DEVELOPMENTAL CHANGE IN PERCEPTION OF CLAUSE BOUNDARIES BY 6- AND 10-MONTH-OLD JAPANESE INFANTS

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ABSTRACT

Present study investigated whether Japanese infants are sensitive to acoustic cues of clausal units in Japanese speech. Groups of 6- and 10-month-old infants were tested using the headturn preference procedure (HPP). Two types of speech samples (child-directed speech) were examined: "Coincident" samples were created by inserting one- second pauses at all clause boundary locations, and "Noncoincident" samples were created by inserting the same number of pauses between words within clauses. Preferences were determined by assessing the listening times for each 12 samples (6 of each type). For the 6-month-old infants, there was no difference in the listening times between the two stimulus types. For the 10-month-old infants, however, the listening time for the "Noncoincident" samples was significantly longer than that for the "Coincident" samples. These results indicate that Japanese clauses are not perceptual units for very young infants, but Japanese infants come to be sensible to the clausal units up to 10-month-old.

1. INTRODUCTION

Recent studies suggest that young infants have some ability to group speech into appropriate syntactic units by prosodic cues (Hirsh-Pasek, et al. 1987, Kemler-Nelson et al. 1989, Jusczyk et al. 1989 and Jusczyk et al.1992). In these studies by the same research group, infants are tested in an auditory preference procedure in which two types of auditory stimuli are presented contingent upon a infant head turning and looking to the appropriate flushing light. The mean looking/listening times for each stimulus type are calculated to determine which stimulus type is preferred by infants.

They investigated infant perception of prosodic cues to clausal units in native language (English) by the headturn preference procedure (HPP). Stimuli were matched speech samples (child-directed speech): "Coincident" samples were created by inserting a one-second pause between every clause, and "Noncoincident" samples were created by inserting the same number of pauses between words within clauses. The results indicated that even 4.5-month-old infants listened significantly longer to the Coincident than to the Noncoincident versions of English speech samples. Also they tested infants with low-pass filtered speech samples at 400Hz to remove phonetic information and to examine the effect of prosodic characteristics on the perception of clausal units. The infants tested on these low-pass filtered samples demonstrated the same listening preferences for the Coincident versions. The implication of these findings is that infants are sensitive to clause-typical prosodic patterns in native language, although these findings are obtained from the studies of American infants only.

Therefor, it is necessary to investigate whether these findings are language-specific or not. To determine this point, in the present study, we tested Japanese infants using Coincident and Noncoincident versions of child-directed Japanese speech samples in the headturn preference procedure(HPP).

2. METHOD

2.1. Subjects

The subjects were 24 6-month-old infants (mean age: 200 days, range: 184-235 days) and 24 10-month-old infants (mean age: 323 days, range: 290-341 days). For 6-month-old group, 2 additional infants were excluded from data due to crying and experimental error. For 10-month-old group, 10 additional infants were excluded due to crying (4 infants), fussiness (4 infants) and experimental error (2 infants).

2.2. Stimuli

The stimuli were generated from a recording of a Japanese mother speaking to her daughter aged 24-month-old and her son aged 7-month-old. The speaker did not know about the purpose of the research. The speaker wore a headset microphone and play with her children in a soundproof room. The child-directed speech was recorded on a digital audio tape.

From the original recording, 8 experts were selected , each five to seven clauses in length. Two versions of each experts were constructed: "Coincident" versions were created by inserting one-second pauses at all of the clause boundary locations, and "Noncoincident" versions were created by inserting the same number of pauses between words within clauses. The mean durations of each version were 18.4 sec (range: 15.6 - 20.0 sec) for the Coincident versions and 18.0 sec (range: 15.4-19.2 sec) for the Noncoincident versions.

Totally 16 samples (8 of each version) were created. 4 samples (2 of each version) were assigned to the pre-exposure phase and 12 samples (6 of each version) were assigned to the test phase. An example of a matched sample is shown in Table 1.

Table 1: A matched pair of speech samples.
Slash indicated where pauses were inserted.

