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Infant-Directed Prosody Helps Infants Map Sounds to Meanings

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Adults typically use an exaggerated, distinctive speaking style when addressing infants. However, the effects of infant-directed (ID) speech on infants' learning are not yet well understood. This research investigates how ID speech affects how infants perform a key function in language acquisition, associating the sounds of words with their meanings. Seventeen-month-old infants were presented with two label-object pairs in a habituation-based word learning task. In Experiment 1, the labels were produced in adult-directed (AD) speech. In Experiment 2, the labels were produced in ID prosody; they had higher pitch, greater pitch variation, and longer durations than the AD labels. We found that infants failed to learn the labels in AD speech, but succeeded in learning the same labels when they were produced in ID speech. Experiment 3 investigated the role of variability in learning from ID speech. When the labels were presented in ID prosody with no variation across tokens, infants failed to learn them. Our findings indicate that ID prosody can affect how readily infants map sounds to meanings and that the variability in prosody that is characteristic of ID speech may play a key role in its effect on learning new words.

Across many cultures, adults use a distinct speaking style for communicating with infants (Fernald et al., 1989; Kitamura, Thanavishuth, Burnham & Luksaneeyanawin, 2002; Masataka, 1992). The prosody of infant-directed (ID) speech is exaggerated compared to the prosody of adult-directed (AD) speech. ID speech typically has a wider pitch range and higher

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overall pitch than AD speech (Fernald & Simon, 1984; Kitamura & Burnham, 2003; Uther, Knoll & Burnham, 2007). Utterances in ID speech are also shorter and produced with a slower tempo and longer pauses. They contain more repetitions of words and phrases than AD speech (Fernald & Morikawa, 1993; Papousek, Papousek & Haekel, 1987; Stern, Spieker, Barnett & MacKain, 1983). Speakers are likely to be rewarded for their vocal efforts by infants' expressions of positive affect in response to ID speech (Werker & McLeod, 1989; Werker, Pegg & McLeod, 1994). Infants also prefer to listen to ID speech over AD speech; a large number of studies have demonstrated this preference in children from newborns to 17 months of age (e.g., Cooper & Aslin, 1990; Fernald, 1985; Glenn & Cunningham, 1983; McRoberts, McDonough & Lakusta, 2009; Werker et al., 1994).

Although there are developmental changes in the forms that ID speech takes (Kitamura & Burnham, 2003; Kitamura et al., 2002; Liu, Tsao & Kuhl, 2009), the forms that infants prefer (e.g., comforting, approving, or directive, Kitamura & Lam, 2009; see also McRoberts et al., 2009), and the strength of infants' attention to ID speech (Hayashi, Tamekawa & Kiritani, 2001; McRoberts et al., 2009; Newman & Hussain, 2006), infants' listening preference for ID speech suggests that the melodic speaking style effectively elicits and holds infants' attention. Evidence of the pervasiveness of ID speech and infants' strong responses to it support the claim that it promotes early development (but see Ochs, 1982; Scarborough & Wyckoff, 1986; for examples of counter-evidence). Fernald (1985, 1992; see also Fernald & Simon, 1984) has proposed that ID speech is a specialized signal for communicating with human infants and that it plays crucial roles in regulating young infants' arousal and affect, engaging attention, and promoting language acquisition.

There are several aspects of ID speech that may contribute to language acquisition. It provides cues to acoustic, lexical, and grammatical structure beyond those commonly available in AD speech. In speech to infants, mothers' vowel categories are more distinct that in speech to adults (Kuhl et al., 1997). Liu, Kuhl and Tsao (2003) found a positive correlation between the distinctiveness of mothers' vowel spaces and infants' speech perception performance, such that mothers with more distinct vowels had infants with better phoneme discrimination (see also Cristia, 2011). The exaggerated pitch contours of ID speech may also promote learning. Trainor and Desjardins (2002) found that large pitch contours facilitated vowel discrimination in 6-month-olds, relative to their performance on steady state vowels. Infants' ability to parse and process words and sentences may also be facilitated by the short simplified utterances, longer pauses, regular repetition, and slow tempo of ID speech (Fisher &

Tokura, 1996; Kemler Nelson, Hirsh-Pasek, Jusczyk & Cassidy, 1989; Kempe, Schaeffler & Thoresen, 2010; Soderstrom, Blossom, Foygel & Morgan, 2008). In addition, mothers tend to place important or new information at the ends of utterances in ID speech (Fernald & Mazzie, 1991). This location allows infants to identify words more readily than when they occur in sentence-medial positions (Seidl & Johnson, 2006).

In addition to the cues to linguistic structure that ID speech provides, its prosodic features may support language acquisition because it elicits and maintains infants' attention. As described above, infants across a range of ages display an ID speech preference; they listen longer to ID speech than to AD speech (e.g., Cooper & Aslin, 1990; Fernald, 1985; Werker et al., 1994; but see Hayashi et al., 2001; Newman & Hussain, 2006 for evidence that the preference is not present at all ages). The motivation to attend to ID speech may affect learning. Kaplan and his colleagues (Kaplan, Bachorowski, Smoski & Hudenko, 2002; Kaplan, Jung, Ryther & Zarlengo-Strouse, 1996) have proposed that a key role of ID speech is to ready infants for learning. Kaplan et al. (1996) found that 4-month-olds learned to associate visual stimuli (faces) with ID speech passages more readily than with AD passages. They argued that ID speech is a stimulus that increases infants' arousal. This arousal primes or sensitizes the system for learning. AD speech is less stimulating, and therefore may not have the same sensitizing effect, making infants less likely to detect or thoroughly process the associated visual stimulus.

Given the widespread use of ID speech and its potential influence on language acquisition, there is surprisingly little direct evidence that it affects how infants learn linguistic information. Two recent studies have examined the effects of ID speech on infants' ability to detect words in fluent speech. Singh, Nestor, Parikh and Yull (2009) found that 7.5-month-olds successfully recognized familiarized words after a 1 day delay when the words were embedded in passages of ID speech, but not when the words were embedded in passages of AD speech. Thiessen, Hill and Saffran (2005) examined how ID speech affects statistical word segmentation. They tested the idea that ID prosody helps infants learn about linguistic structure, even when ID and AD speech possess identical structures. Seven-month-olds successfully tracked the statistical regularities and segmented words in an artificial language presented in ID speech, but not when the same language was presented in AD speech. A key characteristic of the stimuli was that the ID passage did not contain supplemental cues to the structure of the language (i.e., no lengthened pauses, simplified utterances, or enhanced repetition) that were not present in the AD passage. Rather, the ID prosody affected infants' learning. Thiessen et al. (2005) proposed that ID speech can support learning by promoting attention to speech, and therefore to the statistical regularities present in patterns of speech sounds.

