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Language Matters: Thirteen-Month-Olds Understand That the Language a Speaker Uses Constrains Conventinality

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Object labels are valuable communicative tools because their meanings are shared among the members of a particular linguistic community. The current research was conducted to investigate whether 13-month-old infants appreciate that object labels should not be generalized across individuals who have been shown to speak different languages. Using a visual habituation paradigm, Experiment 1 tested whether infants would generalize a new object label that was taught to them by a speaker of a foreign language to a speaker from the infant's own linguistic group. The results suggest that infants do not expect 2 individuals who have been shown to speak different languages to use the same label to refer to the same object. The results of Experiment 2 reveal that infants do not generalize a new object label that was taught to them by a speaker of their native language to an individual who had been shown to speak a foreign language. These findings offer the first evidence that by the end of the 1st year of life, infants are sensitive to the fact that the conventional nature of language is constrained by the language that a person has been shown to speak.

Keywords: conventionality, infant cognition, language development, visual habituation

Suppose you are visiting an aquarium with your 13-month-old son, who is pointing at a big fish in one of the tanks. Before you have the chance to respond, a nearby lady smiles at your son, points to the animal, and says, "*Regardez le requin.*" How will your young language learner interpret this labeling scenario? Will your son form an association between the term *le requin* and the big fish? If so, would he also assume that the rest of his family who were not on the outing that day would know to what *le requin* refers? On the one hand, the lady offered a number of referential cues such as pointing, eye gaze, and line of regard, which could lead your son to form an association between the term and the large fish. On the other hand, because the lady spoke a language to which your son is not regularly exposed, the term *le requin* is unlikely to be a part of your son's linguistic system and thus is unlikely to be used by other individuals in his linguistic community. A large body of evidence suggests that your son would be sensitive to the fact that the woman is speaking a language that differs from the language to which he is regularly exposed (for a review see Gervain & Mehler, 2010). However, it is unknown

whether your son will have developed an understanding that individuals who speak different languages do not share knowledge of word meanings in the same way that speakers of the same language do. The present research sheds novel insights on this question by investigating whether 13-month-old infants appreciate that information about the linguistic community to which an individual belongs constrains the conventional properties of language.

Words are valuable communicative tools primarily because knowledge of their meanings is shared among people who speak the same language (e.g., Clark, 1992, 1993). To illustrate, there would be very little communicative value for a 13-month-old who is being raised in a monolingual English-speaking environment to learn the association between the big fish and the term *le requin* because the association is unlikely to be shared by the members of his linguistic group. A growing body of evidence suggests that an understanding of the conventional nature of language is present early in life and plays an important role in shaping children's word learning (for reviews see Sabbagh & Henderson, 2007, 2013). For instance, Henderson and Graham (2005) demonstrated that 24-month-olds who were taught a new word-referent link by one speaker (e.g., "let's find the mido") generalized the link to a second speaker who was not present during the teaching phase. In other words, infants applied the speaker extension effect; they expected the second speaker to share knowledge of the object label. Importantly, a second group of children, who were taught about an experimenter's object preference (e.g., "let's find the one that I like"), did not generalize this preference to a second experimenter who was not present during the teaching phase. Together, these findings suggest that children understand the shared nature of labels and the nonshared nature of object preferences by their second birthday (see also Graham, Stock, & Henderson, 2006; Woodward, Markman, & Fitzsimmons, 1994).

Buresh and Woodward (2007) investigated whether an appreciation of the conventional nature of words is present in younger

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infants using a visual habituation paradigm. Nine- and 13-month-old infants were habituated to an event in which an actor picked up one of two novel objects and provided either a novel label (e.g., “a modi”) or a verbal expression of preference (e.g., “ooohhh”). Infants were then shown six test trials in which the test actor provided either the novel label or the verbal expression of preference while picking up either the same object (target test trials) or a different object (distractor test trials). Half of the infants saw the actor who presented the habituation events present the test events, and the other half saw a new actor present the test events. The results revealed that the 9- and 13-month-olds who saw the same speaker at test showed longer looking times on the distractor test trials. That is, infants expected the same individual to act consistently across the habituation and test events in both the word and preference conditions. Conversely, 13-month-olds looked longer when the new actor provided the novel label while holding the distractor object but not when the new actor expressed a preference for the distractor object. That is, 13-month-olds in the different speaker condition expected the speaker to use the label in the same way as the habituation speaker (i.e., the speaker extension effect) but did not expect the two speakers to share the same preference (i.e., infants suspended the application of the speaker extension effect). These results suggest that 13-month-olds, but not 9-month-olds, possess a basic appreciation of the shared nature of object labels and the nonshared nature of object preferences (see Henderson & Woodward, 2012, for evidence that 9-month-olds generalize object labels when task demands are reduced).

The above evidence suggests that infants have begun to differentiate the kinds of linguistic information that is and is not conventional by their first birthday. This conclusion is based on the above studies, which have compared infants’ understanding of the shared nature of linguistic labels and the person-specific nature of object preferences. Although the dichotomy between words and verbal expressions of preference is indeed an important one, this is not the only situation in which individuals must distinguish between what is and is not shared. Our scenario described at the outset highlights the fact that, even within the domain of linguistic labels, there are occurrences in which word-referent associations should not be assumed to be shared. In this scenario, the 13-month-old would be incorrect in assuming that the rest of his family (not present when the French woman provided the word-referent link) would know the meaning of *le requin*. Despite a growing body of evidence suggesting that 13-month-olds expect object labels to be generalized across speakers, it remains unclear whether infants this age understand one important nuance of the shared nature of language—that the language a person knows and uses constrains the conventional properties of language.

