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The effects of auditory-visual vowel and consonant training on speechreading performance



Carolyn Richie*
Diane Kewley-Port



Department of Speech & Hearing Sciences
Indiana University
Bloomington, IN 47405
*e-mail: carodavi@indiana.edu

Abstract

Recent work examined the effects of a novel approach to speechreading training using vowels, for normal-hearing listeners tested in masking noise [C. Richie and D. Kewley-Port, J. Acoust. Soc. Am. 114, 2337 (2003)]. That study showed significant improvements in sentence-level speechreading abilities for trained listeners compared to untrained listeners. The purpose of the present study was to determine the effects of combining vowel training with consonant training on speechreading abilities. Normal-hearing adults were tested in auditory-visual conditions in noise designed to simulate a mild-to-moderate sloping sensorineural hearing loss. One group of listeners received training on consonants in monosyllable context, and another group received training on both consonants and vowels in monosyllable context. A control group was tested but did not receive any training. All listeners performed speechreading pre- and post-tests, on words and sentences. Results are discussed in terms of differences between groups, dependent upon which type of training was administered; consonant training, or consonant and vowel training combined. Comparison is made between these and other speechreading training methods. Finally, the potential benefit of these vowel- and consonant-based speechreading training methods for rehabilitation of hearing-impaired listeners is discussed. [Work supported by NIHDCD02229.]

Background

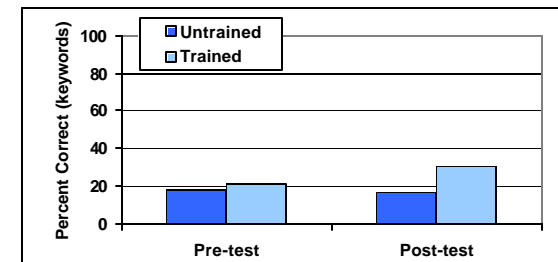
Some argue speechreading is an innate ability that cannot be learned, others argue it may be improved with training (Gagné, 1994).

Some studies have shown modest improvement in speechreading with consonant training (Black et al., 1963; Gesi et al., 1992; Lesner et al., 1987; Massaro et al., 1993; Montgomery et al., 1984; Walden et al., 1977).

A previous study showed improvement in speechreading performance following vowel training (Richie & Kewley-Port, 2003; see also Heider & Heider, 1940).

Previous Findings

Richie and Kewley-Port (2003) showed improvements in sentence-level speechreading ability following vowel identification training



Purpose

The objective of this work was to examine the effects of auditory-visual consonant and vowel training on speechreading performance, for young normal-hearing adults with a simulated hearing loss.

In contrast to previous research, which focused on consonant or vowel training alone, this study combined consonant and vowel training.

Does this training improve speechreading performance?
 How does this training method compare to others?
 What are the implications for hearing-impaired listeners?

Methods

Participants: 21 native English speakers with normal hearing and vision (mean age = 20 yrs).

Group 1 = no training, 2 = C training, 3 = C and V training

Stimuli: Bernstein & Eberhardt (1986), Sensimetrics (2001).

Consonant training was on ten viseme groups:

{b,p,m} {t} {k} {tʃ} {h} {f,v} {s,z} {ʃ} {w,r} {l}

Vowel training was on the following ten vowels:

/i, ɪ, e, ε, æ, α, Δ, o, u, u/

Listening Conditions

Shaped noise simulated the hearing loss of a young, hearing impaired adult (YHI#5 in Richie et al., 2003), SNR = -30 dB.

Protocol


| Day 1 | Day 2 - 7 | Day 8 |
|--------------------------|--------------------------|--------------------------|
| Groups 1, 2, 3 | Groups 2, 3 | Groups 1, 2, 3 |
| Pretest (no feedback): | Training (feedback): | Posttest (no feedback): |
| consonant identification | consonant identification | consonant identification |
| vowel identification | vowel identification | vowel identification |
| word recognition | | word recognition |
| sentence recognition | | sentence recognition |

What were they doing?