The prosody of ID speech may also affect how infants link the sounds of words with their meanings. Based on measures of event-related potentials (ERPs), Zangl and Mills (2007) suggested that ID speech may allow infants to form stronger associations between word forms and their referents by increasing neural activity. They presented 6- and 13-month-olds with lists of familiar and unfamiliar words produced with ID or AD prosody. Overall, ID speech elicited larger ERP amplitudes than AD speech, indicating greater neural activity. They also found that infants' responses to ID speech depended on language experience. At 6 months, the increase in activity to ID speech only occurred for familiar words, whereas at 13 months, the increase occurred for familiar and unfamiliar words. The timing of the 13-month-olds' responses also led Zangl and Mills to propose that for infants who are beginning to associate meanings with words, the increased activity to ID speech supports word learning.

Ma, Golinkoff, Houston and Hirsh-Pasek (2011) recently tested how readily young children (21-month-olds) learn object labels from ID versus AD speech. The children heard two object labels embedded in passages produced with ID or AD prosody. The labels primarily occurred in sentences, with some tokens produced in isolation. During testing, infants viewed the two objects and heard requests to look at one of them. Ma et al. found that although the sentences were identical in the two conditions, children presented with labels in ID speech learned the labels, but children presented with labels in AD speech did not. At 27 months, children successfully learned the novel object labels from AD speech, suggesting that as children develop, they become less reliant on support from ID speech (though see Golinkoff & Alioto, 1995, for the effects of ID speech on adults' learning of foreign language words). The authors proposed that early in lexical development, the exaggerated prosody of ID speech acts as a perceptual cue to support word learning. Children gradually reduce their reliance on perceptual cues as they become more sophisticated learners and increase attention to linguistic cues.

Ma et al. (2011) provided a valuable demonstration that ID speech can help children learn new words. It remains to be explored what aspects of ID speech promote lexical acquisition. Learning a new word requires forming a meaning representation and a sound sequence representation, and linking the two. Young learners may have difficulty at any step in this process. In Ma et al.'s experiment, the object receiving the label was clearly identified in a simple visual scene, so it is unlikely that the children had difficulty locating the appropriate referent. To acquire the novel sound sequence representations, the children may have been challenged to segment the new words and recognize them within the speech stream. In the interest of presenting naturalistic stimuli, most of the repetitions of the labels occurred within sentences (Brent & Siskind, 2001). ID speech contains many characteristics that could facilitate the segmentation of words from fluent speech, such as greater emphasis on target words, exaggerated pauses, and slower speaking rate. Thus, the ID speech may have facilitated label learning by promoting recognition of the novel labels and the formation of phonological representations (Singh et al., 2009; Thiessen et al., 2005). Alternatively, the ID prosody may have specifically facilitated the process of associating the word forms with their meanings, rather than the identification of word forms. ID speech may promote learning of sound-meaning associations, similar to its effect on associative learning of visual stimuli (e.g., Kaplan et al., 1996).

The present study investigated how ID prosody affects infants' ability to associate sounds with meanings, a fundamental process in word learning. The sounds were novel words presented with characteristics of AD or ID prosody. The meanings were represented by novel objects paired with the words. The labels were presented in isolation, so that infants were not required to segment them as they attempted to associate the labels with referents, as they did in Ma et al.'s (2011) task. Our experiments focused on how prosodic characteristics of words in ID speech affect how words are associated with objects. Herein, the ID speech did not provide supplemental cues to linguistic structure, such as word segmentation or phrase-level cues, but maintained the exaggerated prosodic characteristics of high pitch and large pitch range.

In three experiments, we used a version of the Switch task (Werker, Cohen, Lloyd, Casasola & Stager, 1998) to present infants with novel objects and their labels. Werker and colleagues developed the Switch task as a measure of word-object associative learning. Infants view two word-object pairs until they reach habituation. In testing, the pairings of words and objects are switched. If infants learned the original associations, they should look longer on the switched test trials than the test trials showing the original pairings. Although learning in the Switch task is not equal to the full symbolic representations that advanced word learners form, learning associations between words and their referents is, by many accounts, a crucial function in language acquisition (Mayor & Plunkett, 2010; Namy, 2012; Nazzi & Bertoncini, 2003; Smith, Jones, Landau, Gershkoff-Stowe & Samuelson, 2002; Werker et al., 1998; Yu & Smith, 2007). Since its development, several studies have indicated that the learning that occurs in the Switch task is relevant to word learning. For example, infants' performance in the Switch task correlates with vocabulary size (Werker, Fennell, Corcoran & Stager, 2002), and infants detect when labels are switched for words that are part of their receptive vocabularies (Fennell &

Werker, 2003). Recent investigators have increasingly used this associative learning task as a means to study early word learning (Curtin, 2009; Fennell, Byers-Heinlein & Werker, 2007; Graf Estes, Evans, Alibali & Saffran, 2007; Rost & McMurray, 2009; Thiessen, 2007).

An advantage of using the Switch task to measure learning in the present experiments is that it allowed us to examine whether the ability of ID speech to hold infants' attention plays a role in how it affects learning. Because the task is habituation-based, we can let infants control the duration of their exposure to the stimuli, providing a clearer measure of infants' attention during learning than we can collect with a fixed trial duration design. We tested whether object labels produced in ID speech maintained infants' attention longer than the same labels produced in AD speech by analyzing the duration of attention during habituation. One possibility is that infants' listening preferences for ID speech lead them to maintain longer attention to labels produced in ID speech while they are associating sounds with meanings, and this may contribute to superior learning of ID labels. Alternatively, infants may not exhibit a preference or increased attention for ID labels, but may still learn them more readily than AD labels. There may be differences in the quality of learning that occurs from ID input and how it supports the association of sounds and meanings.

The Switch task also allowed us to test younger participants than in previous experiments (Golinkoff & Alioto, 1995; Ma et al., 2011) because it has low task demands and has demonstrated successful learning by 12 months of age (MacKenzie, Curtin & Graham, 2012; MacKenzie, Graham & Curtin, 2011). We predicted that young word learners would benefit from ID prosody as they attempted to learn new object labels. We tested 17-month-old infants because they have previously shown difficulty learning non-ID object labels in a similar version of the task (Graf Estes et al., 2007). There is evidence that infants around 17 months of age prefer ID speech over AD speech, at least in their own mothers' voices (Glenn & Cunningham, 1983). However, the preference in this age group has not been widely tested or replicated, and other studies indicate that the ID speech preference wanes before 17 months (Newman & Hussain, 2006). It is also not yet clear whether ID speech affects learning in 17-month-olds, though Ma et al. (2011) found that ID speech facilitates learning in infants several months older.

