

Robert F. Port
Professor Emeritus
Postal:
Indiana University
5975 S. Handy Road
Bloomington, Indiana 47401
USA

Email:
port@indiana.edu

Speech Communication

Our group, the Technical Committee (TC) on Speech Communication, includes scientists who study all aspects of speech acoustics from linguistics to the physics of vocal fold vibration. Our members can be found in many academic departments, such as speech and hearing science, psychology, linguistics, engineering, computer science, and neuroscience. Some of us work in industrial laboratories and consulting companies. The Speech Communication sessions at Acoustical Society of America (ASA) meetings are the primary international venue for reporting on the latest research about speech production and perception, speech development, the phonetics of various languages and comparisons between them, speech technology, and biomedical issues related to speech communication. Additional technical areas include engineering methods like speech coding as well as physiological research on the production of specific speech sounds.

The ASA Speech Communication TC provides a friendly and supportive environment for researchers and students to report on their latest results. We are the TCs in ASA. Of the roughly 1,200 papers presented at the twice yearly ASA meetings, between 300 and 500 deal with speech communication in some form. Many years ago, it was decided that rather than have a committee accept or reject submitted abstracts for oral presentation, we would have all the Speech Communication submissions presented as posters, except for special sessions organized around a specific topic. The result is that all who submit can be assured that they will have some interaction about their work with interested scientists, of course, from a range of different specializations. In fact, all members, including junior ones, are encouraged to organize special sessions of papers addressing a topic of current importance.

One important topic is how people are able to perceive speech, whether consonants, vowels, or speech intonation in various languages of the world. Although one might imagine that meetings in some other academic area might be the home for research on phonetics of all kinds, it has turned out that ASA meetings and the *Journal of the Acoustical Society of America (JASA)* became our academic home.

Speech Perception

Researchers in the area of speech perception usually focus their experiments on a particular language and on a particular group of speech sounds. This work often involves either modifying natural speech or constructing synthetic speech stimuli for presentation to listeners. They typically develop models of how speech perception is achieved and then test their models on experimental data. The availability in recent years of large speech corpora, such as from the *Linguistic Consortium Database*, has resulted in the development of innovative statistical methods in this area. This work hinges on the development of technical innovations for processing, modifying, and presenting speech signals with either auditory or audiovisual presentation.

Comparison Between Languages

Direct comparisons of different languages or dialects is one of the largest research areas these days. Frequently, this research compares similar sounds, such as a class of vowels or consonants, across two or more languages. This work often demonstrates surprising differences between the phonetics of the two languages. These results keep expanding our view of the actual space of phonetic options available to human speakers.

New Methods in Study of Dialect Variation and Change

The recent development of large-scale corpora of recorded speech is enabling many new research methods. Indeed, many new questions can be addressed and explored regarding regional and social dialects and stylistic effects, such as in American English, and for tracing the evolution of phonetic changes in the speech of individuals over their life and of communities over generations.

One recent study of American English vowels debunked the common implicit claim that it makes sense to speak of the “general American dialect” (Clopper et al., 2004). The authors showed that there are many region-specific ways of pronouncing English vowels but nothing that could be called a dialect-free general American dialect.

Gender Differences in Speech

Another aspect of speech variation coming under increasing scrutiny is a difference in speech details traceable to the speaker’s gender or sexual orientation.

Phonetics and Phonology of Little-Studied and Endangered Languages

Research on phonetics and phonology has studied only a tiny fraction of the 7,000 or so languages spoken around the world. For some years now, some researchers from the Acoustical Society of America have been attempting to document and study as many of these languages as possible. In addition, they seek to at least describe the major outlines of the phonetic and phonological characteristics of these languages.

One interesting study in a recent issue of *JASA* (Heering and van Heuven, 2012) explored how listeners are able to determine the intended intonation of Dutch sentences where the intonation, for example, marks a question versus a statement when the speech is whispered. It turns out that Dutch lis-

teners can do this reasonably well and that speakers modify properties like the formant values of vowels to signal rising pitch to help listeners understand.

Speech Production

Speech production involves very complex and rapid movements which place serious demands on the motor system from the cerebellum to the cortex to the peripheral muscular system. Some members of the Speech Communication group of the ASA work on these issues.

Larynx and Glottis

The vocal folds are exquisitely controlled to change vocal pitch, loudness, and voice quality as well as to serve respiratory functions for both speech and song. Furthermore, as humans mature and age, the behavior of the glottis changes. For example, male voices tend to rise in pitch relative to their voice when young. Technical research techniques such as electroglottography and high-speed laryngeal videoendoscopy as well as basic methods of acoustic analysis are used to account for the details of glottal motion during various kinds of speech.

Tongue Movements

The more gross movements of the vocal tract, that is, those by main articulators like the tongue, lips and velum, are also investigated in detail. These gestures are known to exhibit temporal overlap (often called coarticulation) and thus exhibit great complexity depending on contextual detail. They also exhibit subtle timing constraints. Research on these issues frequently involves neuroimaging techniques such as ultrasound and functional magnetic resonance imaging (fMRI). Even though one might think that these issues of motor control deal only tangentially with acoustics, given ASA audience interest in this research, this work is welcomed at the ASA.

