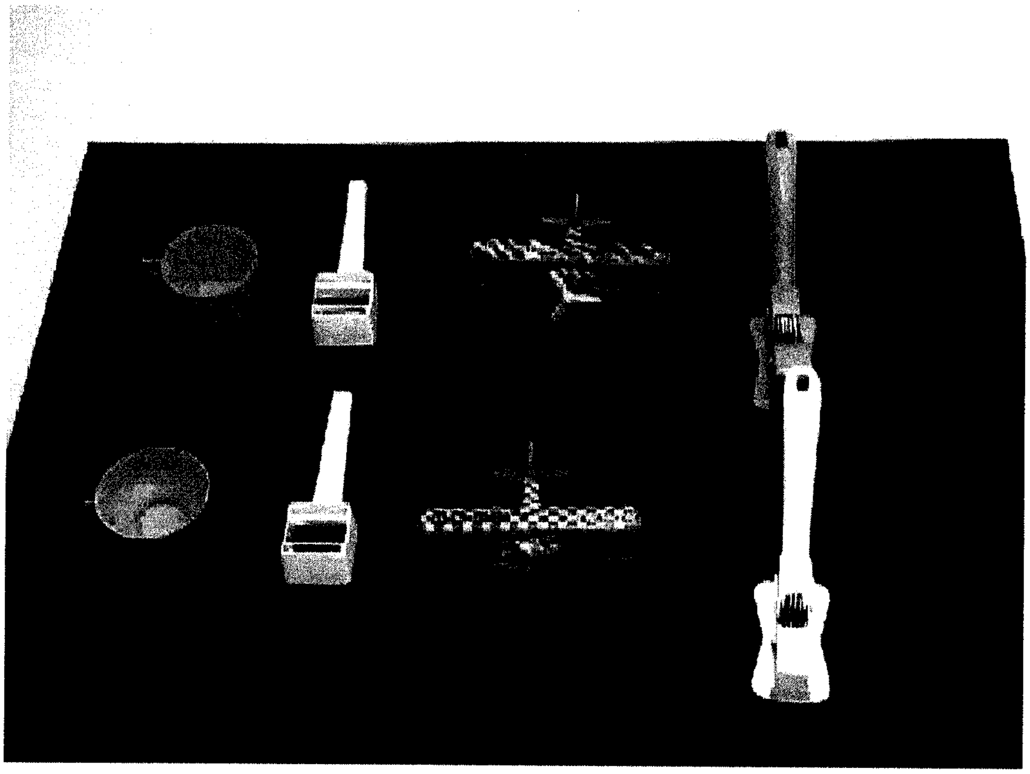
Example of Familiarization,

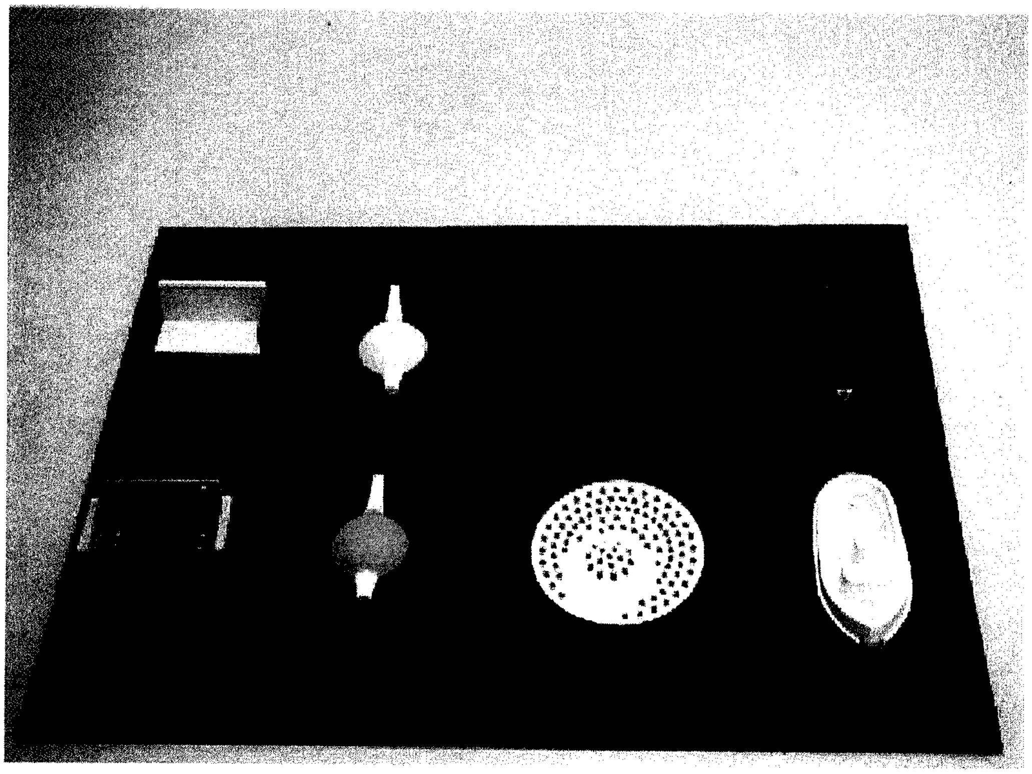
Familiar/Fast-Mapping and Generalization Phase for Each Trial

