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2aSC5. Computer-based English /r/-/l/ perceptual training for Japanese children

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Computer-based perceptual training has proven successful for improving English /r/-/l/ perception by Japanese adults, but this has not been tested with younger age groups, who presumably have greater perceptual plasticity. The present study examined phonetic training for children 6-8 years old. The training program included identification and discrimination tasks with word-initial English /r/-/l/ minimal-pairs (e.g., rock - lock), with each participant completing ten sessions. The results demonstrated that children improved their English /r/-/l/ identification, although identification in untrained positions such as medial and consonant clusters did not improve as much as in the trained word-initial position. In addition, older children in this age range improved more than did younger children, suggesting that the ability to use this kind of program may improve with age, even though perceptual plasticity for speech presumably declines with age.

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INTRODUCTION

It has been proven that computer-based phonetic perceptual training improves Japanese speakers' perception and production of English /r/-/l/ (Lively, Logan, & Pisoni, 1993; Iverson, Hazan & Bannister, 2005). However, there has been no study training Japanese children's English /r/-/l/ perception using computer-based training, and it is plausible that children may respond to training better because of their greater plasticity. The present study examined the effect of training for 6-8 year-old Japanese children, using a multipronged approach that includes training in auditory discrimination, category discrimination, and identification. In addition, the effect of age among these child participants was also evaluated, because development in sensory systems and in phonemic awareness within the 6-8 year-old range could also have an influence on training outcomes (Maxon & Hochberg, 1982; Mann, 1986; Endo, 1991; Matsumoto, 2004; Matsumoto, 2006).

METHOD

Subjects

A total of 14 Japanese children (7 males; 7 females) completed 10 training sessions and pre/post tests. Their age ranged from 82.8 to 105.4 months (median = 94.0 months). They had never lived abroad, and had learned only some basic English (e.g., greetings, color names).

Training Procedure

Ten training sessions were conducted using laptops in a quiet room in Japan. The instructions were given in Japanese. Stimuli were played over headphones, and subjects were allowed to change the loudness to a comfortable level. All training and testing data were automatically recorded by computers and they were protected by password to verify that all subjects completed all tasks.

The training involved identification, auditory discrimination and category discrimination, all with feedback. The stimuli were 100 word-initial minimal-pair words from 5 talkers. In the identification task (90 trials each session), subjects heard one word and clicked on the minimal-pair word that they thought they heard (e.g., *rock* vs. *lock*). In the auditory (48 trials) and category discrimination (60 trials) tasks, subjects heard three stimuli and chose which stimulus sounded different. In the auditory discrimination task, subjects listened for an acoustic difference between the stimuli (i.e., one was different and the other two were acoustically identical); the stimuli were signal-processed words that varied third-formant frequency (F3) only. In the category discrimination task, the words were minimal-pairs (e.g., *rock*, *rock*, *lock*) spoken by different talkers (i.e., same words were not acoustically identical). Each training session lasted about 45 minutes.

Pre and Post Tests

Subjects completed an English /r/-/l/ identification task before and after training. Subjects were tested on untrained English /r/-/l/ minimal-pairs produced by 2 new talkers (1 female; 1 male), in the trained word-initial position (40 trials) and also untrained medial (40 trials) and consonant cluster positions (40 trials).

RESULTS

FIGURE 1 displays the identification accuracy for initial, medial and consonant cluster position for 6-8 year-old Japanese children before and after training. The data were analyzed using a logistic mixed model with fixed factors of pre/post testing block, /r/-/l/ syllable position and age. The random factors were subjects participating in this experiment, and stimulus words nested into speakers. The subjects significantly improved identification accuracy from pre to post training across /r/-/l/ positions, $p < .001$, with an improvement from an average of 51.96% correct at pre test to 59.11% at post test. There was also a main effect of /r/-/l/ position, $p < .001$. The interaction between testing block and /r/-/l/ position was significant, $p < .001$. Post-hoc tests showed that the improvement at initial position was significant, $p < .001$ (Mean pre = 51.25%, Mean post = 70.00%), but was not significant at medial or

consonant cluster position, indicating that only the trained position significantly improved. The three-way interaction of testing block, /r/-/l/ position and age was not significant, $p > .05$.

