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Acquisition of word-sounds pattern of native language by Japanese infants

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1. INTRODUCTION

The emergence of a lexicon is of paramount importance in the process of language acquisition.Developing a lexicon, no matter how primitive, entails coding and storing word-sounds in some way for comprehension and perhaps in another way for production. When are coding and storing word-sounds first evidenced in infants? And are there any differences between Japanese and any other language in the emergence time? These are the questions that motivated this study.

Young children who do not yet produce words often appear to understand a few words and short phrases in certain familiar situations. To do so, they are probably aided various contextual cues provided by intonation, situation, behavioral routines, and so on. For that reason, observational studies perhaps overestimate infants' capacities understand words and should be considered with some caution. For example, Benedict's study (1979) has often been quoted as showing that the onset of word comprehension occurs at 9-10 months. Interpretation of this data in terms of linguistic word comprehension may, however, be somewhat optimistic. In contrast to the optimistic view, a few studies conducted in controlled laboratory settings have detected the onset of word comprehension no earlier than 12-13 months (Thomas, Campos, Shucard, Ramsay, and Shucard, 1981 ; Oviatt, 1980).

More recently, Mandel, Jusczyk, and Pisoni (1995) demonstrated that as early as by 4.5 months, young infants have responded to their own names more than to other name. This is of course an extreme case of "familiar" word recognition and nothing in known as to how very young infants may code the spoken from their own names. As for somewhat older infants, Jusczyk, and Aslin (1995) have reported an impressive body of studies showing that infants as young as 7.5 months are able to code and recognize a few words they had been trained on, even when these words are embedded in short sentences. However, it could hardly the case that infants had already associated such words with meanings. Yet, they were able to code and retain in memory the sound patterns of the words they heard during the training phase. Multiple presentations of words allowed infants to recall word forms and to subsequently recognize them in different linguistic contexts (e.g., training on isolated words and test on words within short sentences, or vice versa). Moreover, 8-month-olds infants were found to be able

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to remember words heard in stories after a two-week delay (Hohne, Jusczyk, and Redanz, 1994), but this ability seemed to overridden by the memory of the story-teller's voice when only two story-tellers were used (Jusczyk, Hohne, Jusczyk, and Redanz, 1993). Interestingly, these experiments suggest that infants coded word forms in a more abstract format than a purely acoustic format : The word forms occurring in the training and in test were acoustically different (due to speaker's voice or to speech context which entail various realizations of the same phones).

Many studies of cross-linguistic speech perception in young infants have indicated that at the beginning, they can discriminate nearly every phonetic contrast—including those that do not occur in their native language. This sensitivity to non-native contrasts was thought to deteriorate with the first year of life with the acquisition of their native language. Evidently, the process of focusing on native language contrasts begins in the latter half of the first year of life. The pioneering research of Werker, and Tees (1984, see Figure 1) demonstrates that, by 12 months of age, infants have taken some steps toward phonological categories. Certain phonetic contrasts falling within the same native language category are not longer readily discriminated, despite the fact that the same contrasts were discriminated by infants at 6 months of age. This finding may be explained by assuming that infants may have some vocabulary (with measurings of some words) in the latter half of the first year of life. If they have some vocabulary, they may be able to organize phonetic contrasts used as different categories of their native language. But, we can not think that by 12 months of age, infants have already had so mach enough vocabulary to organize such native language categories.

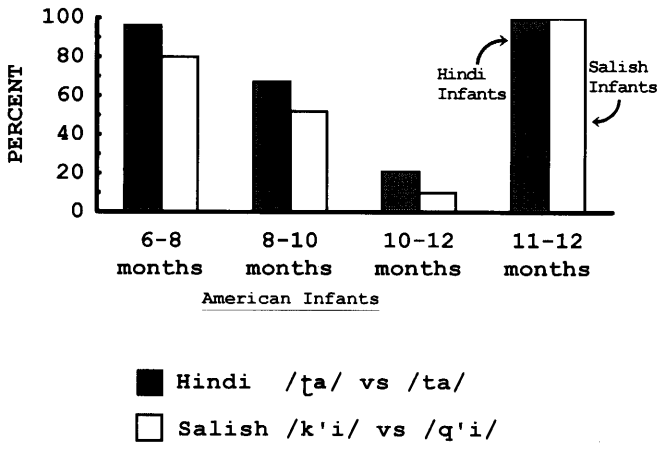

Figure 1. Developmental change of sensitivity to phonetic contrasts of non-native and native language (Werker and Tees, 1984)

Moreover, Hallé, and Boysson-Bardies (1994), found that French 11-and 12-month old infants recognize familiar words (belonging to a core set of " first words" attempted by 12-18 months old) in a situation where no extralinguistic cures exist.