There is some evidence suggesting that older children understand that different languages have different names for things. For instance, Au and Glusman (1990) taught monolingual English-speaking preschool-aged children a novel label for an animal in a set of four animals (e.g., “This is a mido. Can you say mido?”). The children were then asked by a second experimenter if they wanted to learn a foreign word (e.g., “Do you want to learn a word in Spanish? . . . theri is the Spanish word for a kind of animal which is here”). Following this, children were asked to identify which animal could be called a theri under the premise that if children always selected the type of animal not previously labeled in English, it would suggest that they did not understand that the

same thing could have different names in different languages. The experimenter then directly asked if the animal previously labeled in English could also be called a theri in Spanish. The results suggested that 3- to 6-year-olds readily accepted two labels for the same animal, so long as it was clear that the labels came from different languages. This finding suggests that preschool-aged children understand that word meanings are constrained by linguistic community (see also Diesendruck, 2005).

In a recent study, Koenig and Woodward (2012) demonstrated that language ability is related to infants’ understanding of the role that different languages play in word learning. In this study, 24-month-old monolingual English children were taught a novel label for one of two objects either by an English or a Dutch speaker. Children were then asked to select the referent object by two experimenters, the person who had initially taught them the label and a different English speaker. The results revealed that 24-month-olds with high vocabularies showed evidence of learning the new object label from both the English and the Dutch speakers. Interestingly, high vocabulary children who learned the initial association from the Dutch speaker responded randomly when asked to select the referent object by a second English speaker. Thus, 24-month-olds with high vocabularies did not generalize new word-referent links across members from different linguistic communities. These findings suggest that infants require a certain amount of linguistic experience to demonstrate an appreciation of the role that information about a speaker’s linguistic group membership plays in the conventional nature of language. However, it is also possible that the nature of the task (e.g., requiring a behavioral response to demonstrate learning) influenced infants’ performance. It remains unclear whether younger infants might demonstrate a basic understanding of the impact that the language a speaker uses has on the shared nature of labels in a potentially less-demanding paradigm.

Infants’ abilities to distinguish between languages from a young age provides reason to think that children might possess at least a basic appreciation of the role that a person’s spoken language plays in conventionality before their second birthdays. For instance, converging evidence from studies employing a diverse array of experimental procedures, language comparisons, and age ranges suggests that infants discriminate between different languages early in development (e.g., Bahrick & Pickens, 1988; Bosch & Sebastián-Gallé, 1997; Mehler et al., 1988; Moon, Cooper, & Fifer, 1993). In addition to an early ability to show differential responses to different languages, infants’ phoneme discrimination abilities suggest that infants “tune in” to their own language within the first year of their postnatal lives (e.g., Dietrich, Swingley, & Werker, 2007; Jusczyk, Friederici, Wessels, Svenkerud, & Jusczyk, 1993; Nazzi & Ramus, 2003; Werker & Tees, 1984). The findings of these studies (and many others) suggest that, at birth, infants are language generalists; they are born with the ability to discriminate the sounds of all languages. Interestingly, infants quickly become language specialists as their sound pattern differentiation abilities decline by around 6–12 months of age (see also Kuhl et al., 2006; Mehler, Dupoux, Nazzi, & Dehaene-Lambertz, 1996; Werker & Yeung, 2005). By the end of the first year of their postnatal lives, infants are attuned to the specific sounds and stress patterns used in their native language.

In addition to the early emerging perceptual abilities that infants display for their own language, recent evidence has suggested that

infants show social preferences toward speakers of their native language (e.g., Buttelmann, Zmyj, Daum, & Carpenter, 2012; Kinzler, Dupoux, & Spelke, 2007). For instance, Kinzler et al. (2007) demonstrated that 6-month-olds look longer toward a still image of a woman who had previously been shown to speak their native language compared to an image of a woman who had been shown to speak a foreign language. By 10 months, infants prefer to accept toys from speakers of their native language and 5-year-olds preferentially choose native language speakers as their friends. Interestingly, these early preferences for speakers of one's own language might transfer to children's tendency to acquire information from them (e.g., Buttelmann et al., 2012; Kinzler, Corriveau, & Harris, 2011; but see Howard, Henderson, & Woodward, 2013). Taken together, the evidence suggests that infants discriminate between different languages early in their postnatal lives and prefer speakers who have been shown to speak the language with which they are most familiar. Infants' discrimination abilities and social preferences would allow them to focus on learning their native language and possibly support the formation of an understanding of the important role that knowledge of a particular language plays in communication.

By 13 months, infants (1) show differential responses to their own language (Mehler et al., 1988), (2) have tuned in to the sounds of their own language (Werker & Tees, 1984), (3) prefer speakers of their native language (Kinzler et al., 2007), and (4) expect words to be shared across two people shown to speak their native language (Buresh & Woodward, 2007; Henderson & Woodward, 2012). When considered together, these findings support the possibility that 13-month-old infants might possess at least a basic appreciation of the fact that word meanings are tied to particular languages. The current study was designed to investigate whether infants' early appreciation of conventionality involves some understanding that the language a speaker uses constrains object labels.

