

Research Report

SOME BEGINNINGS OF WORD COMPREHENSION IN 6-MONTH-OLDS

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Abstract—Previous studies of infants' comprehension of words estimated the onset of this ability at 9 months or later. However, these estimates were based on responses to names of relatively immobile, familiar objects. Comprehension of names referring to salient, animated figures (e.g., one's parents) may begin even earlier. In a test of this possibility, 6-month-olds were shown side-by-side videos of their parents while listening to the words "mommy" and "daddy." The infants looked significantly more at the video of the named parent. A second experiment revealed that infants do not associate these words with men and women in general. Infants shown videos of unfamiliar parents did not adjust their looking patterns in response to "mommy" and "daddy."

Learning words is critical for acquiring language. Word learning depends on component skills such as the ability to perceive and represent objects and events, the ability to extract and remember sound patterns of potential words, and some capacity to link sounds and meanings appropriately. Considerable evidence shows that even infants between 3 and 6 months of age perceive and represent some objects and events (Mandler, 1997; Quinn & Eimas, in press; Spelke, Breinlinger, Macomber, & Jacobson, 1992). As for the second skill, several recent investigations have reported that infants begin to demonstrate the capacity to segment words from fluent speech at about 8 months of age (Echols, Crowhurst, & Childers, 1997; Jusczyk & Aslin, 1995; Saffran, Aslin, & Newport, 1996). Moreover, infants at this age retain information about the sound patterns of words for as long as 2 weeks (Jusczyk & Hohne, 1997). However, when infants actually begin to link sound patterns with particular meanings is less clear.

Laboratory testing procedures typically fix the onset of word comprehension at 11 to 13 months (Oviatt, 1980; Thomas, Campos, Shucard, Ramsay, & Shucard, 1981; Woodward, Markman, & Fitzsimmons, 1994). However, it has also been shown that 9-month-olds who hear a spoken word, as opposed to a tone, paired with a particular object are more apt to attend to other objects from the same category than to ones from a different category (Balaban & Waxman, 1997). The latter age is consistent with estimates of the onset of word comprehension derived from descriptions of when infants respond appropriately to verbal commands in naturalistic or semistructured settings (Benedict, 1979; Huttenlocher, 1974). However, because previous studies focused mostly on words referring to immobile objects of varying familiarity to infants, these investigations may underestimate early word-learning abilities. It is possible that younger infants associate words with objects when these words refer to animated individuals who are socially important to them, such as their own parents.

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Infants appear to be especially attentive to sound patterns that are used in conjunction with highly salient social figures. Although they may not attach a referent to their own names yet, 4.5-month-olds listen significantly longer to repetitions of their own names than of other infants' names (Mandel, Jusczyk, & Pisoni, 1995). By comparison, they do not attend differentially to other frequently occurring words, such as "baby," until 6 months of age (Mandel & Jusczyk, 1997). Similarly, infants detect their own names in fluent speech sooner (6 months) than they can detect other kinds of familiarized words (7.5 months) (Mandel, 1996).

In the present study, we tested the hypothesis that the process of learning to associate sounds and meanings may occur sooner for words referring to salient social figures in infants' lives than for words referring to immobile objects. We examined whether 6-month-olds have learned to associate the labels "mommy" and "daddy" correctly to their own parents. We chose these labels because they are the ones parents visiting our laboratory report using most frequently. We used the intermodal preferential-looking paradigm (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987), presenting infants with side-by-side videos of their parents while audio presentations of the word "mommy" or "daddy" were played. We predicted that if the infants had already associated each of these sound patterns with the appropriate parent, they would attend longer to the video of the parent named on the audio than to the unnamed parent (i.e., when listening to repetitions of "daddy," they would look longer at the father's than at the mother's video, and when listening to repetitions of "mommy," they would look longer at the mother's video than at the father's video).

EXPERIMENT 1

Method

Participants

Twenty-four 6-month-olds (10 females, 14 males; mean age: 6 months, 11 days) from monolingual English-speaking homes were tested. Eight other infants were tested, but excluded because of crying ($n = 7$) or experimenter error ($n = 1$). Informed consent was obtained from the parents of all participants.