In this series of experiments, we examined how prosodic characteristics of ID speech affect how readily infants learn new object labels. The labels were produced in isolation, but maintained prosodic characteristics of ID speech, such as the high pitch and wide pitch range.

In Experiment 1, we established a set of label-object pairs that infants found difficult to learn when they were presented in AD prosody. In Experiment 2, we tested infants' learning of the same labels when they were presented in ID prosody. Experiment 3 probed what features of ID prosody affect learning, focusing on the role of prosodic variation.

EXPERIMENT 1

Experiment 1 examined infants' learning of a set of object labels in AD speech. Infants were habituated to two label-object pairs, and then tested on their ability to detect violations of the pairings. In previous experiments, infants failed to learn the same label-object associations when they were produced in a monotone speaking style (unless they had previously segmented the words using statistical word segmentation cues; Graf Estes et al., 2007). Here, we expected infants to fail to learn the labels when presented in AD speech.

METHOD

Participants

There were 28 participants (13 female) with a mean age of 17.5 months (*SD* = .25; range: 16.9–17.9 months). All infants were born full-term, had no history of chronic ear infections, and no history of hearing or vision problems. To participate in this experiment and the subsequent experiments, infants were required to come from homes in which English was the primary language spoken. If infants were exposed to a second language, they must hear less than 25 h per week to be included in the study. In Experiment 1, three infants had some exposure to a second language (*M* exposure = 2.4 h/week). The findings remain the same when these infants are excluded from the analyses. All infants were tested at the University of California, Davis. Fourteen additional infants were excluded due to fussiness (e.g., crying; $n = 12$), inattention (i.e., trying to move off of the parent's lap, $n = 1$), or parental interference ($n = 1$). In all experiments, the experimenter recorded information about the infant's eligibility for inclusion before inspecting the data.

Stimuli

Auditory stimuli

To guard against the possibility that label learning patterns were due to infants' idiosyncratic preferences for particular labels, there were two label conditions. In Condition 1, the labels were *timay* and *dobu*; in Condition 2 the labels were *gabu* and *nomay*. Infants were randomly assigned to the label conditions.

TABLE 1
Acoustic Characteristics of the Labels Presented with AD Prosody (Experiment 1) and ID Prosody (Experiments 2 and 3).

	M F0 (Hz)	*SD F0 (Hz)*	*Range F0 (Hz)*	*M Duration (sec)*	*SD Duration (sec)*
AD labels	189.7	15.2	69.1–303.4	.826	.13
ID labels with variation	271.9	44.4	80.2–521.5	1.002	.10
ID labels without variation	310.9	5.7	91.6–499.5	1.034	.11

Notes. Fundamental frequency (F0) is an indicator of voice pitch. In all experiments, the stimuli were amplified to the same root-mean-square amplitude using Adobe Audition software. They were presented at 65 dB ± 5 dB, as measured by a digital sound level meter located at the infant's head.

A female speaker was instructed to produce the labels as if she were speaking to an adult. There were three distinct tokens of each label with different pitch contours and durations. Acoustic analyses of the stimuli are shown in Table 1. Each label repetition was separated by 800 msec of silence and the three-token sequence repeated for the duration of the trial (up to 20 sec). In this experiment and the subsequent experiments, the stimuli were amplified to the same root-mean-square amplitude using Adobe Audition software. They were presented at an amplitude of 65 dB ± 5 dB, as measured by a digital sound level meter at the location of the infant's head. The same tokens of the labels were used during habituation and testing.

Visual stimuli

The two novel objects that received labels are shown in Figure 1. The objects were designed to be visually complex and highly discriminable (i.e., different shapes and textures). Object 1 was displayed at a size of 5.5″ × 7″. Object 2 was displayed at 7″ × 5″. Each object moved from left to right on a black background at the center of the screen while its associated label played. The timing of the labels was not linked to the object's movement.

Apparatus and procedure

Each infant was tested in a sound-attenuated booth. The infant was seated on a parent's lap or on a booster seat approximately 3′ from a large

Object 1 Object 2

Figure 1 Novel objects that received labels. Object 1 was labeled *dobu* or *gabu* (label condition 1 versus 2, respectively). Object 2 was labeled *timay* or *nomay* (label condition 1 versus 2, respectively).

television with integrated speakers. The video feed from a camera positioned below the screen was displayed to an experimenter located outside of the booth. To prevent bias, the experimenter was blind to the identity of the stimuli being presented and the parent listened to music on headphones.

We used a modified version of the Switch Task (Werker et al., 1998) to test infants' learning of label-object associations. The program Habit X (Cohen, Atkinson & Chaput, 2004) was used to present the stimuli and record infants' looking times. Before the start of each trial, a cartoon video played to direct the infant's attention to the screen. When the infant looked at the screen, the experimenter triggered the start of a trial by depressing a button on the computer running Habit. Infants first participated in a familiarization trial that was intended to help them become accustomed to the audio and visual stimuli presentation before the start of the label-object association task. In the trial, infants saw a computer-animated rotating gray screen and heard repetitions of the syllable *neem*.

During the habituation phase, the infant viewed the two label-object combinations, presented one at a time in a pseudo-random order (with the constraint that no combination appeared more than twice in succession). Trial duration was infant-controlled; the stimulus continued to play until the infant looked away for at least 1 sec or for a maximum of 20 sec. The trials continued until the infant met the habituation criterion, defined as a looking time decrement of 50% on the last three trials compared to the first three trials. If the infant failed to habituate, they viewed a maximum of 25 habituation trials.

The test trials began immediately following the habituation trials. There were two types of test trials. In the *same* test trials, the original label-object pairings were maintained. In the *switch* test trials, the original label-object pairings were violated (e.g., object 1 appeared with label 2). There were four trials of each type, presented in two test blocks (Graf Estes et al., 2007). For half of the infants, the first test block consisted of two same test trials followed by two switch test trials. For the other half of the infants, the first test block consisted of two switch test trials followed by two same trials. In the second test block, the trials repeated in the same order. We presented pairs of each trial type together and presented two blocks of test items to maximize the stability of infants' responses. Preliminary analyses of infants' looking time on same versus switch trials indicated that there were no significant differences across blocks or across orders. Therefore, all analyses are collapsed across test blocks and test orders. The rationale behind the Switch Task is that if infants learned the original label-object associations, they should look significantly longer on the switch test trials in which those associations are violated.