To investigate this question, we used a visual habituation paradigm similar to that utilized by Buresh and Woodward (2007). In Experiment 1, 13-month-old infants being raised in primarily English environments were familiarized to two actors singing nursery rhymes. One actor sang French nursery rhymes, and the other sang English nursery rhymes. Infants were then repeatedly shown an event in which the French speaker picked up one of two novel objects and referred to it using a novel label (i.e., "medo"). After habituation, infants were shown six test events in which either the same French speaker (i.e., Same Speaker condition) or the English speaker (i.e., Different Speaker condition) from the familiarization phase used the novel label (i.e., "medo") to refer to either the same object from habituation (i.e., target test trials) or the other object that had been present in habituation but had not been referred to (i.e., distractor test trials). Of primary interest was whether infants would look reliably longer toward the test trials in which the test actor violated the previously established word-object link (i.e., infants should look longer during the distractor test trials). If 13-month-olds expect foreign speakers to label objects consistently (as they do speakers of their own language), infants in the Same Speaker condition should look longer toward the distractor test trials. Consistent with previous work (e.g., Buresh & Woodward, 2007; Henderson & Woodward, 2012), this finding would demonstrate that 13-month-olds expect the same individual, regardless of language spoken, to use labels in a con-

sistent manner. Critically, if 13-month-olds appreciate that word meanings are tied to particular languages, infants in the Different Speaker condition should not generalize the word-object link across speakers and thus should not look reliably longer toward either type of test trial. Experiment 2 investigated whether 13-month-olds expect an object label provided by a speaker of their native language to generalize across speakers from a foreign language. Together, the two experiments reported here provide the first examination of infants' understanding of the constraint that a person's native language places on the conventional nature of language.

Experiment 1

Method

Participants. Thirty-six full-term infants (mean age = 12 months 26 days, range = 12 months 10 days to 13 months 23 days) exposed to English during at least 80% of their waking hours participated in this study. Participants were from an urban center in New Zealand and were recruited from a database of families who had expressed an interest in volunteering for studies on child development. Twenty-nine infants were classified as New Zealand European, one infant was classified as other European, and six infants belonged to more than one ethnic group. Eighteen infants (10 males, mean age = 12 months 27 days, range = 12 months 10 days to 13 months 23 days) participated in the Same Speaker condition, and 18 infants (11 males, mean age = 12 months 26 days, range = 12 months 10 days to 13 months 17 days) participated in the Different Speaker condition. Assignment across conditions was random, while keeping in mind counterbalancing age and gender as much as possible. An additional 10 infants participated in this study but were removed from the final sample for the following reasons: the infant became too distressed during the session ($n = 1$), parental interference ($n = 2$), experimental error ($n = 4$), the infant's total looking time on the test trials was greater than 2.5 standard deviations above the mean ($n = 1$), or one or more of the test trials were prematurely terminated due to the infant's moving out of the camera view ($n = 2$). All families who participated received a gift voucher to a local supermarket, and infants received a small prize as a token of appreciation.

Apparatus and procedure. Infants were seated on their parent's lap, approximately 1.4 m from a 42-in. LCD screen throughout the experimental session. Apart from the TV screen, all equipment was concealed behind curtains. A Sony video camera was also concealed but with a small opening to accommodate the lens, which was focused on the infant's face. The habituation and test events were presented in video format. Two actors were used in the clips. All infants participated in the following four phases: language exposure, habituation, familiarization, and test. All phases involved showing infants video clips involving one of two actors: a native French actor who was male and wearing a white T-shirt or a native English actor who was female and wearing a purple T-shirt. All of the video clips began with a 1-s black screen and an electronic ding to gain infants' attention. Video stimulus was presented using the computer software LookingTimeX (Hannigan, 2008).

Language exposure. During this phase all infants were shown a 94-s video in which two actors alternated singing nursery songs.

Each actor sang two songs. The first and third songs (i.e., “Alouette,” “Frère Jacques”) were sung by the native French speaker. The second and fourth songs (i.e., “Row, Row, Row Your Boat,” “Twinkle, Twinkle”) were sung by the native English speaker.

Habituation. Following language exposure, infants were shown a video in which the French speaker looked up at the infant, smiled, looked at one of two novel objects on the table in front of him (i.e., the target object), uttered a novel word (i.e., “medo”), picked up the target object, and then repeated the novel word while looking at the target object (see Figure 1). The video then froze with the speaker holding his final position (as in Figure 1) until the infant looked away for more than 2 s or after 120 s elapsed. At that time point, the screen went blank until the next trial began. Infants were shown this habituation event until their looking on three consecutive trials was less than half of the total looking time on the first three trials as calculated on software jHab (Casstevens, 2007). All infants watched a minimum of six habituation trials and a maximum of 14 habituation trials. After the habituation criterion was reached (or 14 trials had elapsed), infants were shown the habituation event one more time to attain a baseline index of infants’ attention to the habituation event before proceeding to the next phase.

Infants’ attention during the habituation phase, as well as all of the remaining phases, was coded by a trained online coder who was blind to condition and trial type and was watching the live video feed in a separate coding room.

Familiarization. This phase consisted of one trial designed to familiarize infants to the setup that was to be used for the test trials. Infants were shown a video clip in which the target and distractor object appeared on different sides of the table than they had been on during habituation. The speaker who would be presenting the test trials looked at the infant, looked at the object on the right side of the table, then looked at the object on the left side of the table, looked back at the camera, and shrugged his/her shoulders (as if to say “where is it?”). For infants in the Same Speaker condition, the speaker who was present during habituation (i.e., the French



Figure 1. Sample of the habituation event used in Experiment 1. The individual who appears here gave signed consent for his likeness to be published in this article.

speaker) presented the familiarization trial. For infants in the Different Speaker condition, the English actor from the language exposure phase presented the familiarization trial. Once again the last frame of the video was frozen and remained on the screen till the infant looked away for more than 2 s or after 120 s elapsed.