<Coincident version>
Ashi-kara haku mono-de-su // Kondo-wa kukku, o-kutsu-da-yo // O-kutsu-wa doo-suru-no-ka-naa // O-kutsu-wa anyo-ni haku-n-de-shi-ta // Yoisho yoisho-tte // Ashi-ni haku mono-de-shi-ta //
<Noncoincident version>
haku mono-de-su. Ashi-kara // haku mono de-su. Kondo-wa // kukku, o-kutsu-da-yo. O-kutsu-wa// doo-suru-no-ka-naa. O-kutsu-wa // anyo-ni haku-n-de-shi-ta. Yoisho // yoisho-tte ashi-ni //

2.3. Procedure

Infants were tested using HPP developed by Kemler Nelson, et al.(1995). HPP was conducted in a testing booth depicted in Figure 1. An infant was seated on its mother's lap in the center of the three-sided booth. A green light was mounted on each of the side panels at the infant's eye level. Loudspeakers were mounted behind the two red lights. An experimenter hid herself behind the center panel and observed the infant's behavior from a small peephole. She had a response box connected to a computer which controlled the presentation of the stimuli and recorded the timing of the responses. She started trials and signaled the occurrence, direction and termination of headturns using one of the buttons on the response box.

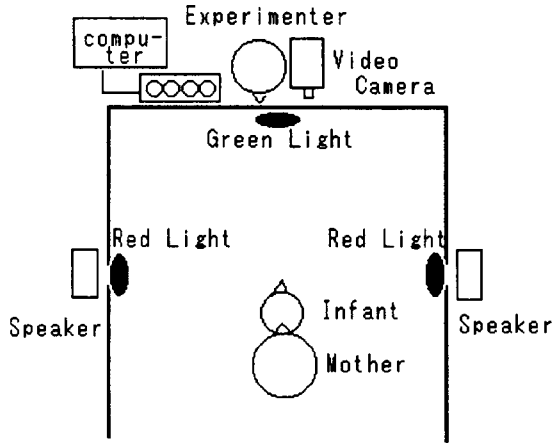

Figure 1: Testing Booth

A trial was started by flickering the green light in order to draw the infant's attention to the center. When the infant oriented to the center, the green light was turned off, and one of the two side red light began flashing. Once the infant turned to that side, an auditory stimulus began to play from the loudspeaker mounted behind the flashing red light. The stimulus was presented (and the side red light kept flashing) until the infant turned away for at least a continuous 2 seconds.

The infant was first given 4 pre-exposure trials, then 12 successive test trials, 6 trials each for the Coincident and Noncoincident versions. Pre-exposure trials were designed to occur infant's headturns to the adequate location (a flushing red light) and acquaint the infant with the contingency between headturns and auditory stimulation. During pre-exposure trials, unlike the test trials, the side light was extinguished as soon as the infant looked to that location, and only the sound continues throughout the headturn.

Over the series of test trials, both versions of speech samples were heard by the infant from both sides of the booth, and the order of the stimuli and the order of locations were independent of the infant's behavior. In each trial, the time during which the infant oriented to the auditory stimulus was recorded as the infant's listening time to that stimulus.

To avoid observer bias, the experimenter and the mother wore headphones over which loud music was played to mask the auditory stimuli.

3. RESULTS

The individual mean listening/looking times for each stimulus version were calculated for each infant and indicated in Figure 2 for the 6-month-old group and in Figure 3 for the 10-month-old group. In these figures, the abscissa is the listening time for the Coincident samples, and the ordinate is that for the Noncoincident samples.

For the 10-month-old group, the consistency of the preference in the Noncoincident samples is shown by the fact that 20 of 24 infants showed a longer listening time to the Noncoincident samples. For the 6-month-old group, however, any clear preference was not shown because only 12 of 24 infants showed a longer listening time to the Noncoincident samples.

The mean listening times of all the infants in each age group for each stimulus version were demonstrated in Figure 4 for the 6-month-old infants, and in Figure 5 for the 10-month-old infants. For the 6-month-old group, the mean listening time over subjects was 7.70 sec (SD: 2.26 sec) for the Coincident versions and 7.86 sec (SD: 2.79 sec) for the Noncoincident versions. For 10-month-old group, the mean listening time over subjects was 7.71 sec (SD: 2.45 sec) for the Coincident versions and 10.28 sec (SD: 3.59 sec) for the Noncoincident versions. A statistical analysis showed a significant preference for Noncoincident samples in the 10-month-old group ($t(23) = 4.84$, $p < .001$), but not in the 6-month-old group ($t(23) = 0.41$).

