Pronunciationforteachers.com/ Key Concepts

Are Listening and Speaking Connected? The Link Between Perception and Production

When second language learners communicate orally, two modes of language are involved: listening (i.e., perception) and speaking (i.e., production). Neuroscientists, linguists, and language instructors have been interested in the connection between these two modalities for decades. As a result, research from these varied disciplines contributes to our current state of knowledge of the interaction between perception and production.

What happens in the brain during listening and speaking?

The field of neurolinguistics offers insight into the simultaneous processing of speech perception and production in one moment of time. With fMRI, transcranial stimulation (TMS), and EEG equipment, neuroscientists have detected the various parts of the brain that are involved in oral speech communication. There is persuasive evidence that the areas of the brain that are typically associated with moving and motor control are activated when humans passively listen to speech (e.g., Galantucci, Fowler, & Turvey, 2006; Pickering & Garrod, 2013; Pulvermuller, Huss, Kherif, Moscoso del Prado Martin, Hauk, & Shtyrov, 2006; Skipper, Devlin & Lametti, 2017; Skipper, Nusbaum, & Small, 2005; Wilson, Saygin, Sereno, & Iacoboni, 2004). That is, when someone who is perfectly still listens to speech sounds, the motor areas of the brain activate. Even more specifically, if a listener hears another person say the bilabial "Mmmm" sound, the region that controls lip movement is activated in the listener's brain (D'Ausilio, Bufalari, Salmas, & Fadiga, 2012). Motor area activation may occur because the listener's brain is trying to perceive the articulatory movements needed make particular speech sounds. This phenomenon is called auditory-to-articulatory mapping, and it may be a large contributor to language learning.

Just as the motor areas are activated during passive speech listening, the opposite is also true: The auditory portions of the brain activate during silent speech production (e.g., Parker Jones, Seghier, Kawabata Duncan, Leff, Green, & Price, 2013; Price, Crinion, & MacSweeney, 2011; Sato, Troille, Menard, Cathiard, & Gracco, 2013). Studies using this methodology ask participants to silently mouth speech, producing absolutely no noise. As the participants make these mouth movements, the auditory cortex activates. This likely happens because adults have developed a strong association between particular mouth shapes and potential resulting sounds over decades of language use. If you round your lips, your brain knows that a [w] sound is possible. Even if no sound comes out, the brain still anticipates the sound or sounds that *could* come out. Again, this is auditory-to-articulatory mapping, just in the opposite direction. While speaking, this predictive auditory mechanism may help speakers match their intended speech with what actually comes out. This process is also a likely and valuable contributor to language learning.

Neurolinguistics has contributed valuable information about the interaction of the listening and speaking modes in one instant. On the other hand, language learning that occurs over the course of days, weeks, or years can reveal how the two modes interact over a longer period of time.

One Theory of Second Language Speech Learning

One accepted theory of second language speech learning is the Speech Learning Model (SLM), proposed by Jim Flege in 1995. The SLM hypothesizes that learners must first hear sounds accurately before they can say them accurately. The theory suggests that humans have mental representations of sounds stored in memory. The listening mode fine-tunes a sound's mental representation, making it more accurate. Then the accurate mental representation guides how the sound should be pronounced. This flow of ability and information is proposed to be unidirectional, from the perception mode to the production mode.

Does improved perception lead to gains in production?

One way that linguists have tested if perception gains lead to production gains as the SLM suggests is through perception training experiments. In laboratories and classrooms, research participants undergo training to improve the perception of difficult second language sounds. After listening training, they are tested for gains in their speech. Dozens of investigations have utilized this research methodology, and a meta-analysis that combined all of their results found that perception training leads to a small but reliable degree of improvement in production (Sakai & Moorman, 2018). Language instructors and learners can be encouraged by the fact that time spent working on the perception of difficult sounds can positively affect pronunciation as well.

The collection of studies reported in the meta-analysis shows that there is a connection in one direction: listening improvements flow into the speaking mode. The next logical question, though, is to ask if the speaking mode has the ability to improve listening.

Does production training lead to perception gains?

It is difficult to know if production gains lead to perception gains because pronunciation practice typically involves many chances to hear the target sound. Learners analyze and mimic an auditory sample; they also hear the sound of their own voices as they practice. If learners are hearing multiple iterations of the target sound, how can a researcher claim that any perceptual gains are not simply a result of listening practice? It is a challenge for researchers to effectively remove all auditory exposure during pronunciation practice. However, a few studies have attempted to address this question by carefully eliminating exposure to auditory models during the training (e.g., Herd, 2011; Liakin, Cardoso, & Liakina, 2013; Warsi, 2001). The results of these few studies vary: Two found small and inconclusive evidence of perception gains (Herd, 2011; Warsi, 2001), while the other did not find any perception gains (Liakin et al., 2013). One unique study successfully eliminated auditory models in the training *and* auditory exposure from participants' own voices by having them wear noise-cancelling headphones. Sakai (2016) found that after articulatory training alone, vowel perception significantly improved. More studies are needed to confirm these results, but it certainly seems possible that articulatory practice can lead to perception improvements. In that case, perception and production in terms of language development may be connected in a bidirectional relationship.

Conclusion

In sum, neurolinguistics shows that the brain motor areas are activated during speech listening, and the auditory areas are activated during silent speech movements. Linguistics research suggests that perception training leads to production improvements, and production practice may lead to perceptual gains. Findings from these two fields paint a picture of the interconnected nature of the perception and production modalities, and language instructors and learners are encouraged to utilize this information in order to effectively propel students' listening and speaking development.

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