Test trials. Infants were then shown six test trials in which the test actor (i.e., the French speaker in the Same Speaker condition or the English speaker in the Different Speaker condition) used the same label from habituation (i.e., “medo”) while picking up either the same object that had been labeled during habituation (i.e., target test trials) or the object that was present throughout habituation yet never referred to (i.e., distractor test trials; see Figure 2). Each type of test trial occurred in alternation, resulting in three pairs of test trials. As in the previous phases, all looking times were recorded from when the action in the video stopped and the image froze until the infant looked away for more than 2 s or after 120 s elapsed. In terms of counterbalancing, the object that served as the target object, as well as the type of test trial that was shown to infants first (i.e., target test trial vs. distractor test trial), was counterbalanced for each participant across each condition.

The experimental session was recorded in picture-in-picture mode using the video software CutFour (AvTake, 2010). This resulted in a combined image of the infant’s face from the video camera with the simultaneous display of the stimulus presentation the infant was watching, which enabled offline coding to be completed. Thirty-five videos were reliability-coded offline by a trained coder who was blind to condition as the picture-in-picture display was concealed (there was an error in the video recording of one infant). There was 95% agreement on the same look away ending the trial. Fisher’s exact tests revealed that the disagreement was unsystematic across test trial type ($p = .2$).

Results and Discussion

Preliminary analyses.

Language exposure phase. Our first set of preliminary analyses were conducted to investigate whether there were any differences between conditions in the amount of time that infants attended to the French and English speakers during the language exposure phase. Infants’ attention toward the actors during this phase was coded offline from the video recordings by a trained coder using Mangold Interact computer software (Mangold, 1998). Of the 36 infants included in the sample, the data for 33 infants were coded (the remaining three infants were missing complete videos of this phase). Twenty percent of the videos were reliability-coded by a second individual with 85% agreement within plus or minus five frames on fixation start and end times.

To investigate whether there were any reliable differences in the percentage of time that infants attended to each of the four songs, a 2 (language: French, English) \times 2 (song placement: first song, second song) \times 2 (condition: Same Speaker, Different Speaker) mixed-design analysis of variance (ANOVA) was conducted with language of speaker and song placement order as within-subject measures.¹ First, the ANOVA revealed a significant main effect of

¹ For all analyses reported in this article, we first conducted the ANOVAs with infant gender as an additional between-subjects variable. In both experiments, none of the analyses revealed significant gender effects. Thus, all analyses were collapsed across this dimension.



Figure 2. Examples of the target test trials and distractor test trials used in the Different Speaker Condition (Experiment 1). The individual who appears here gave signed consent for her likeness to be published in this article.

song placement, $F(1, 31) = 5.32, p = .03, \eta_p^2 = .15$, suggesting that infants spent a significantly greater percentage of time attending to the first songs from each speaker ($M = 93.26, SE = 1.79$) than they did to the second songs ($M = 89.48, SE = 1.61$), regardless of the language. Second, the ANOVA revealed a significant main effect of language, $F(1, 31) = 22.74, p < .001, \eta_p^2 = .42$, suggesting that infants spent a significantly greater percentage of time attending to the English speaker ($M = 96.30, SE = 1.00$) than they did to the French speaker ($M = 86.43, SE = 2.37$). These findings are consistent with previous studies, which have shown that infants look longer toward individuals who have been shown to speak their own, as opposed to a foreign, language (e.g., Kinzler et al., 2007). Critically, these results suggest that infants noticed the difference between the French and the English actors.

Habituation analyses. Infants' average looking times during the habituation, familiarization, and test trials are summarized in Table 1. This set of analyses investigated whether the conditions differed in infants' looking times during the habituation phase. A 2 (habituation trial: sum of first three, sum of last three) \times 2 (condition: same speaker, different speaker) mixed-design ANOVA with habituation trial as the within-subject variable revealed a significant main effect of habituation trial, $F(1, 34) = 102.16, p < .001, \eta_p^2 = .75$. As expected, infants' attention significantly declined throughout the habituation phase. There

were no other significant effects. An independent samples t test revealed that the conditions did not differ in the number of trials in which infants habituated, $t(34) < 1, d = 0.10, r = .05$. Infants in the Same Speaker condition habituated in an average of 7.89 trials ($SE = 0.70$), while infants in the Different Speaker condition habituated in an average of 7.61 trials ($SE = 0.63$). The conditions did not differ in the amount of time that infants looked toward the baseline trial, $t(34) < 1, d = 0.25, r = .12$, or the familiarization trial, $t(34) = 1.45, p = .16, d = 0.49, r = .24$. Taken together, the analyses of the habituation phase revealed that there were no significant differences between the two conditions prior to the test phase.