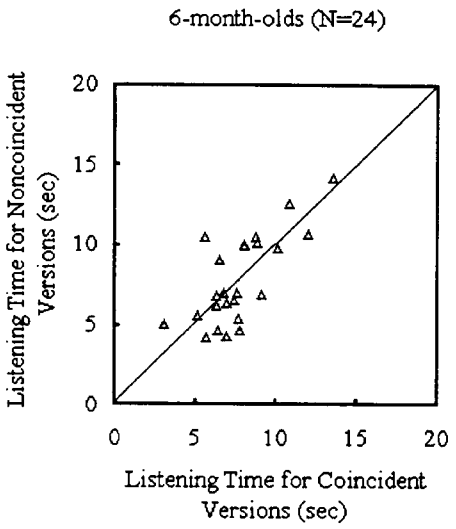

Figure 2: Listening times of individual 6-month-old infants for each stimulus version.

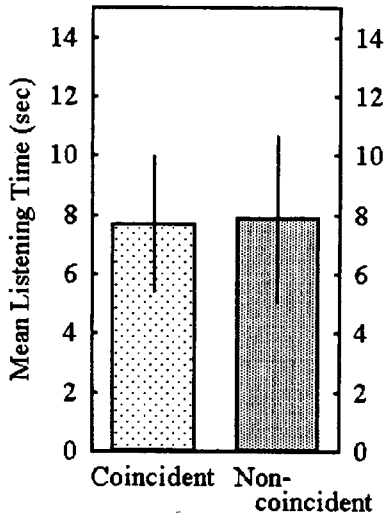

Figure 3: Mean listening times of 6-month-old infants for each stimulus version.

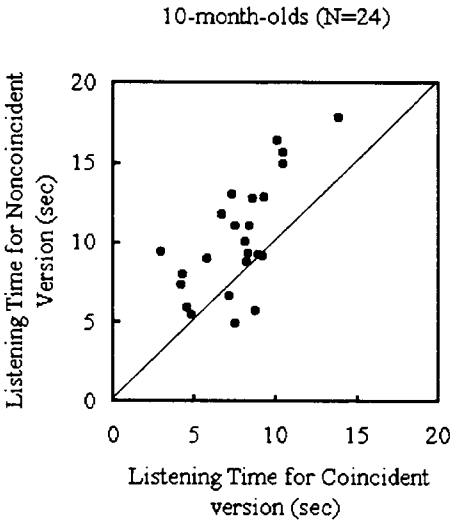

Figure 3: Listening times of individual 10-month-old infants for each stimulus version.

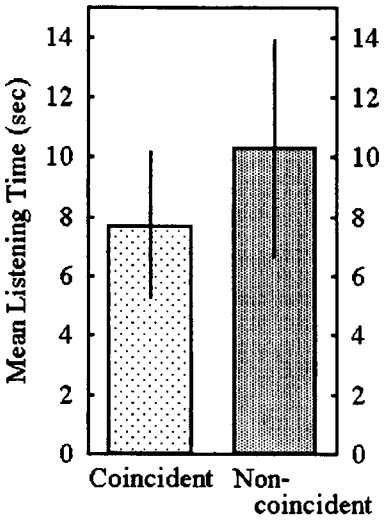

Figure 4: Mean listening times of 10-month-old infants for each stimulus version.

4. DISCUSSION

In the present study, Japanese 10-month-old infants listened significantly longer to the Noncoincident samples than to the Coincident samples, but the 6-month-old infants did not show a significant difference in the listening time between both stimulus versions. These results mean that Japanese 10-month-old infants are able to discriminate the two types of speech stimuli and prefer the Noncoincident samples, although 6-month-old infants fail to discriminate these stimuli.

These findings suggest that, for Japanese infants, the sensitivity of the naturalness of speech segmentation at clause boundaries by inserting pauses in there native language does not emerge in the early months, but it is acquired before 10 months old.

There are two interesting differences between the results from the present study and those from the series of prior studies of American infants using English samples (Hirsh-Pasek, et al. 1987, Kemler-Nelson et al. 1989, Jusczyk et al. 1989 and Jusczyk et al.1992).

First, in those prior studies, even 4.5-month-old American infants did discriminate between Coincident and Noncoincident versions of English stimuli. However, in present study, Japanese infants did not discriminate those versions of Japanese stimuli until about 10 months old. Second, Japanese 10-month-old infants preferred to Noncoincident Japanese samples, while American infants at 4 to 9 months of age consistently showed a preference for Coincident English samples.

These discrepancy suggests that language-specific processing may take part in the perception of prosodic cues to clausal units. To examine this possibility, further cross-linguistic studies are necessary.

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