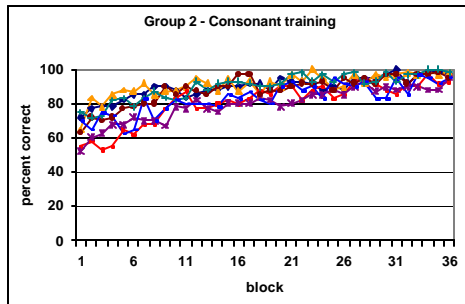
In this experiment you will see some short movies.
 In the box below, click on the vowel sound the speaker said.
 Then press any key to continue. Click OK to begin...

OK

1. bat, boat, boat
 2. di, fi, fi
 3. tape, rake, boat
 4. back, cake, hat
 5. book, sock, hat
 6. put, and, tonight
 7. egg, map, hat
 8. road, even, hat
 9. good, thank, put
 10. radio, even, hat



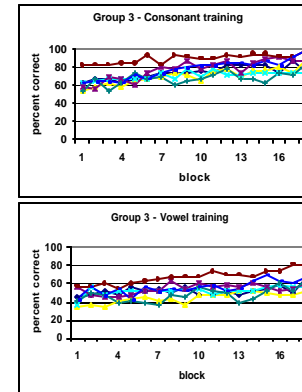
Training Curves



Training curves for Group 2 showed steady increases over the 6 days of training (average improvement was 28%).

Training Curves

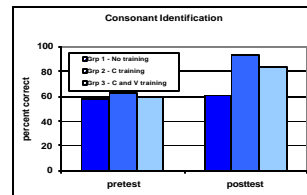
Training curves for Group 3 showed steady improvement over the six days of training (average improvement was 20% for consonants and 14% for vowels).



Consonant Identification

A repeated-measures ANOVA showed significant main effects of Test and Group, and Test X Group interaction.

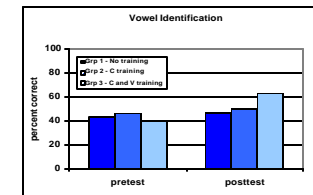
Post-hoc tests showed the training groups performed better than the control group in the posttest, but no difference between training groups in the posttest.



Vowel Identification

A repeated-measures ANOVA showed a significant main effect of Test and Test X Group interaction.

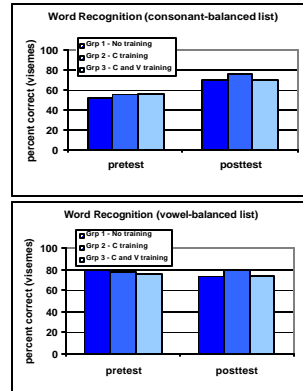
Post-hoc tests showed Group 3 performed better than the control group in the posttest, but no difference between training groups in the posttest.



Word Recognition

On words balanced for consonants, a repeated-measures ANOVA showed a significant main effect of Test.

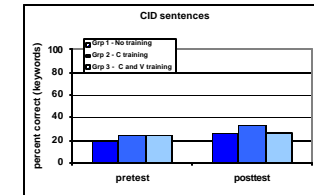
On words balanced for vowels, a repeated-measures ANOVA showed no significant main effects or interactions.



Sentence Recognition

A repeated-measures ANOVA showed a significant main effect of Test.

Post-hoc tests showed no significant differences between groups on the posttest.



Discussion

Do these training methods improve speechreading performance?

Yes These methods improved speechreading performance for vowels and consonants. However, the effects of training on words and sentences are not clear.

How does this training method compare to others?

These methods did not produce improvements in word and sentence recognition, as training on vowels alone did, in Richie and Kewley-Port (2003).

Discussion

Lack of training effects seen in the word recognition task may have been due to the inclusion of new talkers in the posttest

The combined (consonant and vowel) training program might have been more successful if subjects had trained for twice as long.

Subjects in Group 3 only received half as much consonant training as subjects in Group 2.

Conclusions

These speechreading training methods, involving identification of consonants or consonants and vowels in monosyllables, lead to improvements in speechreading ability for consonants and vowels.

However, these training methods did not greatly improve word or sentence recognition abilities, which may be important to listeners with hearing impairment. The utility of these speechreading training methods for rehabilitation is therefore unclear.

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Acknowledgments

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