

Individual variation in Swedish and American 12- and 18-monthers' babbling as judged by expert listeners

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Abstract

There is lack of agreement on the extent to which infants' vocalizations are influenced by the sounds of the ambient language. In this experiment, 5 expert listeners were asked to discern ambient language effects on babbled vocalizations produced by American and Swedish 12- and 18-month-olds. Listener responses revealed considerable individual variability among children in both age groups; whereas about half of the 18-monthers were correctly recognized with respect to ambient language, most – but not all – 12-monthers produced vocalizations that were not sufficiently native-sounding to be reliably identified. Some children's vocalizations thus displayed recognizable effects of ambient language as early as 12 months of age, whereas other children failed to display such effects at 18 months. Even though negative listener responses do not necessarily indicate a complete absence of an ambient language influence on babbling, the results suggest that theories advocating either an early or a late onset may be overly categorical. The question would probably turn out to be less controversial if sufficient attention were paid to individual development patterns underlying the group data.

1 Introduction

Experimental evidence (e.g., Kuhl and Meltzoff, 1995) suggests that, by 12 weeks of age, infants have begun to store representations of vowels in memory, and that these representations form auditory targets that infants try to match in production. Given an incipient perceptual-motor link at that remarkably early age, it is conceivable that an infant's ambient language should be apparent in vocalizations several months later. With few exceptions, however, studies have failed to verify such effects even in the late babbling period (e.g., Atkinson et al., 1968; Olney and Scholnick, 1976; Oller and Eilers, 1982; Locke, 1983; Thevenin et al., 1985). On the other hand, a few studies have reported discernible ambient language effects during the second half of the first year (e.g., Boysson-Bardies et al., 1984; Whalen et al., 1991). Thus, in spite of experimental evidence for an early influence on infants' perceptual structuring of speech sounds (Kuhl et al., 1992), there is as yet no general consensus on the extent to which language-specific perceptual representations have an impact on young children's spontaneous vocalizations. However, many studies have reported group level data based on relatively few infants and may thus have failed to represent the considerable cross-subject variability known to exist in infants' phonetic behavior (e.g., Engstrand et al., 1991). The purpose of the present listening test was therefore to focus on individual variability in a relatively large infant group (32 infants in all) consisting of Swedish and American 12- and 18-month-olds.

2 Methodsⁱ

Eight American and 8 Swedish 12-month-olds (± 2 weeks), and 8 American and 8 Swedish 18-month-olds (± 2 weeks) were audio and video recorded at two separate, 30- to 45-minute long recording sessions in sound-treated rooms in Stockholm and Seattle, respectively. This made a total of 32 monolingual, sociolinguistically comparable children with boys and girls represented in equal proportions. Word and imitation status were coded by two independent judges with the aid of audio and video recordings. The stimuli for the listening test consisted

of 20 digitized utterances per child (a total of 640 stimuli), selected by rule. The utterances were to be non-cry, non-screaming, non-whispered, longer than 400 ms, and free from environmental noise. The selected utterances were digitized using the Kay Elemetrics CSL (Ver. 4.0) speech analysis system (20 kHz sampling rate, 16 bit quantization). The listeners were all professional phoneticians, hence 'expert listeners': one male American who was also fluent in Swedish; one female American who was not a speaker of Swedish; one female Estonian who was also fluent in Swedish and English; one female American (the second author) who was also fluent in Swedish; and one male Swede (the first author) who was also fluent in English. The listening test was carried out using software (written by J. Stark) running on an Apollo workstation. Each listener had his/her own randomization of the 640 utterances to be judged. The whole task took about 6 hours and was divided up into approximately one-hour long daily sessions. The listener heard several repetitions of a given utterance and was required to decide whether the utterance was produced by a Swedish or an American child, and to motivate his/her choice.