RESULTS AND DISCUSSION

The mean number of trials to reach the habituation criterion was 11.2 trials (SD = 4.6) and the mean total time to reach habituation was 118.6 sec (SD = 59.2). One infant failed to habituate; the pattern of results is unchanged with this participant excluded. To examine infants' label learning performance, we performed a 2 (Label condition: *gabu*/*nomay* versus *timay*/*dobu*) $\times$ 2 (Test trial type: same trials versus switch trials) mixed ANOVA. There was no main effect of label condition ($F < 1$), indicating that there was no difference between the two sets of label pairs. There was also no main effect of trial type ($F(1, 26) = 1.08$, $p = .309$, $\eta_p^2 = .040$), or an interaction of trial type by label condition ($F < 1$). Looking time performance is shown in the left panel of Figure 2. The lack of a significant switch test trial preference indicates that there is no evidence that infants learned the labels when they were presented in AD prosody. This replicates 17-month-olds' difficulty learning the same labels in monotone prosody (Graf Estes et al., 2007).

Given that infants controlled the duration of their exposure to the label-object associations, it is possible that infants with greater exposure tend to show a greater difference in looking time to same test trials versus switch test trials. To test this idea, we determined infants' looking time difference scores to same versus switch test trials, calculated as [M switch trial looking time] − [M same trial looking time]. We examined the correlations between infants' looking time difference scores and number of trials to reach habituation and total time to reach habituation. The correlation between looking time difference score and trials to reach habituation was not significant, $r(26) = .079$, $p = .689$, nor was the correlation between looking time difference score and time to reach habituation, $r(26) = .141$, $p = .475$. The results of Experiment 1 indicate that infants do not show evidence of learning these label-object pairings in AD prosody and infants' attention

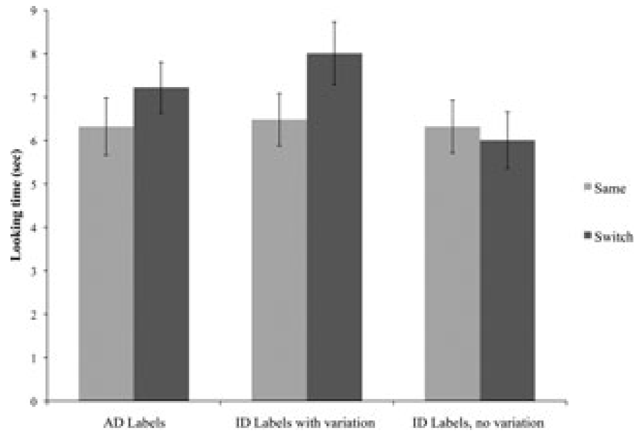

Figure 2 Mean looking time on Same versus Switch test trials for infants presented with labels in AD prosody (Experiment 1; left panel), ID prosody with variation (Experiment 2; middle panel), and ID prosody without variation in tokens (Experiment 3; right panel). Error bars represent standard errors.

during habituation is unrelated to label-learning performance. Experiment 2 tests whether presenting the labels with ID prosody promotes learning.

EXPERIMENT 2

One of the proposed roles of ID speech is to elicit and maintain infants' attention. The attentional effects of ID speech may facilitate learning even when it does not provide additional structural information, such as enhanced word segmentation cues or phrase-level information. As in Experiment 1, infants heard repetitions of object labels produced in isolation. In Experiment 2, the labels were presented in ID prosody. We predicted that presenting the identical labels in ID prosody would allow infants to learn the labels. We also compared the duration of infants' attention to the ID versus AD labels during habituation to examine the role of the ID speech listening preference in word learning.

METHOD

Participants

Seven 17-month-old infants participated at the University of California, Davis (UCD) and 19 infants participated at the University of Wisconsin—Madison (UWM; *M* age = 17.4 months, *SD* = .24; range = 17.0–17.9 months). There were 13 males and 13 females, randomly assigned to the two label conditions. All infants were from homes in which English was the primary language. Three infants had some exposure to a second language (*M* exposure = 15.3 h/week). The findings remain the same if these infants are excluded from the analyses. Eight additional infants were excluded due to fussiness. The infants met the same inclusion criteria as described in Experiment 1.

Stimuli

The objects and labels were the same as in Experiment 1, and the same speaker produced the labels. She was instructed to produce the words as if she were speaking to an infant. Consistent with the characteristics of ID prosody, the labels were longer in duration, higher in overall pitch (as measured by fundamental frequency, F0), and had greater pitch ranges than the AD labels. There were three distinct tokens of each label, with different pitch contours and durations. Acoustic analyses of the labels are shown in Table 1. Each label repetition was separated by 800 msec of silence and the three-token sequence repeated for the duration of the trial (up to 20 sec). The stimuli were normalized for amplitude and were presented at 65 dB $\pm$ 5 dB. The same tokens of the labels were used during habituation and testing.

As the labels were produced in isolation, they lacked some of the typical characteristics of ID speech. To ensure that the labels were perceived as sounding infant-directed, we collected judgments from a set of 10 adults. They rated the labels on a scale of 1 (speech directed to an infant) to 7 (speech directed to an adult). The ID labels were rated significantly lower (i.e., more infant-directed; $M = 1.82$; $SD = .74$) than the AD labels ($M = 5.68$, $SD = .76$), $t(9) = 9.2$, $p < .001$.

Procedure

We used the same procedure as described in Experiment 1. The first author oversaw testing in both locations, and the procedures were the same in both locations. There were some minor differences in the testing apparatus. At UCD, infants viewed the objects on a 42″ television with integrated speakers (described in Experiment 1) and the objects were displayed at the same size as in Experiment 1. At UWM, infants viewed the objects on a 17″ computer monitor connected to external speakers and the objects were displayed at a size similar to Experiment 1 (1″ smaller in each dimension). As in Experiment 1, preliminary analyses indicated that there were no significant differences in performance across test blocks or across test orders. Therefore, we collapsed across these factors in the subsequent analyses.

RESULTS AND DISCUSSION

To ensure that performance did not differ across test locations, we performed an independent-samples t-test comparing "infants' looking time" difference scores to same versus switch trials at UCD versus UWM. Participants tested in the two locations did not differ (UCD: $M = 1.35$, $SD = 3.25$; UWM: $M = 1.59$, $SD = 2.83$), $t(24) = .177$, $p = .861$, $d = .08$. We collapsed across test location in all subsequent analyses.