Procedure

Each parent was videotaped separately against a white background while watching the same videotaped news story in a small room. During testing, these videos were played on identical videotape players and monitors. A DECTalk speech synthesizer, in the voice of "Kit the Kid," produced the audio presentations of "mommy" and "daddy." This synthetic voice simulates that of a 10-year-old without discernible gender qualities. It was chosen because previous studies indicated that infants look more toward males when hearing a male voice and more toward females when hearing a female voice (Walker-Andrews, Bahrick, Raglioni, & Diaz, 1991). We surveyed the parents for the

names they used to refer to themselves. The names for mother were “mommy” ($n = 19$), “mama” ($n = 3$), and “mom” ($n = 2$); the names for father were “daddy” ($n = 20$), “dad” ($n = 3$), and “papa” ($n = 1$).

During testing, each infant sat on a parent’s lap facing a white wall with openings for two television monitors, a video camera, and a speaker. The parent wore a visor with a piece of thick black felt, which blocked any view of the monitors. The experimenter stood behind the wall to control the stimulus presentation and viewed the infant through the camera. She judged when the infant visually fixated a blinking orange light located between the television monitors to initiate a trial, raised and lowered an opaque screen that concealed the monitors from the infants’ view between trials, and signaled the computer for the next trial. Both the parent and the experimenter were blind to the conditions of the video presentation. The test session was recorded on videotape for later off-line coding. The experimenter and another observer, also blind to the conditions of the video presentation, coded the videotapes of the infants’ test sessions with the sound turned off. Fixations were measured from the onset of the first to the offset of the last auditory stimulus, indicated by illumination of a small light. Reliability checks for judging the amount of time an infant was oriented to each side (Monitor 1 or 2) on each trial yielded reliability coefficients greater than .90.

Infants were tested with videos of their own mothers and fathers. The experiment had three phases: four silent pretest trials, four silent baseline trials, and eight test trials with audio presentations (four with “mommy” and four with “daddy,” randomized into two test blocks). Each trial lasted for 10 s. The silent pretest trials acquainted the infant with the location of each parent’s video (e.g., father on right, mother on left). Only one monitor was illuminated on these trials. By comparison, on silent baseline trials, both monitors were illuminated for the full trial duration. These trials served as a check on whether an infant displayed any inherent preference for one video over the other. Finally, on test trials, both monitors were illuminated, but with accompanying audio consisting of 10 acoustically varied tokens of either “mommy” or “daddy.” The auditory stimuli emanated from a loudspeaker centered below the two video monitors. Side of presentation for each parent and location of the video presented first in the pretest were counterbalanced across infants.

Results

Because infants did not always look at the video displays during test trials, data analyses were based on the proportion of time on a given trial that infants spent looking at each parent. We calculated a baseline difference score for each infant based on the mean looking times on the four silent baseline trials (positive differences = preference for the mother’s video; negative differences = preference for the father’s video). An analysis of the baseline proportional looking times indicated that 15 of the infants looked longer at the mother ($M = .281$, $SD = .249$) and 9 looked longer at the father ($M = -.434$, $SD = .207$). An unpaired t test confirmed that these groups had significantly different looking biases, $t(22) = 7.387$, $p < .001$. Consequently, for the test trials, we compared infants’ proportional looking times to the named and unnamed parents’ videos, adjusting for an infant’s preference during the silent baseline period. Therefore, the proportional looking times on the test trials (i.e., to mother’s video when named, father’s video when named, mother’s video when unnamed, and father’s video when unnamed) were divided by the corresponding proportional looking times on the silent baseline trials (i.e., to mother’s video on baseline or to father’s video on baseline).