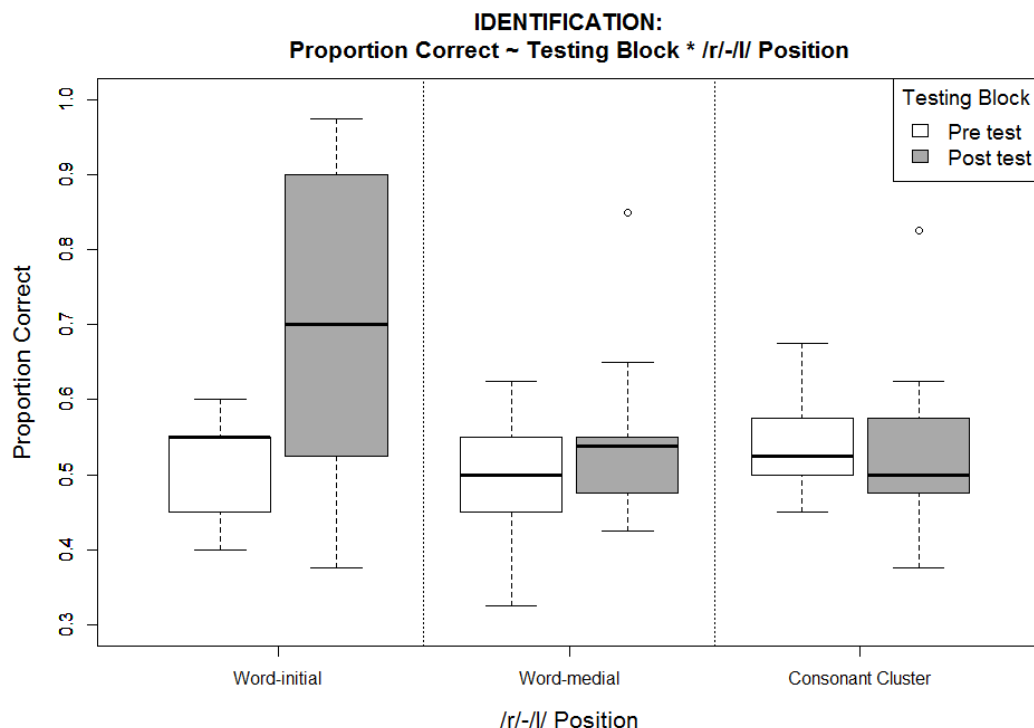


FIGURE 1. Boxplots of identification accuracy for English /r/-/l/, pre and post tests, for Japanese children aged from 82.8 to 105.4 months. The boxplots represent the quartile ranges of identification scores, with circles marking outliers.

FIGURE 2 displays identification accuracy vs. age. There was no significant main effect of age, $p > .05$, but there was a significant interaction between testing block and age, $p = .001$. The older children had higher identification accuracy than younger children at post test, although this difference was not seen at pre test. Post-hoc tests revealed that there was a significant interaction between testing block and age only in the trained initial position, $p < .001$, but not in the untrained medial or consonant cluster position, $p > .05$.

DISCUSSION

Our results demonstrated that Japanese children significantly improved their identification ability in the trained /r/-/l/ position by 18.75%, but the improvement did not transfer to untrained /r/-/l/ positions. This confirmed that computer-based perceptual training can improve children's perception of new L2 phonemes which do not exist in their L1 phonological categories. They also demonstrated that older children improved significantly more than younger children, indicating that plasticity alone does not affect learning, given that plasticity would be thought to be greater at younger ages. It is plausible that developmental changes in children's sensory systems and growing phonological awareness may produce greater learning abilities as children become older (Maxon & Hochberg, 1982; Mann, 1986). Because this study cannot confirm which factors caused the age effect, future studies with other age groups should be conducted, controlling developmental factors such as sensory processing, phonemic awareness, attention, IQ and working memory.