Focal analyses. The primary question of interest was whether there was a difference between the two conditions in the amount of time that infants looked toward the distractor and target test trials. If 13-month-olds are sensitive to conventionality and its constraints, infants in the Same Speaker condition should look longer toward the distractor test trials, while infants in the Different Speaker condition should not look reliably longer toward either type of test trial. A 2 (test trial type: target, distractor) \times 2 (first test trial: target, distractor) \times 2 (condition: Same Speaker, Different Speaker) mixed-design ANOVA with test trial type as the within-subject variable was performed on infants' looking toward both types of test trials. The ANOVA revealed a significant main effect of test

Table 1

Mean Looking Times (in Seconds) and Standard Errors for the Habituation, Familiarization, and Test Trial Phases for Each Condition Across Both Experiments

	Habituation			Familiarization	Type of test trial	
	Sum first 3 trials	Sum last 3 trials	Baseline		Average target	Average distractor
Experiment 1						
Same Speaker						
<i>M</i>	40.36	16.06*	7.47	13.27	6.82	9.10*
<i>SE</i>	4.07	1.83	0.86	1.86	0.87	1.17
Different Speaker						
<i>M</i>	42.64	15.96*	6.54	17.43	6.79	6.96
<i>SE</i>	5.12	1.82	0.95	2.19	0.78	1.04
Experiment 2						
Different Speaker: English First						
<i>M</i>	48.78	19.89	7.85	19.43	8.70	7.94
<i>SE</i>	5.71	2.60	1.31	4.53	1.00	1.25

* $p < .05$.

trial type, $F(1, 32) = 5.73$, $p = .02$, $\eta_p^2 = .15$, with infants generally looking significantly longer on the distractor test trials ($M = 8.20$, $SE = 0.77$) than they did on the target test trials ($M = 6.91$, $SE = 0.58$). However, this main effect was qualified by a significant interaction between test trial type and condition, $F(1, 32) = 4.46$, $p = .04$, $\eta_p^2 = .12$. No other effects were significant.

To follow up the significant interaction between test trial type and condition, we conducted a paired samples t test for each condition. Infants in the Same Speaker condition looked reliably longer toward the distractor test trials than they did the target test trials, $t(17) = 2.87$, $p = .01$, $d = 0.52$, $r = .25$, which suggests that infants expected the same speaker to continue to use the label in the same manner as he had during habituation. Conversely, infants in the Different Speaker condition did not look reliably longer toward either type of test trial, $t(17) < 1$, $d = 0.04$, $r = .02$, which suggests that infants did not expect the speaker who had previously been shown to speak a different language from the habituation actor to use the same label consistently. Together these findings suggest that 13-month-olds are sensitive to the fact that the two speakers who have been shown to speak different languages are unlikely to label an object in the same way.

Individual-level comparisons further confirmed the above findings. Two Wilcoxon signed-ranks tests were conducted to examine whether there were any significant differences in the number of infants in each condition who looked longer toward the distractor test trials. In the Same Speaker condition, 15 out of the 18 infants looked longer on the distractor test trials than they did on the target test trials ($z = -2.68$, $p < .01$). In contrast, only 9 out of the 18 infants in the Different Speaker condition looked longer on the distractor test trials ($z = -0.11$, $p = .91$), indicating that overall the infants looked equally at both types of test trials. These findings provide further evidence suggesting that 13-month-olds do not generalize object labels across two individuals who have been shown to speak different languages.

Finally two paired samples t tests were computed to investigate whether infants in either condition demonstrated a recovery of attention from the baseline trial to either the first target test trial or the first distractor test trial. Infants in the Same Speaker condition did not look reliably longer toward the first target test trial than they did the baseline trial, $t(17) < 1$, $d = 0.19$, $r = .09$, but did look significantly longer toward the first distractor trial than they did the baseline trial, $t(17) = 2.38$, $p = .03$, $d = 0.64$, $r = .31$. Thus, infants in the Same Speaker condition demonstrated a recovery of attention from baseline only when the same speaker used the same label to refer to a different object. Infants in the Different Speaker condition looked significantly longer toward the first target trial than they did the baseline trial, $t(17) = 2.28$, $p = .04$, $d = 0.62$, $r = .30$, but did not look reliably longer toward the first distractor test trial than they did the baseline trial, $t(17) = 1.72$, $p > .10$, $d = 0.47$, $r = .23$. Interestingly this indicates that infants in the Different Speaker condition demonstrated a recovery of attention from baseline only when the test actor used the same label to refer to the same object as was used by the habituation actor. These final analyses provide compelling evidence suggesting that not only do infants not generalize object labels across two speakers who have been shown to use different languages but they also show some understanding that it is in fact unusual for the two speakers to use the same object label.

Taken together, the results of the Same Speaker condition suggest that 13-month-olds expect individuals to be consistent with their labeling, regardless of the fact that the speaker had previously been shown to speak a foreign language. The results of the Different Speaker condition suggest that infants this age do not expect two people who were shown to speak different languages to label objects in the same way. Buresh and Woodward (2007) used same speaker versus different speaker paradigms to demonstrate that 13-month-old infants expect two English-speaking actors to be consistent in their object labeling, regardless of the actors' gender. Our findings extend this work by suggesting that infants take into account the language used by the speakers when determining whether they should expect them to use object labels in the same way and thus provide further evidence suggesting that a fairly sophisticated appreciation of conventionality is in place at the end of the first year of life.

These findings provide the first evidence suggesting that infants are sensitive to the fact that information about a person's linguistic community membership constrains the shared nature of labels. However, there is at least one alternative explanation that should be considered. In Experiment 1, a foreign language speaker labeled an unfamiliar object using a novel label during habituation. This procedural decision was valuable in that it enabled us to test whether infants expect someone who has been shown to speak a foreign language to label objects consistently over time. However, doing so raises the possibility that infants might not have generalized knowledge of the object-label association to the test actor simply due to the fact that the label was originally provided by a speaker who had spoken a foreign language and not because both speakers had been shown to use different languages. It is possible that infants do not expect object labels provided by someone who does not speak the child's *own* language to be shared across speakers without the broad understanding that words should not be shared across *any* speakers who do not speak the same language. If this were the case, infants in the Different Speaker condition might have showed a different pattern of response if the native English speaker were the one who initially provided the word-object association.