(Experiment 2, Chapter 3)

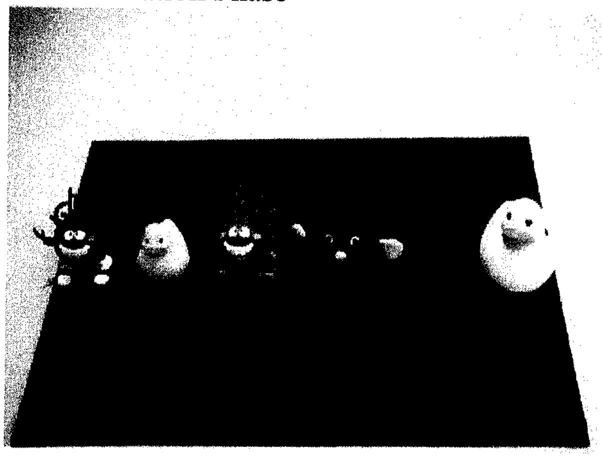




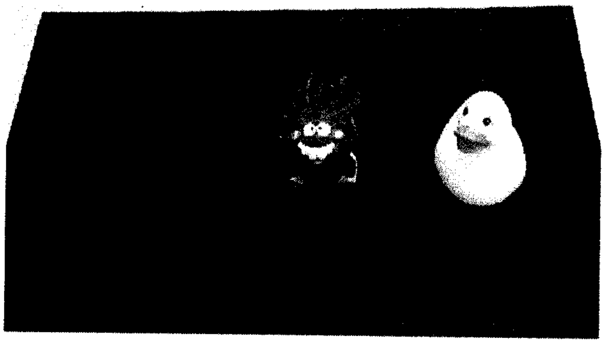




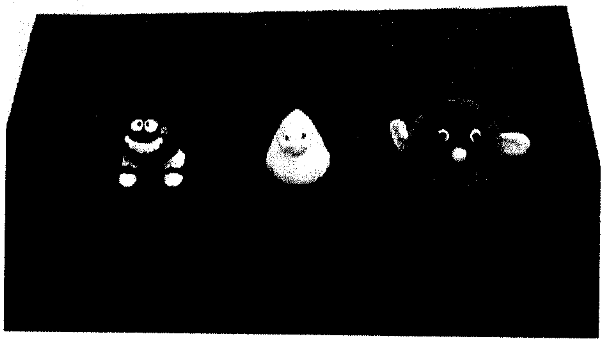
Familiarization Phase



Familiar/ Fast-Mapping Phase



Generalization Phase



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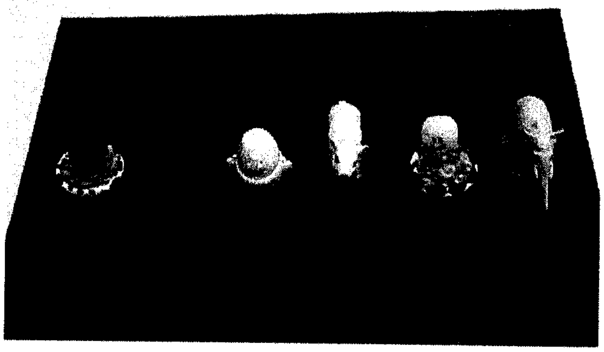
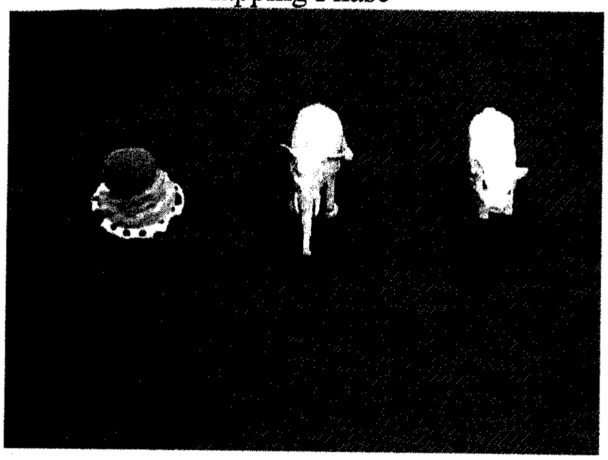