In order to investigate when Japanese infants start perceiving word-sounds pattern in the absence of a sentence context and a possible referent object, this study used the headturn preference procedure (HPP) to measure the preference, indexed as an attention span, for familiar words belonging to the early production lexicon over unfamiliar words. Words were presented in lists, with no refernce objects used. Accordingly,this experiments tested for word recognition in the absence of any situation or context cuing ; that is, it tested for the existence of a receptive lexicon devoid of nonlinguistic representations.

2. METHOD

2.1 Subjects

Twenty-four infants in two groups were tested. Infants in the 10-month group had s mean age of 10 months and 11 days (range=10.01-10.30). Infants in the 12-month group had a mean age of 12 months and 12 days (range=12.00-12.30). There were 12 males and 12 females in the 10-month group, while there were 14 males and 10 females in the 12-month group. All subjects showed a normal perceptual and motor development. Their households were exclusively Japanese environments.

2.2 Stimuli

We used 12 familiar words and 12 rare words (Table 1). Familiar words were chosen as words most frequently attempted by three-year old Japanese children (Nakanishi, 1977). Rare

Table 1. Familiar and rare words

familiar words			rare words		
あし	ashi	(foot)	はいわ	haiwa	(talks on "haiku")
あった	aQta	(here it is)	あっさい	aQsai	(crushing)
いない	inai	(it's not here)	エース	eesu	(ace)
ぶうぶ	buubu	(car)	ぼうしょ	bousho	(a given place)
だっこ	daQko	(hug)	とうた	touta	(elimination)
でんわ	deNwa	(telephone)	だんげん	daNgeN	(assertion)
はいった	haiQta	(it's got into it)	ふぎ	fugi	(adultery)
ジュース	zyuusu	(juce)	じゅし	zyushi	(resin)
くつ	kutsu	(shoes)	きがい	kigai	(detriment)
ねんね	neNne	(sleep)	にっかん	niQkan	(daily publication)
わんわん	waNwaN	(doggy)	わせい	wasei	(made in Japan)
どうぞ	douzo	(please)	さんし	saNshi	(silk thread)