Experiment 2

Experiment 2 was designed to investigate whether 13-month-old infants expect word-object associations offered by a speaker of their own language to be shared by a speaker who has been shown to speak a foreign language. To investigate this question, we employed the same paradigm as in our first experiment with one key difference. In Experiment 2 the speaker who had been shown to speak the infants' own language (i.e., English) provided the object label during habituation, and the speaker who had been shown to speak a foreign language (i.e., French) performed the test events. If 13-month-olds are truly sensitive to the constraint that the language a speaker uses has on the conventional nature of labels, the looking patterns of infants in this experiment should be similar to those of the infants in the Different Speaker condition of Experiment 1 (i.e., infants should not look reliably longer toward either type of test trial). If, however, infants expect object labels provided by a speaker of their native language to be shared, regardless of the language a speaker has been shown to use, infants

in this experiment would show the speaker extension effect (i.e., infants should look reliably longer toward the distractor test trials).

Method

Participants. Eighteen full-term infants (11 males, mean age = 13 months, range = 12 months 10 days to 13 months 29 days) from a large city in New Zealand who were exposed to English for at least 80% of their waking hours participated in this study. Fourteen infants were classified as New Zealand European, one infant was classified as other European, and two infants belonged to more than one ethnic group. One caregiver failed to complete the demographic questionnaire. Three additional infants participated but were excluded from the final sample due to failure to complete the study because of excessive fussiness ($n = 1$) or technical error ($n = 2$).

Apparatus and procedure. Infants followed the same procedure as did the infants in the Different Speaker condition (Experiment 1), with one key difference. The speaker during the habituation phase was the English speaker, and during the test phase the speaker was the French speaker. Fifteen of the participants were reliability-coded by a second trained coder who was blind to condition (the videos of the remaining three infants were corrupt). There was 94% agreement on the same look away ending the trial. Fisher's exact test revealed that the distribution of disagreements was unsystematic across test trial types ($p = 1$).

Results and Discussion

Preliminary analyses.

Language exposure. Fourteen of the 18 infants' attention to the language exposure phase was coded and reliability coded (85% agreement) in the same manner as in Experiment 1. To investigate any differences in infants' attention during the French and English nursery rhymes, a 2 (language of song: French, English) \times 2 (song placement: first song, second song) \times 2 (condition: Same Speaker, Different Speaker) mixed-design ANOVA with language of speaker and song placement as the within-subject measures was conducted. The ANOVA revealed a significant main effect of song placement, $F(1, 13) = 5.55, p = .035, \eta_p^2 = .30$, indicating that infants paid a greater percentage of attention to the first songs ($M = 95.24, SE = 1.70$) than the second songs ($M = 91.18, SE = 2.53$). The ANOVA also revealed a significant main effect of the language of speaker, $F(1, 13) = 11.99, p = .004, \eta_p^2 = .48$, indicating that infants paid a greater percentage of attention to the English speaker ($M = 96.65, SE = 1.30$) than they did to the French speaker ($M = 89.77, SE = 2.83$). Consistent with our findings from Experiment 1, these results suggest that infants distinguished the French speaker from the English speaker.

Habituation analyses. Infants' average looking times during the habituation and test trials are summarized in Table 1. A paired samples t test revealed a significant difference between looking times on the first three trials and the last three trials, $t(17) = 6.91, p < .001, d = 1.64, r = .63$, which suggests that infants habituate to the labeling event. Indeed, infants habituated in an average of 7.67 trials ($SD = 2.25$).

Focal analyses. The focal analyses examined differences in infants' looking times toward the two types of test trials to investigate whether infants would generalize a new word-object asso-

ciation provided by a speaker of their native language to a second speaker who has been shown to speak a foreign language. A 2 (test trial type: target, distractor) \times 2 (first test trial: target first, distractor first) mixed-design ANOVA with test trial type as the within-subject variable was performed on infants' looking during test trials and revealed no significant effects. As in the Different Speaker condition (Experiment 1), infants did not look reliably longer toward either type of test trial. Thus, infants did not expect an object label in their native language to be shared by a speaker who had been shown to speak a foreign language. This finding was further confirmed using a Wilcoxon signed-ranks test. Thirteen out of 18 infants looked longer on the target test trials than they did on the distractor test trials ($z = -0.81, p = .42$). Although not statistically significant, the number of infants who looked longer toward the target test trials is noteworthy as it suggests that infants may have found it particularly novel when the French speaker used the same word-object association that the English speaker had used previously.

As in Experiment 1, two paired samples t tests were conducted to investigate whether infants showed a significant recovery of attention from the baseline to either type of first test trial. As was the case in the Different Speaker condition (Experiment 1), infants looked reliably longer on the first target test trial than they did on the baseline trial, $t(17) = 2.47, p = .02, d = 0.67, r = .32$, but did not look reliably longer on the first distractor trial than they did on the baseline trial, $t(17) = 1.18, p = .25, d = 0.38, r = .19$. These results further suggest that infants found it particularly novel when two speakers who had been shown to speak two different languages used the same word-object association. In sum, the results of Experiment 2 provide further evidence suggesting that 13-month-olds do not expect two speakers who speak different languages to label objects in the same manner, even when the object label was established by a speaker of the infant's own language.