3 Results

Figure 1 presents expert listeners' ambient language responses by child to all babbled vocalizations. By the fairly liberal definition used in this paper, babbles were vocalizations that had either been unanimously classified as non-words and non-imitations by both judges, or that had been so classified by one of the judges, the second judge being undecided. The scale indicating 'American' responses goes from 0 to 5, with 2.5 (indicated by the horizontal line) representing chance level. American children are represented on the left-hand side of the figure, Swedish children on the right-hand side. Individual children are indicated along the abscissa along with number of vocalizations per child. Each individual child is coded in terms of ambient language, sex and age; for example, 'amf4t' stands for an American (am) female (f) 12-monther (t) with identification number 4.

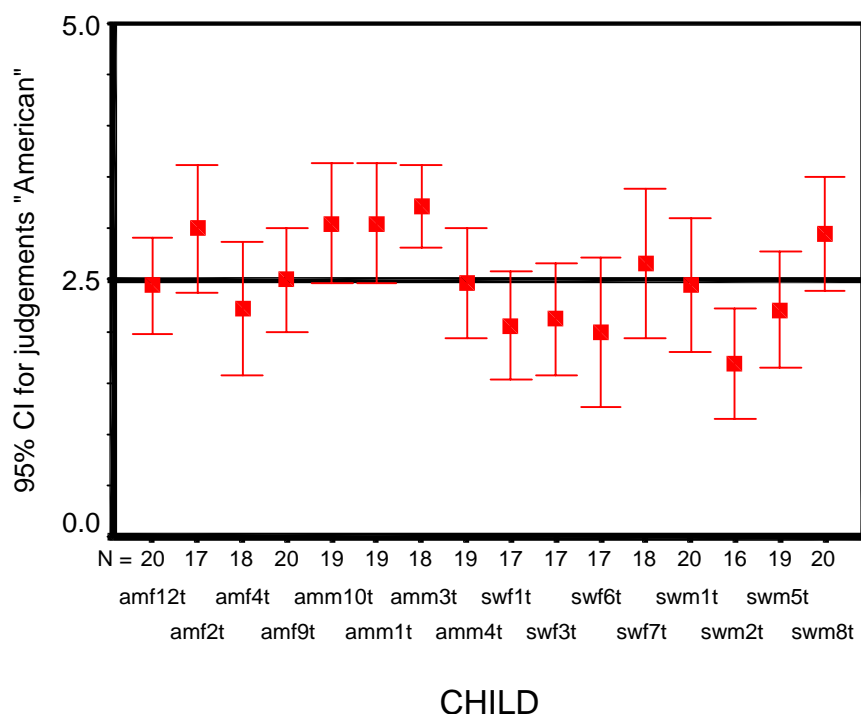


Fig. 1. Expert listeners' 'American' responses for individual 12-month-olds. American children are represented on the left-hand side of the figure, Swedish children on the right-hand side.

The graph gives the overall impression that utterances produced by the American children tended to be heard as American, whereas utterances produced by the Swedish children tended to be heard as Swedish. It is clear, however, that the data contain a great deal of individual variation. In particular, for 5 of the 8 American children, the 95 percent confidence interval is seen to stretch below the horizontal line representing chance level; i.e., the vocalizations produced by these children were not reliably judged 'American' ($p > 0.05$). Thus, only 3 of the American children were reliably identified as American at the 5 percent level of significance. For 7 of the 8 Swedish children, the 95 percent confidence interval stretches above chance level; i.e., these children's vocalizations were not reliably judged 'Swedish' ($p > 0.05$) and, thus, only one of the Swedish children was significantly identified as Swedish at the 5 percent level. In other words, it can not be concluded for a majority of either the American or the Swedish 12-monthers that their vocalizations contained any such property, phonetic or otherwise, that would enable the expert listeners to reliably perceive their linguistic background.