Familiar/Fast-Mapping Phase



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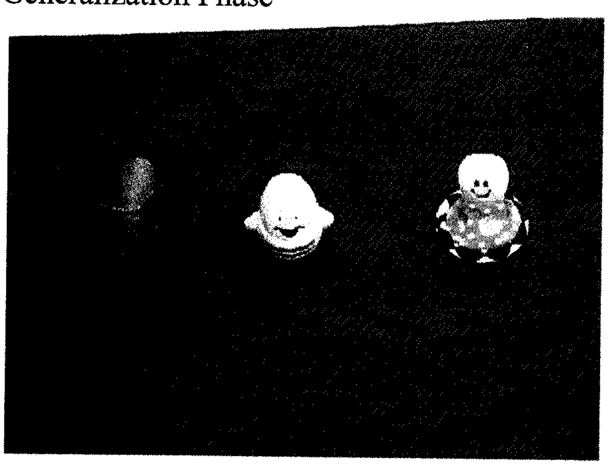

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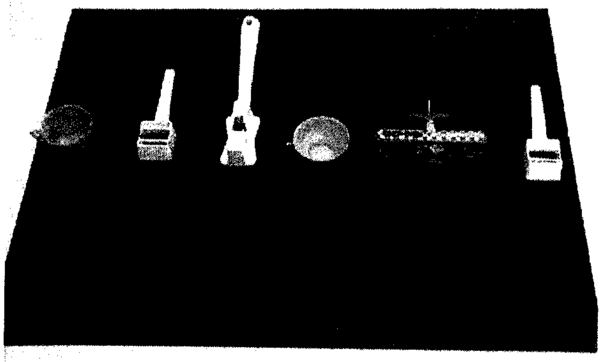
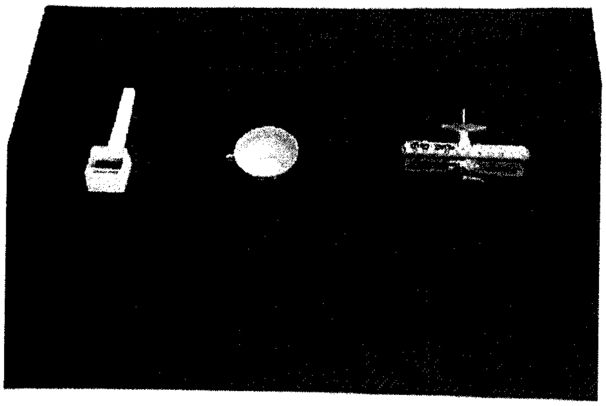


Familiar/Fast-Mapping Phase



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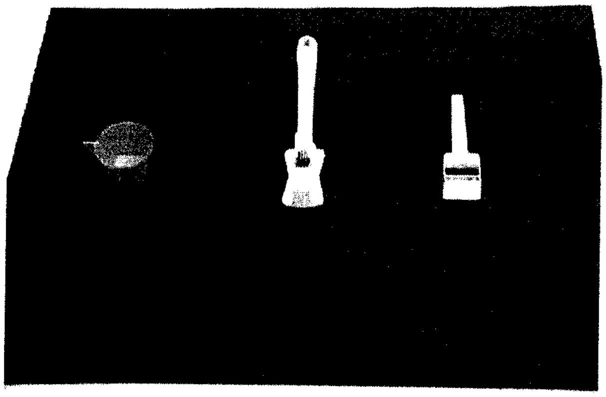
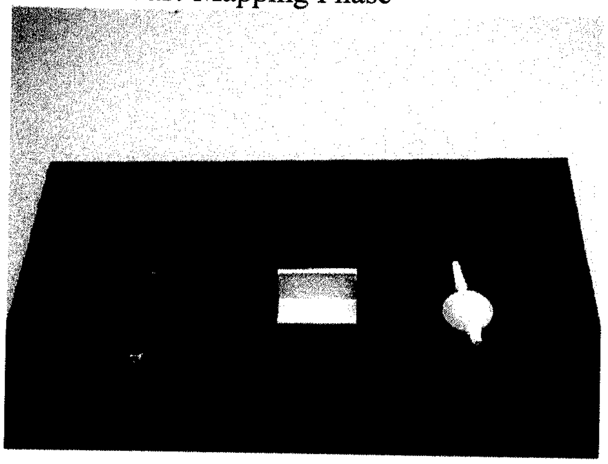


Familiarization Phase

Familiar/Fast-Mapping Phase



Generalization Phase