Cross-experiment analyses. As a final analysis, we conducted cross-study comparisons to examine differences in infants' looking times between the Different Speaker conditions from each experiment. First, preliminary analyses were conducted to investigate whether there were any differences between the conditions in the habituation phase for which we would have to control. A 2 (habituation trial: sum of first three, sum of last three) \times 2 (condition: Different Speaker, Different Speaker-English First) mixed-design ANOVA with habituation trial as the within-subject variable revealed a significant main effect of habituation trial, $F(1, 34) = 95.26, p < .001, \eta_p^2 = .74$. As expected, infants' attention declined throughout the habituation phase (see Table 1). No other effects reached significance. An independent samples t test also revealed that the conditions did not differ in the number of trials in which infants habituated, $t(34) < 1, d = 0.02, r = .01$. Infants in the Different Speaker condition habituated in an average of 7.61 trials ($SE = 0.63$), while infants in the Different Speaker-English First condition habituated in an average of 7.67 trials ($SE = 0.53$). The conditions also did not differ in the duration of the baseline trial, $t(34) < 1, d = 0.28, r = .14$, or the familiarization trial, $t(34) < 1, d = 0.14, r = .07$. Thus, there were no reliable differences between the two Different Speaker conditions prior to the test phase.

Of key interest was whether the language of the speaker who initially provided a new object label influenced 13-month-olds'

tendency to avoid generalizing the word–referent link to a speaker who had been shown to speak another language. A 2 (test trial type: target, distractor) \times 2 (test trial order: target trial first, distractor trial first) \times 2 (condition: Different Speaker, Different Speaker–English First) mixed-measures ANOVA with trial type as the within-subject variable on the average amount of time infants looked toward either type of test trial did not reveal any significant effects. Thus, the spoken language of the speaker who initially provided the object label did not differentially influence infants' looking toward either type of test trial. These findings replicate and extend the findings from our first experiment. Together, the results of both experiments provide converging evidence that infants have a fairly sophisticated understanding of conventionality by 13 months—they appreciate that people who do not speak the same language do not share object labels.

General Discussion

Previous research has demonstrated that by 13 months, infants expect object labels to be shared across two individuals who had been shown to speak the same language (Buresh & Woodward, 2007; Henderson & Woodward, 2012). The present research was conducted to investigate the scope of infants' understanding of the conventional nature of object labels by examining whether infants generalize object labels across two individuals who had been shown to speak different languages. The results demonstrate that 13-month-old infants expect the same person to label an object consistently over time but do not expect the same object label to generalize across two people who had been shown to differ in their spoken language. Thus, by 13 months, infants are sensitive to the fact that individuals who do not speak the same language do not share object labels in the same manner as do speakers of the same language. There is some evidence of an understanding of the fact that word meanings are not shared by people who speak different languages in toddlers (Koenig & Woodward, 2012) and preschoolers (e.g., Au & Glusman, 1990; Diesendruck, 2005). To our knowledge, the present findings provide the first evidence of a basic appreciation of this fact about language in children younger than 2 years of age.

Infants' understanding of the constraints of conventionality was examined in the present research by introducing infants to two individuals who differed in the language they spoke (i.e., French vs. English). Existing evidence demonstrating that infants distinguish between languages early in their postnatal lives (e.g., Bahrick & Pickens, 1988; Bosch & Sebastián-Gallé, 1997; Mehler et al., 1988; Moon et al., 1993) and show early social preferences for native language speakers (Kinzler et al., 2007) provided us with reason to believe that 13-month-olds would be able to make such a discrimination. Our expectations were confirmed as infants in the language exposure phases in both experiments directed more attention to a person singing nursery rhymes in their native language than they did to a person singing in a foreign language. Infants' preferential looking toward speakers of their own language confirms that, by 13 months, infants can differentiate speakers using contrasting languages (at least in the case of English vs. French), and this is consistent with existing evidence surrounding infants' language discrimination abilities (e.g., Bahrick & Pickens, 1988; Mehler et al., 1988; Moon et al., 1993; Bosch & Sebastián-Gallé, 1997). By capitalizing on infants' rapidly developing language

discrimination abilities, the present research offers a new dichotomy that can be used to probe infants' appreciation of the shared nature of language and contributes to the existing literature in a number of ways.

First, our findings add to the growing body of evidence supporting a fairly sophisticated understanding of the conventional nature of language early in a child's life (e.g., Buresh & Woodward, 2007; Graham et al., 2006; Henderson & Graham, 2005; Henderson & Woodward, 2012; Martin, Onishi, & Vouloumanos, 2012). To date, previous investigations of the development of an understanding of conventionality have focused on identifying the age at which children generalize linguistic object labels across two English-speaking individuals (e.g., Buresh & Woodward, 2007; Graham et al., 2006; Henderson & Graham, 2005; Henderson & Woodward, 2012; Woodward et al., 1994). This past work has demonstrated that infants as young as 13 months of age generalize object labels but not object preferences across speakers of the same language (Buresh & Woodward, 2007; see Henderson & Woodward, 2012, for similar results with 9-month-old infants). Our findings extend this work by providing the first known evidence suggesting that 13-month-olds do not simply assume that all linguistic labels are shared indiscriminately across all speakers. Instead, infants consider the language that a speaker has been shown to use and do not generalize an object label if the speakers have been shown to use different languages.