The infants reached the habituation criterion with a mean of 10.3 trials ($SD = 4.4$) and a mean total time to habituate of 110.0 sec ($SD = 73.6$). All the infants met the habituation criterion. One advantage of using the Switch task to teach novel labels is that we can analyze the duration of infants' attention to the label-object pairings during learning (i.e., habituation). We used this value as a measure of whether they preferred some types of labels over others. A prediction based on listening preference findings is that during habituation, infants might provide themselves with additional exposure to ID labels relative to AD labels. A difference in exposure could be responsible for any difference in label learning performance. To test this possibility, we compared infants' number of trials to reach the habituation criterion and the time to reach habituation across the ID speech (Experiment 2) and AD speech (Experiment 1) tasks. A pair of independent samples t-tests revealed no significant differences in the duration of exposure to the labels in the number of trials ($t(52) = .741$, $p = .462$, $d = .24$) or time to habituate ($t(52) = .472$, $p = .639$, $d = .13$).

Given the difference in speaking rate for ID and AD prosody, the durations of the ID labels were longer than the AD labels. This is important because infants could have heard more repetitions of the AD labels than the ID labels given the same amount of habituation time. Although greater exposure would seem to promote the learning of the AD labels (in contrast to the present findings), we must establish whether or not infants had equal exposure to the labels across experiments to interpret the relationship between infants' attention and label learning. For each infant[1], we calculated the number of repetitions of a given label by dividing the looking time on each habituation trial by the labeling rate, then summing across trials. The labeling rate equaled the average duration of the label's tokens plus the silent interval (.8 sec) between repetitions (e.g., for *dobu* in Experiment 2, the rate was 1 repetition per 1.77 sec). Despite the difference in label durations across Experiments 1 and 2, these calculations revealed that the total number of repetitions infants heard of the AD

[1]Trial-by-trial habituation data were unavailable for 4 infants in Experiment 2. They were excluded from all analyses based on individual habituation trials.

labels ($M = 70$, $SD = 35$) was not significantly greater than the number of repetitions infants heard of the ID labels ($M = 59$, $SD = 42$), $t(48) = 1.0$, $p = .31$, $d = .29$.

In addition, we compared the duration of the first three trials of the habituation phase across the ID and AD speech experiments. These trials set the habituation criterion and therefore play a large role in determining the duration of infants' exposure to the stimuli during habituation. The analysis allowed us to examine whether or not infants had any initial attentional biases toward the labels presented in ID speech that were not maintained over the entire habituation phase. We found no difference in the total looking time across the first three habituation trials between the infants who heard ID labels ($M = 39.9$ sec, $SD = 14.6$) versus AD labels ($M = 39.9$ sec, $SD = 14.5$), $t(48) = .004$, $p = .996$, $d = 0$.

To examine infants' learning performance for the ID labels, we conducted a 2 (Label condition: *gabu/nomay* versus *timay/dobu*) × 2 (Test trial type: same trials versus switch trials) mixed ANOVA. There was no main effect of label condition ($F < 1$), indicating that there was no difference between the two sets of label pairs. There was also no significant interaction of label condition by trial type ($F < 1$). However, there was a main effect of trial type, $F(1, 24) = 6.95$, $p = .014$, $\eta_p^2 = .23$. As shown in the middle panel of Figure 2, infants presented with ID labels looked longer on switch test trial than on same trials, indicating that they learned the label-object associations. We found that infants learned new words presented in ID prosody that they had not appeared to learn when the words were presented in AD prosody. Thus, even when ID speech did not provide supplemental lexical or grammatical cues, the prosodic characteristics of isolated words were sufficient to support infants' association of words with their referents.

We examined the relationship between the duration of infants' attention to the label-object associations and their label learning performance, as evaluated by their looking time difference scores to same versus switch test trials. Similar to Experiment 1, in Experiment 2 we did not find any correlations between infants' looking time difference scores and number of habituation trials ($r(24) = -.089$, $p = .666$) or time to habituate ($r(24) = -.073$, $p = .724$). Using the label repetition calculations described above, we also found that label learning performance did not correlate with the number of label repetitions in Experiment 2 ($r(20) = -.09$, $p = .677$), or in Experiment 1 ($r(26) = .15$, $p = .452$).

When infants were presented with label-object associations, they did not attend significantly longer to ID labels than to AD labels, did not differ in the number of label repetitions they heard, and greater exposure during habituation was not associated with a larger switch test trial preference.

Other studies using versions of the Switch task have also found that infants can display differences in learning despite similar habituation patterns (e.g., Graf Estes et al., 2007; MacKenzie et al., 2012; Thiessen, 2007). Thus, although there is no difference in the duration of attention to the label-object associations, there may be differences in the quality of attention or how readily the ID and AD labels support the formation of sound-meaning associations. We will return to this topic in the General Discussion.

Across Experiments 1 and 2, we found no evidence that infants learned new label-object associations presented in AD speech, but they learned the same labels when they were presented in ID speech. To specifically address whether there was a difference in the magnitude of the learning effect (i.e., the preference for switch test trials over same test trials) for ID labels versus AD labels, we analyzed performance across experiments in a 2 (Experiment: 1 [AD speech] versus 2 [ID speech]) × 2 (Trial type: same versus switch) mixed ANOVA. There was a main effect of trial type, $F(1, 52) = 6.44$, $p = .014$, $\eta_p^2 = .110$, indicating that infants looked longer on switch test trials than same test trials. We found no main effect of experiment and no interaction (both F's < 1). In both experiments, infants tend to look longer on switch test trials than on same trials. However, the findings from each experiment showed that infants only looked reliably longer to switch test trials when they heard ID labels, indicating that infants presented with ID labels learned the label-object associations. The performance of infants presented with AD labels did not indicate that they learned them. The divergent learning patterns here suggest that infants are able to learn labels in ID prosody, but do not readily learn the same labels in AD prosody.