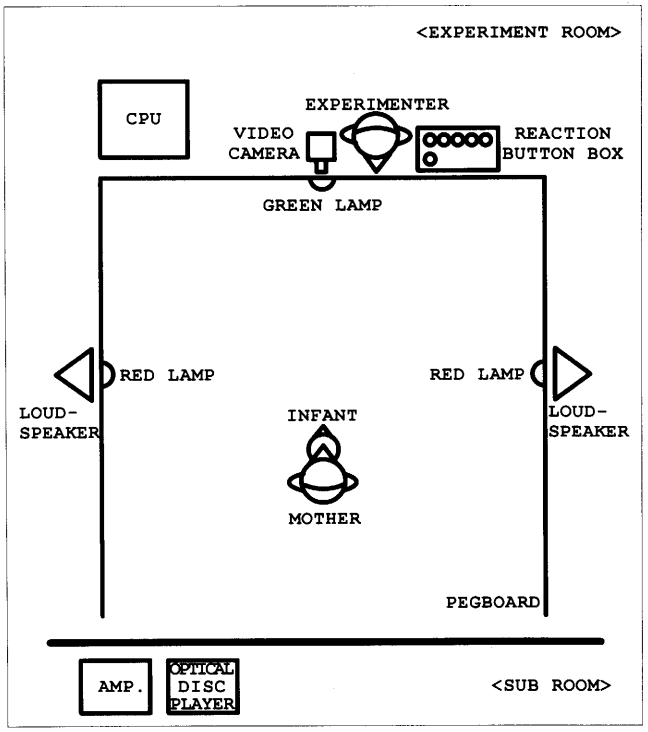

Figure 2. The arrangement of the experiment room

words were chosen as low-frequency Japanese words (The National Language Research Institute, 1984), with their numbers of moras matched to those in the familiar words. Word accents were also counterbalanced between the familiar and rare words. All these words were recorded by a female Japanese speaker with a natural and regular intonation (neither "Motherese" nor "baby talk"). They were used to build a number of randomized lists. All lists were about 15. 4 seconds in duration. Word durations ranged between 445 and 723 ms (M=582 ms) for familiar words and between 367 and 759 ms (M=587 ms) for rare words. This difference showed no significance ($t(22)=0.112$, $p>.10$).

2.3 Apparatus

The subject sat on the parent's lap in the center of a three-sided booth (1.8×1.8 m) with the infant's eyes at 95 cm from the center panel. A small lamp and a loudspeaker were mounted on each side panel at eye level and about 75° from the center direction. The observer sat behind the center and could monitor the infant's gaze direction through a hole without being seen.

2.4 Procedure

All infants were tested using a modified version of the headturn preference procedure (HPP) originally developed by Fernald (1985) (see Figure 2). Experimental sessions consisted of two phases : a familiarization phase and a subsequent test phase. Throughout the familiarization phase, the familiar words came from the same speaker, which differed between infants, and the rare words came from the other speaker. The type of words first presented was the same in the test and familiarization phases. These two factors, the side assigned to the familiar words and the type of the list, were counterbalanced across infants. In the familiarization phase, intended to acquaint the infant with the side assigned to each type of list, 2 different lists of the same type were presented first, then 2 lists of the other type. In the test phase, a total of 6 rare lists and 6 familiar lists were presented (12 trials). The type of the lists presented after the first one was randomly changed, with a constraint that no more than 3 lists of the same type could occur in a row.

In both the familiarization and test phases, the observer pressed a start button assigned to the

side of current presentation to start counting time whenever the infant began or resumed orienting to the speech, and a stop button when the infant looked away from the speech. The total gaze duration for each list was measured as a cumulative time from the observer's pressing the start button. Presentation of a list was terminated if the infant did not orient to the speech for 4 seconds from the start of presentation. Presentation was also terminated before its last item if the infant looked away from the speech for more than 2 seconds. If the infant looked away for less then 2 seconds, then looked back, presentation was not terminated, but the time during which the infant was looking away was excluded from the total gaze duration.

In both phases, the presentation was interrupted after every trial until the infant looked back to the green lamp in the center. Once the infant did, the lamp on the side of next presentation started blinking, then the next list was started. In the familiarization phase, the next list was started after the infant began orienting to the lamp; in the test phase, the next list was started immediately. This was intended to make sure that, during the familiarization phase, the infant would both orient and listen to the speech sounds. The lamp was kept blinking throughout the presentation of a list in the test phase but was turned off after the infant started gazing in the familiarization phase.

During a session, both the observer and the infant's parent listened to music over headphones in order to be deaf to the stimuli presented.

3. RESULTS AND DISCUSSION

The results of the test phase are summarized in Fugure 3. The mean listening times per trial were 6.6 s for the familiar versus 6.3 s for the rare words in the 10-month group (SD=2.8 and 2.5, respectively). The means were 8.3 s versus 6.6 s in the 12-month group (SD=3.1 and 2.9, respectively). Infants listened significantly longer to the familiar words than to the rare words in the 12-month group ($t(23)=2.531$, $p<.05$), but not in the 10-month group ($t(23)=0.490$, $p>.05$).