Another interesting recent paper (Ménard et al., 2013) compared articulatory and acoustic details of a group of congenitally blind adult speakers of Canadian French with a control group of sighted speakers for the pronunciation of the full set of isolated Canadian French vowels. Using ultrasound, video, and acoustic analysis, the authors found that the blind speakers exhibited somewhat smaller acoustic contrasts between their vowels but large articulatory differences from the sighted speakers. For example, the blind speakers showed quite a bit less lip protrusion for the rounded vowels and correspondingly greater tongue movements.

Phonetic Accommodation

It is well known that human speech provides a great deal of information about the speaker: gender, approximate age, approximate weight, social class, and so forth. A recently developing research issue is the tendency of speakers in conversation with each other to imitate spontaneously and unconsciously certain features of the person they are speaking with. For example, people in conversation may imitate the intonation, formant values, and timing patterns of speakers whose voice they admire. This new research question is attracting significant interest.

Speech Acquisition

First Language Acquisition of Speech

Children typically begin to recognize their first words toward the end of their first year of life. By the middle of the second year, they will have an active vocabulary of around 50 words. But in the third year, it has been estimated that many children must learn 10-20 words every day. This remarkable achievement requires skills that are not yet understood. Many children face further challenges if more than one language is spoken in the home. Researchers in the ASA study the development of speech articulation, intonation patterns, and speech timing patterns in children.

Acquisition of a Second Language

The difficulties faced by anyone who has a well-established language already and attempts to acquire another language are very different from the challenges faced by young children. There is now a large and growing research program on second-language acquisition addressing these issues. One major issue is to understand the role of the phonetics of the first language in production and perception of the new language. The basic question is what causes a foreign accent? A major goal of this research is, of course, to develop more effective methods of second-language teaching.

Medical Aspects of Speech and Hearing

There are many medical issues that influence the perception or production of speech. Among these is autism spectrum disorder and Down's syndrome, which have consequences for speech production and understanding. But there is much more as well.

Cochlear Implants for the Deaf

Cochlear implants, artificial cochleas that provide a limited number of frequency channels for those who are completely deaf, have undergone rapid technological development over

the past 30 years, leading to many important questions for speech researchers (see article by Matthew Goupell in this issue of *Acoustics Today*). What speech-processing techniques will improve the intelligibility of speech produced by the limited acoustic capabilities provided by current implants? And what kind of training will improve the utility of the device for everyday speech transmission? A small number of laboratories are working on these issues.

Training Methods for Hearing Aid Use

General hearing aids for the hearing impaired have turned out to be less useful than one would hope. Many users leave the aids in their dresser drawer because they find the benefits are not outweighed by the inconveniences. Work is being done to develop training methods to enable more effective use of the aid.

Signal Processing and Speech Technology

Some of our members work on methods of speech coding and speech recognition by computer. This work requires extracting information like formant frequencies and critical other aspects of the speech signal.

Conclusions

The Speech Communication TC of ASA enjoys a nationwide and, indeed, international sense of community that includes many European, South American, and East Asian participants who convene at our meetings to present their latest research results and discuss progress in our areas of interest. An award is given at each meeting for the best poster done primarily by a student. There is also the Raymond Stetson Award given annually to promising graduate students in phonetics and speech science. A limited amount of funding is also available to support student participation in our meetings. When attending our meetings, I personally enjoy not only the sessions on speech but also some of the animal acoustics and musical acoustics session. I have always found that our meetings are interesting and helpful to my research program. It should be mentioned that our group has many affiliations and has cosponsored special sessions with the Physiological and Psychological Acoustics TC, the hearing scientists. We always try to arrange our sessions to be physically near each other at our meetings and to avoid conflicts in scheduling.

Biosketch



Robert F. Port is Emeritus Professor of Linguistics and Cognitive Science at Indiana University where he has worked for 39 years. He received his PhD at University of Connecticut in linguistics, and while at Indiana he helped found the Cognitive Science Program 25 years ago. His research has centered on the phonetics of English, German, Japanese, and other languages with an emphasis on details of speech timing. In the fall of 2014, he served as Technical Program Chair for the Indianapolis Meeting of the ASA and this year he begins service on the Society's Archives and History Committee.

References

- Clopper, C., Pisoni, D. B., and de Jong, K. (2004). Acoustic characteristics of the vowel systems of six regional varieties of American English. *Journal of the Acoustical Society of America* 118, 1661-1676.
- Heeren, W. F. L., and van Heuven, V. J. (2014). The interaction of lexical and phrasal prosody in whispered speech. *Journal of the Acoustical Society of America* 136, 3272-3289.
- Ménard, L., Toupin, C., Baum, S., Drouin, S., Aubin, J., and Tiede, M. (2013). Acoustic and articulatory analysis of French vowels produced by congenitally blind adults and sighted adults. *Journal of the Acoustical Society of America* 134, 2975-2987.

Acoustics Today Interns (ATI)

An opportunity for graduate students and early career acousticians who are members of ASA to serve the Society and gain experience in publication of a major scientific magazine.

Contact the magazine editor, Arthur Popper, to find out more about the ATI program.
(apopper@umd.edu)