We submitted these scores to a repeated measures analysis of variance (ANOVA) of a 2 (video: named parent vs. unnamed parent) \times 2 (test item: “mommy” vs. “daddy”) design. This analysis revealed a significant main effect of video, $F(1, 23) = 5.339$, $p < .05$. As shown in Figure 1, infants looked more at the parent being named than at the unnamed parent ($M_{\text{named}} = 1.077$, $SD = 0.473$; $M_{\text{unnamed}} = 0.921$, $SD = 0.437$). Neither the main effect of test item nor the interaction between video and test item was statistically significant. Overall, 18 of the 24 infants had longer looking times for the named than for the unnamed parent ($p < .025$ by a sign test).

Further confirmation that the infants associated each name with the appropriate parent comes from an examination of first-look data during the test trials. Across all eight trials, the tendency to look first toward the named parent did not significantly differ from chance, $t(23) = 1.320$, $p > .10$, $M = .536$, $SD = .135$. However, a finer breakdown of the data indicated that significantly more first looks were made to the named parent in the first half of the test session, $t(23) = 2.145$, $p < .05$, $M = .583$, $SD = .190$, but not in the second half, $t(23) = -.371$, $p > .70$, $M = .490$, $SD = .138$.

EXPERIMENT 2

The results of the first experiment indicated that infants responded to the auditory labels by looking more toward the named parent. However, before we could conclude that 6-month-olds have learned the correct links between “mommy” and “daddy” and their parents, we had to rule out another possibility. When infants begin producing words, they often overextend labels to objects not included in the adult category (Behrend, 1988; Clark, 1983). Thus, “dog” may be used to name sheep and cows, as well as canines. Is it possible that younger infants extend “mommy” to include all women, and “daddy” to include all men? To explore this possibility, we tested another group of 6-month-olds with the same parent videos used in Experiment 1. If 6-month-olds do overextend “mommy” and “daddy” to other women and men, the infants should have looked more toward the female in response to “mommy” and more toward the male in response to “daddy.”

Method

Participants

Twenty-four 6-month-olds (12 females, 12 males; mean age: 6 months, 5 days) from monolingual English-speaking homes were tested. An additional 7 infants were tested, but excluded because of equipment failure ($n = 3$), crying ($n = 2$), failure to look at the displays ($n = 1$), and not being correctly centered on the parent’s lap ($n = 1$). Informed consent was obtained from the parents of all participants.

Procedure

The procedure was the same as in the previous experiment. The names that parents used for mother were “mommy” ($n = 20$), “mama” ($n = 3$), and “mom” ($n = 1$); the names for father were “daddy” ($n = 21$), “dada” ($n = 2$), and “dad” ($n = 1$).

Results

The data were scored and analyzed as in Experiment 1. The baseline proportional looking times indicated that 9 of the infants looked longer to the females ($M = .310$, $SD = .249$) and 15 looked longer to

the males ($M = -.434$, $SD = .207$). The looking biases of these groups differed significantly, $t(22) = 7.91$, $p < .001$. Thus, the data were adjusted for the preferences shown during the baseline period. A repeated measures ANOVA indicated that neither main effect nor their interaction was significant. Most important, the main effect of video was not significant, $F(1, 23) < 1.00$, indicating that infants did not look more toward the unfamiliar father in response to “daddy” and the unfamiliar mother in response to “mommy” ($M_{\text{named}} = 1.63$, $SD = 2.93$; $M_{\text{unnamed}} = 1.66$, $SD = 3.19$; see Fig. 1). Overall, 10 of the 24 infants had longer looking times for the named than for the unnamed parent ($p > .50$ by a sign test). The lack of significant differences between the named and unnamed video occurred in all analyses of the first-look data (across all the test trials: $t[23] = 0.00$; in the first half of the test trials: $t[23] = 1.24$, $p > .20$; in the second half of the test trials: $t[23] = -1.55$, $p > .10$).

To confirm that the tendency to look toward the named video occurred only for infants’ own parents, we combined the proportional looking-time data from both experiments for an ANOVA of a 2 (group: own parents vs. unfamiliar parents) \times 2 (video: named parent vs. unnamed parent) \times 2 (test item: “mommy” vs. “daddy”) design. The critical interaction of Group \times Video was marginally significant, $F(1, 46) = 3.753$, $p = .059$. None of the other interactions or main effects approached significance. Similarly, the overall number of infants with longer looking times to the named videos was significantly greater in Experiment 1 than in Experiment 2, $\chi^2(1, N = 48) = 4.2$, $p < .05$. Therefore, it appears that 6-month-olds initially attach the words “mommy” and “daddy” to their own parents, and not to women and men in general.