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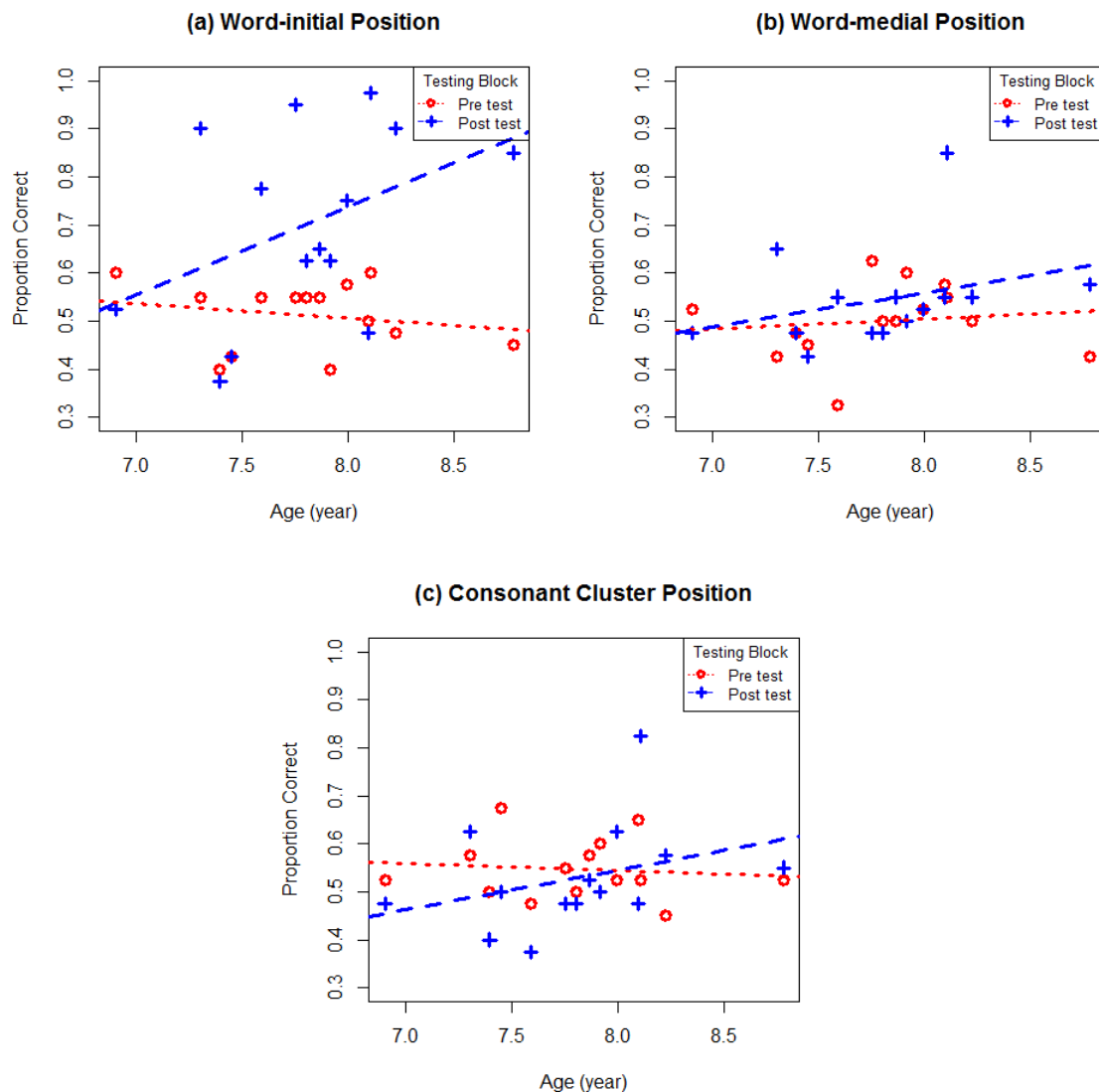


FIGURE 2. Scatterplots displaying individual identification accuracy along with age at pre (circles) and post tests (crosses) of (a) word-initial, (b) word-medial, (c) consonant cluster positions. Dashed lines show linear representations of correlations between proportion correct and age at pre and post tests for each /r-/l/ position.

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