Our findings raise questions surrounding the developmental progression of an appreciation of the constraint that the language a speaker uses on conventionality. Previous work has shown that preschool-aged children (Au & Glusman, 1990) and 2-year-olds with high vocabularies (Koenig & Woodward, 2012) are sensitive to the fact that objects have different names in different languages. The findings reported here provide the first demonstration of this awareness in children younger than 2 years of age. Evidence of this awareness at 13 months is particularly noteworthy considering the fact that it was only the toddlers who were more advanced in their language development who seemed to understand that word meanings cannot be generalized across speakers of different languages in the Koenig and Woodward's (2012) study. Although our findings seem to contradict those reported by Koenig and Woodward, we speculate that these seemingly inconsistent results are a consequence of the different methodologies used in the two studies. Koenig and Woodward used a traditional word-learning paradigm in which toddlers were required to reach toward and grasp an object in response to a comprehension question (i.e., "where is the sep?"). This paradigm was necessary to assess their key question of interest, which was whether toddlers would learn words from a person from a different linguistic community. However, it is possible that the task demands required to respond to the comprehension question may have resulted in an underestimation of 24-month-olds' understanding of the constraint that linguistic community places on conventionality. We used a visual habituation paradigm in the present research because such paradigms have been widely used to test infants' action understanding across a broad range of contexts (for a review see Woodward, 2009) and, more importantly, because similar paradigms have provided evidence of an understanding of conventionality in same-aged (Buresh & Woodward, 2007) and younger (Henderson & Woodward, 2012) infants. Future work could investigate whether toddlers, regardless of their linguistic ability, might evidence an understand-

ing of the fact that words are not shared across different languages in a less-demanding task than that utilized by Koenig and Woodward.

Existing evidence suggests that infants as young as 9 months of age expect an individual's labeling behavior and object preferences to remain consistent over time (Buresh & Woodward, 2007; Henderson & Woodward, 2012). The results of the Same Speaker condition reported here extend this work by demonstrating that 13-month-olds expect a person's labeling behavior to be consistent over time, regardless of the particular language that the speaker has been shown to use. This finding suggests that infants generalize at least one rule of their own language (i.e., people label objects consistently) to individual speakers of other languages. This finding opens the door for future work to examine the contexts in which infants will apply other rules of their native language to speakers of a foreign language.

The results of our Same Speaker condition are also relevant to the literature surrounding infants' tendencies to accept a variety of symbolic forms as labels for novel objects (e.g., Hollich, Hirsh-Pasek, & Golinkoff, 2000; MacKenzie, Graham, & Curtin, 2011; Namy, 2001; Namy, Campbell, & Tomasello, 2004; Namy & Waxman, 1998; Woodward & Hoyne, 1999). There is now a solid body of evidence suggesting that infants in the second year of their lives are willing to accept a wide range of symbolic forms such as gestures, nonverbal sounds, and nonlinguistic pictograms to refer to objects (e.g., Namy, 2001; Woodward & Hoyne, 1999). Interestingly, as infants near their second birthdays their symbolic openness becomes restricted and infants tend to map only spoken labels onto objects (e.g., Namy, 2001; Woodward & Hoyne, 1999). Although, the present research was not designed to test whether infants mapped the novel word "medo" onto the target object, our findings do suggest that infants formed some sort of an association between the word, the target object, and the French speaker. It remains unclear whether infants would expect a foreign-language user to refer to an object consistently over time across a range of symbolic forms.

To date, research investigating infants' appreciation of conventionality has focused largely on the application of the speaker extension effect and thus has identified the kinds of information that infants do (e.g., object labels) and do not (e.g., object preferences, desires) extend across individuals (e.g., Buresh & Woodward, 2007; Graham et al., 2006; Henderson & Graham, 2005; Henderson & Woodward, 2012). However, the tendency to show the speaker extension effect is not the only consequence of an understanding of conventionality. Sabbagh and Henderson (2007) outlined at least two other ways in which an appreciation of conventionality can be manifested (e.g., contrast and error avoidance effects). For example, preschool-aged children evidence an understanding of conventionality by their tendency to avoid learning word-referent links that are unlikely to be shared by the broader linguistic community (for reviews also see Diesendruck & Markson, 2011; Sabbagh & Henderson, 2013). To gain a more comprehensive picture of the development of an understanding of conventionality, future studies should be designed to investigate whether infants also demonstrate error-avoidance and contrast effects.

Infants in the present studies did not assume conventionality of object labels across speakers who differ in their national language. However, the particular language that one speaks is not the only

marker of conventionality (see also Diesendruck & Markson, 2011). People can act in unconventional ways (e.g., comb their hair with a fork), use unconventional gestures (e.g., click their fingers and say "good-bye" when someone leaves), or dress unconventionally (e.g., men wearing skirts in Western cultures). An early appreciation of conventionality may result in infants' becoming sensitive to other speaker properties that might lead them to restrict the application of the speaker extension effect. We, and others, are currently investigating the impact that witnessing an individual acting in an unconventional manner (e.g., putting shoes on their hands) might have on infants' application of a speaker extension effect and word learning, more generally.

In sum, the current research demonstrates that infants possess at least a basic appreciation of the fact that the language a speaker uses constrains conventionality. By 13 months, infants do not expect individuals who have been shown to speak different languages to share the same object labels. Our findings make a novel contribution to the growing body of evidence demonstrating that infants possess a fairly sophisticated appreciation of the conventional nature of language (e.g., Buresh & Woodward, 2007; Graham et al., 2006; Henderson & Woodward, 2012; Martin et al., 2012). Conventionality is critical for successful everyday communication, and possessing an understanding of conventionality is likely to have a significant impact on the way that children acquire language (see also Sabbagh & Henderson, 2007, 2013). In order to become able communicators, language learners must acquire the word meanings that are conventional within their own linguistic community. Infants' early emerging understanding of the fact that word meanings do not generalize across speakers who use different languages might help infants achieve this goal by encouraging them to focus on learning the words that will most likely be shared by the members of their own linguistic group.

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