It is theoretically possible that the patterns of performance for ID versus AD labels were produced by differences in the underlying causes or levels of habituation across Experiments 1 and 2. That is, infants may have habituated because they learned the ID labels, but habituated due to boredom when they heard AD labels. We do not have data from posttest trials (see examples in Werker et al., 1998, 2002) available to eliminate the possibility that a lack of interest in the AD labels led to infants' failure to reliably distinguish between same and switch test trials. However, we do not believe that this accounts to the observed patterns of results for the following reasons. First, there were no significant differences between Experiments 1 and 2 in the amount of time to reach habituation, the number of trials to reach habituation, the number of label repetitions, or infants' attention during the first three habituation trials. These data all suggest that the stimuli did not differ in how long they maintained infants' interest during habituation and that infants habituated to approximately the same degree in the two experiments. Second, the ANOVA comparing Experiments 1 and 2 did not reveal that infants who heard AD labels had shorter looking time durations during test trials than infants who heard ID labels (i.e., there was no main effect of experiment on looking time). If the infants who heard AD labels were more habituated or less interested at the end of habituation, we would expect them to show shorter looking times during habituation and testing. As such differences were not observed, it does not seem likely that the lack of dishabituation to switch trials in Experiment 1 was caused by deeper levels of boredom. Rather, the lack of dishabituation suggests that the infants presented with AD labels did not detect when the label-object pairings they viewed repeatedly during habituation were switched. In contrast, infants presented with ID labels did dishabituate when the pairings were switched.

EXPERIMENT 3

Ma et al. (2011) demonstrated that ID speech facilitates learning when labels are embedded in sentences. Experiment 2 showed that ID speech also promotes learning when words are presented in isolation. The prosodic patterns of ID words are sufficient to facilitate learning of new sound-meaning associations. It is not yet clear what characteristics of the ID labels promoted learning. The ID labels were longer, higher pitched, and had greater pitch variation than the AD labels. In addition, even though both sets of labels included tokens that differed acoustically, the exaggerated prosody made the ID tokens more distinct and potentially more informative than the AD tokens. Several recent experiments have demonstrated that variation can have substantial effects on early lexical processing. Rost and McMurray (2009, 2010) reported that variation in surface form characteristics (i.e., speakers' voices) affects how readily infants form label-object associations when the labels are minimal pairs. Singh (2008) found that variation in surface form (i.e., speaker's affect) also helps infants recognize words in fluent speech (see also Houston, 1999). Given the recent findings regarding variation and early learning about words, we examined whether variation in the ID labels was crucial for supporting label learning. In Experiment 3, we removed the variation across tokens; infants heard a single token of each label repeated throughout the task, rather than the three distinct tokens of each label used in Experiment 2.

Participants

There were 28 participants (14 females) with a mean age of 17.4 months (*SD* = .49; range 16.5–18.3 months). The infants met the same inclusion criteria as in the previous experiments. All infants were from homes in which English was the primary language; two infants had some exposure to a second language (*M* exposure = 20 h/week). The findings remained the same when these infants were excluded from the analyses. All infants were tested at UCD. They were randomly assigned to the two label conditions. An additional eight infants were excluded due to fussiness ($n = 6$) or inattention (i.e., trying to get off of parents' lap, $n = 1$; playing with parent's headphones and looking at the back of the room, $n = 1$).

Stimuli

We used the same labels and objects as in the previous experiments. In this experiment, each object was labeled with repetitions of a single token of the ID stimuli. For each label, we used the first token from the stimuli used in Experiment 2. The acoustic characteristics of these labels are shown in Table 1. Similar to the stimuli used in Experiment 2, the labels in Experiment 3 had a longer duration, higher average pitch, and a wider pitch range than the AD labels in Experiment 1. Each label token was copied and repeated with each repetition separated by 800 msec of silence, forming a sequence that lasted for the maximum trial duration (20 sec). The same token was used during habituation and testing.

Procedure

We used the same procedure as described in Experiment 1. Preliminary analyses indicated that there were no significant differences across test blocks or across test orders. We collapsed across these factors in the subsequent analyses.

RESULTS AND DISCUSSION

The infants reached the habituation criterion with a mean of 10.6 trials ($SD = 5.6$) and a mean total time to habituate of 101.2 sec ($SD = 58.0$). Two infants failed to habituate; the patterns of results are unchanged by excluding these participants. The analyses of habituation patterns revealed that there was no significant difference in the number of trials to reach habituation between infants presented with the ID labels with variation (Experiment 2) and the ID labels without variation (Experiment 3), $t(52) = .193$, $p = .848$, $d = .05$. There was also no difference in the time to reach habituation across experiments, $t(52) = -.492$, $p = .625$, $d = .13$.

Infants heard an average of 56 repetitions of the ID labels without variation ($SD = 38$), which was not significantly different from the repetitions of ID labels with variation (M = 59, SD = 42), $t(48) = .238$, $p = .813$, $d = .08$. Thus, infants did not provide themselves with less exposure to ID labels without variation than to ID labels with variation. In the final habituation analyses, we compared the total duration of infants' attention in the first three habituation trials across Experiments 2 and 3 to examine whether there were differences in infants' initial attention to the ID labels with variation (M = 39.9 sec; SD = 14.4) and without variation (M = 37.3 sec; SD = 14.6) at the start of the task. Like the comparison of Experiments 1 and 2, the difference was not significant, $t(48) = .668$, $p = .507$, $d = .18$. The analyses of habituation performance do not indicate that infants attended longer to ID labels with variation than ID labels without variation, suggesting that this is not responsible for the learning patterns found across experiments.

To examine infants' learning performance for ID labels without variation, we performed a 2 (Label condition: *gabu/nomay* versus *timay/dobu*) × 2 (Test trial type: same trials versus switch trials) mixed ANOVA. There was no main effect of label condition, no main effect of trial type, and no interaction of trial type by label condition (all F's < 1). Looking time performance is shown in the right panel of Figure 2. Based on their performance on the same and switch test trials, there was no indication that the infants learned when there was minimal variation in the ID labels. The findings suggest that variation plays a role in the effectiveness of ID speech. It also demonstrates that even a small amount of variation has significant effects on word learning. The difference in labels between Experiments 2 and 3 is three tokens versus one token, respectively.

As in the previous experiments, there were no significant correlations between infants' looking time difference scores to same versus switch test trials and the number of trials to reach habituation ($r(26) = .174$, $p = .377$) or time to reach habituation ($r(26) = .210$, $p = .284$). There was also no significant correlation with the number of label repetitions $r(28) = .32$, $p = .100$. Infants with greater exposure to the labels did not show reliably stronger label learning performance.