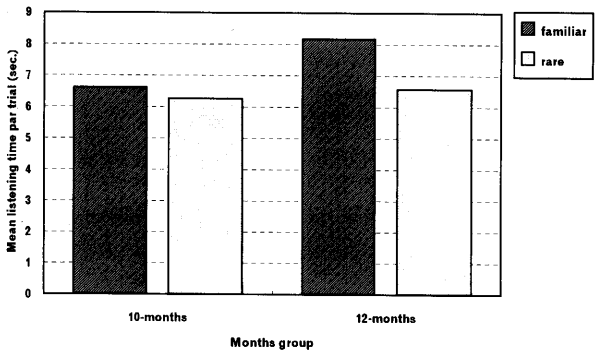

Figure 3. Mean listening time per trial to familiar versus rare words (10-and 12-month-olds)

The measured durations for each type of list include variance due to the defferences in total attention span between infants (total listening time to both types of words). A possible means to factor out this variance is to analyze the preference for familiar words as the proportion of listening time for familiar words to the total listening time. In the 12-month group, the mean preference was 0.56 (SD=0.12), significantly above the chance level 0.5, $t(23)=2.448$, $p<.0.5$; in the 10-month group, it was 0.51 (SD=0.14), no significantly above 0.5, $t(23)=0.407$, $p>.05$.

Comparison of the mean listening time between words-presented sides (left vs. right, disregarding the type of words presented) showed no significance in either the 10-month group (6.7 s for left (SD=2.9) and 6.2 for right (SD=2.4), $t(23)=0.804$, $p>.05$) or in the 12-month group (7.1 s for left (SD=2.8) and 7.7 for right (SD=3.5), $t(23)=0.767$, $p>.05$). Moreover, comparison of the mean listening time between the types of first presented list showed no significance in either age group (in the 10-month group, 6.9 s for the first presented type (SD=2.5) and 6.0 s for the other type, $t(23)=1.456$, $p>.05$; in the 12-month group, 7.6 s for the first presented type (SD=3.2) and 7.3 s for the other type, $t(23)=0.373$, $p>.05$).

Distribution of preference for familiar words by age are shown in Figure 4. Comparison of the preference with a chance level (0.5) in the younger and elder subgroups (10.00-10.14, 10.15-10.30, 12.00-12.14, and 12.15-12.30 months)

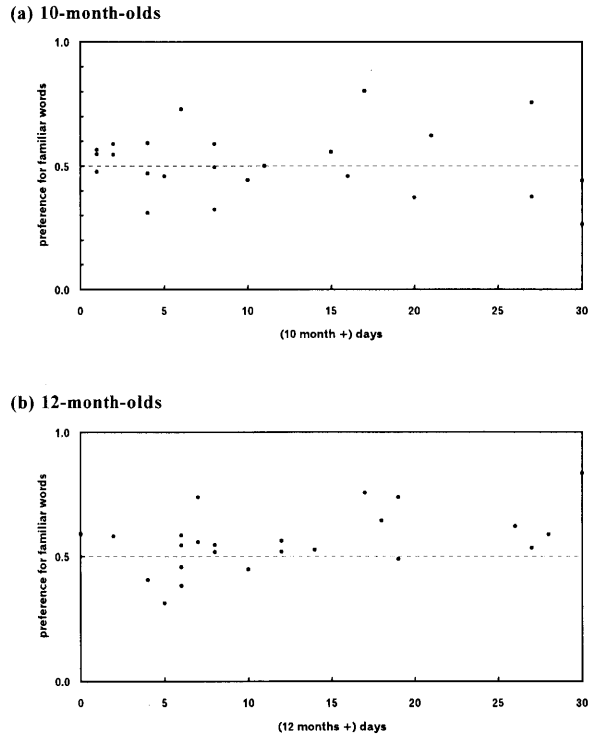

Figure 4. Perference for familiar words accross ages (days)
(a) 10-month-olds (b) 12-month-olds

showed a notably significant preference only in the elder subgroup of the 12-month-olds ($t(7)=3.598$, $p<.01$, Wilcoxon matched-pairs signed-rank test, $T(8)=1$, $p<.02$).

These results suggest a preference for familiar words in the 12-month old group ; however, another interpretation may deserve examination, considering that only the elder subgroup of the 12-month-olds preferred familiar words.

Hence, this study confirms that the onset of word-sounds pattern acquisition occurs at about 11 months. Further research is needed to clarify the type of representation that underlies early lexicon. Actually, a research has already begun on French children, giving an indication that infants rely on rather holistic representation (Hallé, and Boysson-Bardies, in press). We should study on Japanese children also in view of the French results.

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