GENERAL DISCUSSION

The present findings demonstrate that infants begin to link sound patterns with meanings at 6 months of age, considerably earlier than previously thought (Bates, Thal, & Janowsky, 1992; Benedict, 1979; Huttenlocher, 1974; Oviatt, 1980; Thomas et al., 1981). A critical difference compared with earlier studies is that the words we used named salient social figures for the infants. Although it may take several more months for infants to attach labels more widely to other kinds of objects in their environment, our findings suggest that infants may begin to form their lexicons by linking sound patterns to socially significant figures, such as their parents.

Recent investigations have shown that early in the second half of their first year, infants have some prerequisites needed to develop a lexicon, such as the abilities to segment (Echols et al., 1997; Jusczyk & Aslin, 1995; Saffran et al., 1996) and encode (Jusczyk & Hohne, 1997) the sound patterns of words. Thus, infants are developing the capacities necessary for dealing with the sound patterns of words. The present findings indicate that 6-month-olds are beginning to take the next critical step in lexical development by linking sound patterns to specific meanings. Ultimately, the relation between sound patterns and what they name becomes considerably more abstract and complex than linking “mommy” and “daddy” to one’s parents. Learners have to go beyond attaching a name to a specific individual; they must discover that linguistic labels apply to whole classes of objects. Nevertheless, the general principle that sound patterns can be used to symbolize meanings may be discovered by first learning to attach names to specific individuals, such as one’s own parents. The full extent of 6-month-olds’ abilities to attach labels to other significant

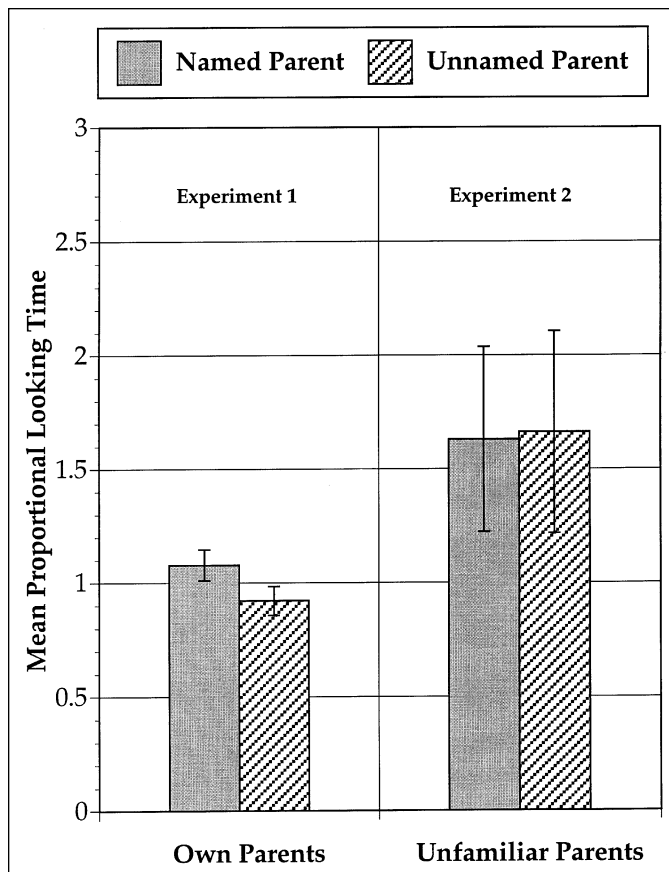


Fig. 1. Mean proportional looking time (and standard error bars), adjusted for baseline preference, for the videos of named and unnamed parents in Experiments 1 and 2. Proportions greater than 1.0 indicate greater attention to the video in the test period compared with the baseline period.

individuals and objects in their environment remains to be determined, as does the point at which they begin to use labels to stand for classes of objects.

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