To compare the magnitude of the learning effect (i.e., the switch test trial preference) for ID labels with variation versus ID labels without variation, we performed a 2 (Experiment: 2 versus 3) × 2 (Trial type: same versus switch) mixed ANOVA of infants' looking time. The main effect for trial type was not significant, $F(1, 52) = 2.74$, $p = .104$, $\eta_p^2 = .050$, nor was the main effect for experiment, $F(1, 52) = 1.65$, $p = .204$, $\eta_p^2 = .031$. There was a significant interaction of trial type by experiment, $F(1, 52) = 6.28$, $p = .015$, $\eta_p^2 = .108$. As shown in the analyses for Experiment 2 and Experiment 3, infants presented with ID labels with variation showed a significant preference for switch test trials over same trials, whereas infants presented with ID labels without variation did not. Despite similar amounts of exposure to the labels, infants only learned them when they were presented in ID prosody with variation, not when there was a single repeated token of each label.

GENERAL DISCUSSION

In this series of experiments, we found that 17-month-old infants learned novel object labels when they were presented in ID prosody, but displayed no evidence of learning the same labels when they were produced in AD prosody. Infants also did not display learning when the labels were produced in ID prosody without variation across tokens. Importantly, the labels occurred in isolation, rather than in fluent speech. Thus, the ID labels lacked many of the structurally informative characteristics of ID speech, such as shorter utterances, enhanced repetition, and longer pauses. Our findings indicate that ID speech can facilitate learning without these features. Rather, the prosody of ID labels—in particular, the prosodic variation included in ID speech—is sufficient to promote the formation of new sound-meaning associations. These results suggest a novel conclusion about the important characteristics of ID speech. The variation in ID speech seems to be crucial for promoting learning.

The present findings expand on the recently emerging literature demonstrating that ID speech can affect how infants learn. Singh et al. (2009) and Thiessen et al. (2005) have shown that ID speech facilitates infants' ability to detect words in continuous speech. Ma et al. (2011) recently reported that 21-month-olds learn labels more effectively from ID passages than from AD passages. From Ma et al.'s experiments, it was not yet clear whether ID speech affects word learning through its facilitation of word segmentation, or whether it can specifically ease the process of forming new label-object associations. Our results indicate that sentence-level ID speech characteristics are not necessary for ID speech to promote learning. Hearing varied tokens of ID labels produced in isolation supports young word learners' ability to learn new object labels.

ID speech has the potential to affect language acquisition in myriad ways (Fernald, 1985, 1992; Kaplan et al., 1996, 2002; Thiessen et al., 2005; Zangl & Mills, 2007). The present experiments investigated two ways that ID speech could affect word learning, focusing on the role of attention to ID speech and the role of prosodic variation. We first address the findings regarding attention, followed by a discussion of the effects of variation.

Across experiments, infants showed different patterns of learning for ID labels versus AD labels or ID labels with versus without variation, but did not display differences in the amount of time required to habituate to the label-object pairs. Despite the infant-controlled learning phase, infants did not provide themselves with greater exposure to the ID labels, and stronger learning was not correlated with longer attention during habituation or the number of label repetitions. Thus, the listening preference that has been reported at many ages (e.g., Cooper & Aslin, 1990; Fernald, 1985; Werker et al., 1994) did not occur when novel objects were present, indicating that it did not drive the differences in learning performance (see also Hayashi et al., 2001; Newman & Hussain, 2006; for additional evidence of an absence of preference at some ages). Furthermore, although there is one study indicating that infants around 17 months of age prefer ID speech to AD speech in non-labeling tasks (Glenn & Cunningham, 1983), it is possible that this preference is no longer as strong as it is for younger infants. Perhaps younger infants with more robust ID speech preferences would show stronger associations between learning and duration of attention.

Given that infants did not seem to prefer the ID labels over the AD labels, how do our findings regarding attention during habituation fit with descriptions of the role of ID speech in learning? Thiessen et al. (2005) proposed that in statistical word segmentation, ID prosody promotes infants' attention to the speech signal, which may then promote the detection of patterns of associations between syllables. Based on young infants' ability to learn associations between visual stimuli and ID speech passages, Kaplan and colleagues (Kaplan et al., 1996, 2002) have suggested that ID speech primes infants for learning, making them more susceptible to detecting and storing associations. Our evidence suggests that infants may not attend longer when they are presented with label-object associations in ID speech, but there may be differences in the quality of attention and learning. During the habituation phase, the infants who heard AD labels or ID labels without variation learned enough about the labels and objects to habituate to them, but not enough to detect when the pairings of familiar objects and familiar labels were violated during testing. Infants who heard ID labels with prosodic variation displayed similar amounts of attention to the labels during habituation, but demonstrated more thorough learning. The specific nature of the difference in quality of learning is not yet clear, but our findings indicate that by 17 months, the effects of ID speech on learning are not solely driven by attentional preferences.

A novel conclusion from this series of experiments is that the variation present in ID speech is important for learning. When infants heard repetitions of a single ID token for each label, they failed to learn the labels. When they heard three tokens of each label, they learned them. When the labels were presented with moderately variable AD tokens, infants also failed to learn them. Thus, the variation in ID speech that comes from its exaggerated pitch patterns may play a key role in how ID speech supports learning. One possible account of the effects of variation in ID speech on label learning is linked to the role of attention. Hearing labels with minimal or no variation may cause infants to "tune out" the auditory signal. As discussed above, variation may not always determine the duration of infants' attention, but may affect its quality. Fernald and Kuhl (1987; see also Vihman, 1996) proposed that, as in visual attention, auditory processing may be motivated by a general preference for dynamic, changing stimuli over static, consistent stimuli. ID speech provides a dynamic signal, with its wide pitch ranges and exaggerated pitch contours. These characteristics were present in the ID labels with variation in Experiment 2. The ID labels without variation in Experiment 3 maintained a wide pitch range and exaggerated contour within the single repeated token, but the labels lacked the contrast that occurs across words in natural ID speech and that occurred in the ID labels with variation. Fernald and Kuhl explained that contrast may be important for promoting attention, thereby increasing neural activity and facilitating learning. More recently, Zangl and Mills's (2007) ERP findings confirmed that hearing words in ID speech increases infant's neural activity relative to words in AD speech. They also proposed that increased activity to ID speech could encourage word learning. Consistent with Fernald and Kuhl's explanation for infants' ID speech preference, the results of the present study indicate that the dynamic and varied speech that infants often hear provides them with an excellent learning signal. Furthermore, although substantial prosodic variation is a more typical characteristic of ID speech than AD speech, AD speech with exaggerated variation and contrast could also help infants learn. This possibility remains to be tested.

