

The effect of visual information on speech comprehension in Japanese younger and older adults

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Our daily communication is rarely conducted in a quiet environment. Messages are often conveyed amid noise. Previous research has shown that visual information accompanying speech, especially mouth movements and gestures, helps us to understand a speaker's speech in noisy environments (e.g., Drijvers & Özyürek, 2017; Schubotz, et al. 2019). However, these studies were conducted in English and Dutch, which have a large number of phonemes for both vowels and consonants. For those language speakers, lip movements can be an important clue for phonological discrimination. In fact, Sekiyama and Tohkura (1991) found that the McGurk effect in English speakers gradually becomes bigger with age, but the effect in Japanese speakers does not change with age. This suggests that as Japanese has fewer phonemes than English, mouth movements are not a crucial cue to perceive sound information in Japanese communication. However, when they comprehend the meaning of a word, rather than perceiving a sound, mouth movements and hand gestures may also be a reliable resource for them. Thus, we investigated the effects of visual information on speech comprehension in noise in Japanese younger and older adults.

Twenty-five younger adults (M= 20, SD= 3.3, 13 women) and twenty-five older adults (M=69, SD= 4.1, 12 women) participated. To create the audiovisual stimuli, 220 Japanese verbs were initially selected. We then videotaped a female actor saying each verb with two different versions. In one version, she uttered a verb while producing an iconic gesture to represent the action of the verb. We also created another version by blurring her mouth movement. For speech quality, we created three versions of speech: SNR-12, SNR-18 multi-talker bubbles and clear speech. From these materials, we created experimental conditions. Nine conditions came from combinations of three visual variations and three speech variations. Two more conditions were added by editing the 'only mouth movement' condition, and the 'only mouth and gesture condition' (without speech). But these visual-only conditions were excluded from the first analysis due to the unbalanced design for ANOVA.

The experiment was carried out individually. Participants were instructed to verbally state which verb the actor said into a microphone. The order in which the conditions and verbs were presented was randomized. The correct response rate (correct trials out of 20 trials) for each condition was calculated. We conducted a three-way mixed ANOVA with the effect of modality (blurred-mouth, mouth, or mouth + gesture) and noise level (clear speech, SNR-12, or SNR-18) as within-subject factors and with age (younger or older adults) for score accuracy.

Results can be summarized as follows; 1) younger adults comprehend speech better than older adults, 2) for both age groups, mouth movements and gestures facilitate comprehension of degraded speech when noise is present, and 3) younger adults obtained more information from gestures than older adults. These suggest that for both Japanese younger and older adults, both mouth movements and gestures aid speech comprehension. Although mouth movement has a similar impact on both age groups, gestures have a stronger influence on comprehension in younger adults.

References

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