Figure 2 presents the corresponding listener responses for the individual 18-month-olds (American children to the left, Swedish children to the right). Again, the overall pattern suggests that utterances produced by the American children were heard as American, while utterances produced by the Swedish children were heard as Swedish. Even if the difference between the American and Swedish 18-monthers is statistically significant at the group level, the picture is less clear-cut at the individual level. Thus, vocalizations produced by 4 of the 8 American 18-monthers were not reliably judged 'American' ($p > 0.05$), whereas the vocalizations produced by the remaining 4 children were reliably judged 'American' at the 5 percent level. Vocalizations produced by 4 of the 8 Swedish children were not reliably judged 'Swedish' ($p > 0.05$), while 4 of the Swedish children were correctly and reliably identified as Swedish at this level of significance. Even for the 18-monthers, then, only half of the vocalizations were native-sounding in the sense that expert listeners were able to consistently perceive their linguistic background.

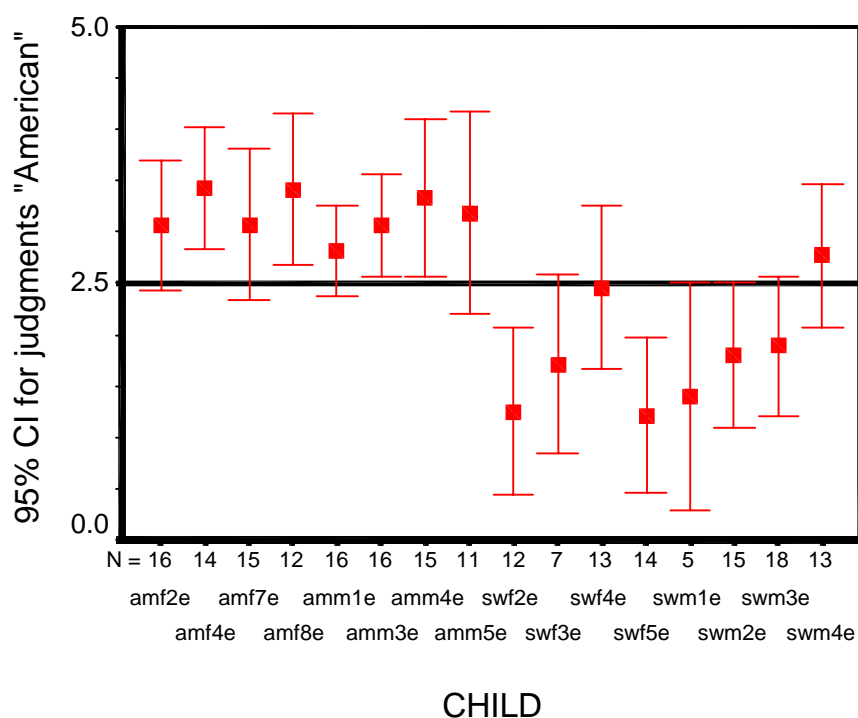


Fig. 2. Expert listeners' 'American' responses for individual 18-month-olds. American children are represented on the left-hand side of the figure, Swedish children on the right-hand side.

3 Conclusions

In summary, the listener responses obtained in this experiment reflected a considerable individual variability between the children in both age groups. Thus, while about half of the 18-monthers tended to be correctly recognized with respect to ambient language, most 12-monthers did not produce vocalizations that sounded sufficiently native to be reliably identified by expert listeners. Judging from listener responses, then, some children's vocalizations displayed effects of the ambient language as early as 12 months of age, whereas other children failed to display such effects even at 18 months. Clearly, the fact that some language-specific properties were not discerned by listeners does not necessarily mean that the respective ambient languages did not influence the vocalizations produced by these children. The data suggest, however, that the question of early vs. late ambient language effects on infants' vocalizations has no clear-cut yes or no answer. It is likely that paying more attention to individual differences underlying accumulated effects at the group level would make the problem seem less controversial. After all, individual variation is a notorious characteristic of children's babbling and early speech.

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ⁱ Experimental procedures and results are described in more detail in a forthcoming publication.