Our findings regarding the effects of prosodic variation in ID speech add to a growing literature investigating the role of variation in language acquisition. For example, variation in speakers' voices (Rost & McMurray, 2009, 2010) and in phonological contexts (Thiessen, 2007, 2011) helps infants learn minimal pair object labels. Variation in vocal affect allows younger infants' word recognition to be more robust and flexible (Singh, 2008). Lexical and speaker variation facilitate adults' learning of difficult foreign language phoneme contrasts (e.g., Lively, Logan, & Pisoni, 1993). These studies illustrate one way variation affects learning: it acts to highlight what is constant amidst the change, allowing learners to discriminate confusable categories or to generalize beyond surface form acoustic details such as a speaker's voice. Our findings raise the possibility that variation can also affect word learning when words are phonetically dissimilar and generalization is not necessary. In the present experiments, the labels did not overlap phonetically (though all labels were bisyllabic with first syllable stress), and no generalization was required to display learning because the labels used in testing also occurred during habituation. Acoustic variation, such as the variation in ID speech, could promote the formation of robust phonological representations, meaning representations that are encoded thoroughly, stored with phonetic detail, and are flexible and generalizable during word recognition. Strong phonological representations may allow young learners to associate word forms with meanings easily because they can apply their limited computational resources to linking word forms with their referents, rather than spending resources on processing phonological structure (Werker & Curtin, 2005). This account for our findings produces the prediction that variation should support the formation of phonological representations that are more precise and flexible than words presented without variation. Therefore, for ID labels learned from prosodically varying tokens (or other forms of acoustic variation), infants should be sensitive to changes in individual phonemes (Swingley & Aslin, 2000, 2002), and should be able to recognize words across changes in surface form characteristics, such as a speaker's voice (Schmale, Cristia, & Seidl, 2012). Many types of acoustic variation are likely to be beneficial in language acquisition. Future experiments will explore the range of the types of variation that promote learning.

Going beyond the effects of attention and variation on learning, there are several other factors that could have contributed to the differences in performance across AD labels and ID labels with and without variation. Although our labels were produced in isolation, they included several acoustic dimensions of ID speech that could affect learning. The ID labels in Experiment 2 differed from the AD labels in duration, overall pitch, and pitch variation. Our acoustics analyses of the differences were validated by adults' judgments confirming that the ID labels sounded more infant-directed than the AD labels. Another consideration is that some phoneme contrasts tend to be exaggerated in speech to infants, making phonemes more distinct than they are in AD speech (e.g., Kuhl et al., 1997). The ID and AD labels were all clearly pronounced; this was confirmed by a set of fully accurate adult transcriptions (n = 8) of the labeling stimuli. The labels were also not highly confusable because they had no phonetic overlap (e.g., *timay* and *dobu*). However, ID hyperarticulation could play a role in the infants' performance by facilitating the formation of phonological representations for new words. When starting with strong phonological representations, infants may have greater attentional resources available to focus on mapping the sounds of words to their referents (e.g., Werker & Curtin, 2005). Other acoustic characteristics of ID speech may also affect word learning in this way (as described above in the discussion of variability in label learning). It is not yet possible to determine specifically which factors supported learning of the ID labels, but not the AD labels. Additional experiments will be necessary to investigate the independent roles of salient ID speech characteristics such as overall pitch, pitch range, pitch contour variation, speaking rate, and phoneme distinctiveness.

An alternative approach to understanding the differences in label learning across this set of experiments comes from considering how ID speech affects infants' interpretation of word learning contexts, rather than their interpretation of words' acoustic characteristics. The Switch task lacks many of the referential cues present in natural labeling interactions, such as eye gaze, pointing, and common labeling phrases. The design allows for a controlled means of examining influences on infants' learning of label-object associations that might otherwise be obscured. However, Fennell and Waxman (2010) found that 14-month-olds were able to learn minimal pair object labels that differed by a single phoneme (e.g., *bin* and *din*) in the Switch task when it was designed to highlight the referential event. They provided sentential labeling cues or contextual cues with familiar object names within the task. Without referential cues, 14-month-olds frequently do not display learning of minimal pair labels (e.g., Werker et al., 2002). Thus, when the referential context is clear, infants learn words more effectively than when the context is ambiguous. In the present experiments, the ID labels with variation may have provided referential context; because of the speaking style, it was similar to infants' prior history with labeling events. At 17 months, infants have ample experience with ID speech as an important communicative signal, one that frequently directs their attention and actions (Kitamura & Lam, 2009). AD labels may not match as closely with infants' expectations about labeling events and may fail to readily support the formation of sound-meaning associations (but see Thiessen, 2007, 2011). Similarly, ID labels produced without variation may present an artificial label-learning environment that inhibits learning. This explanation suggests that enriching the referential cues in the task should allow infants to learn AD labels and ID labels without variation.

In addition, it is possible that infants who are slightly older than our participants may show successful learning of label-object associations produced in AD speech (or ID labels without variation). Ma et al. (2011) found that 27-month-olds, but not 21-month-olds learned novel words from passages of AD speech. There may be a similar developmental effect for infants presented with isolated tokens of ID versus AD labels in the Switch task. Furthermore, infants who are younger than our participants (e.g., 12- to 14-month-olds) may be even more reliant on ID speech to learn labels than 17-month-olds. In our findings, there are some indications that 17-month-olds may be on the cusp of learning flexibly from AD speech. Infants who heard AD labels tended to look longer on switch test trials than same trials, although the difference was not statistically reliable. There was also no significant difference in the magnitude of the switch trial preference across Experiments 1 and 2. It may be possible to reveal successful learning of labels in both ID and AD speech by using a more sensitive measure of learning, such as the task that integrates habituation with a visual choice test measure designed by Yoshida, Fennell, Swingley and Werker (2009). Infants may still differ in the ease or robustness of learning between ID and AD labels, a difference that will require nuanced measures of acquisition to detect.

In conclusion, the present experiments demonstrate that ID speech can promote word learning even when it does not provide word segmentation or other supplemental cues to linguistic structure. The exaggerated prosody of ID speech produced with variation is sufficient to facilitate the learning of new sound-meaning associations. Although infants did not attend longer to labels in ID prosody than to labels in AD prosody, they learned ID labels readily, but did not display learning of the AD labels. The results also indicate that the variation that comes with the exaggerated prosody of ID speech may play a key role in how ID speech affects learning. When ID labels lacked variation, infants did not learn the labels. In the multitude of studies that have presented new words in ID speech, infants may have benefitted greatly from hearing labels produced in ID speech with variation, even when speaking register was unrelated to the ideas under investigation. The findings, explanations, and predictions we have set forth illustrate the broad range of ways that ID speech can shape language acquisition.

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