PHONETICS IN THE NEXT TEN YEARS

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ABSTRACT

One perspective on trends in research and training in phonetics — that of an American linguist — is presented.

1. INTRODUCTION

Our charge in this session is to discuss the immediate future of phonetics: what will be the main topics of research, what advances will occur, how the field will change, and similar questions. When one tries to talk about the future, it is hard not to simply survey the present, and assume that basically the same will continue. At best, one finds small, recent changes, and extrapolates from these to infer large, future changes. These limitations will hold in my paper. Also, as an American and a linguist, I will have more to say about phonetics in America and phonetics as part of linguistics; I will trust to my colleagues in this session to better represent other perspectives. (See also Kuhl [2] for yet another view.) However, to broaden my horizons, I circulated a questionnaire asking for thoughts from other phoneticians. Although this paper will not consist of a systematic report on responses to that inquiry, the responses nonetheless influence my ideas here, and a list of respondents is thanked below. A second influence has been my service as phonetician/phonologist on the U.S. National Science Foundation Linguistics Program advisory panel. Like the survey, this position gives me a wider perspective on what other individual researchers take to be the most interesting and promising areas and methods of research in the immediate future.

2. CHANGES IN WHAT PEOPLE DO AND HOW THEY DO IT

2.1. Introduction

Work in phonetics is in part driven by the development and availability of new technologies. This is very much the case today, in several ways.

2.1.1. Speech Production. First, outside of industry there is a current great enthusiasm for work on speech production, especially articulator movements, due to the X-ray microbeam facility and to the various magnetometer systems, ultrasound, and other emerging possibilities. These devices are now available primarily in a few specialized labs, but magnetometers and ultrasound may come to be found in other well-equipped labs (as are the Seispot and other movement-tracking systems). The interest of these systems is that they provide data over time which is easily processed and interpreted, and thus they fit in with the study of speech dynamics. I will rely on Professor Fujisato for more extensive discussion of this topic.

2.1.2. Databases. Second, especially outside of academia, there is a growing use of large speech databases for work in acoustic phonetics and speech recognition. Virtually all industry phoneticians mention this as an important factor for the direction of future work. Such databases, as a consequence of cheaper computer memory and faster access devices, will become more common outside of industry as well, and more of them will be assembled, particularly in Europe. This development in the availability of large corpuses of speech is symbiotic with an interest in natural, connected speech, which I will discuss below: with carefully annotated databases, analysis of large numbers of instances of any kind of acoustic phonetic event is possible. Researchers then need not limit their studies to minimal pairs or otherwise carefully controlled wordlists. However, it must be noted that the databases available today are not typically based on natural speech, nor do they span a range of styles and genres. While it may be hoped that large speech databases will in the future contribute to the study of more natural speech, much careful thought is needed to plan databases for this purpose.

2.1.3. Computers. Third, the range of acoustic analyses available outside of the major research labs is vastly improved. Ten years ago a DEC PDP-11 computer (standard in linguistics department phonetics labs) provided one user at a time access to not-always-flexible DSP, acoustic analysis, and synthesis programs. A spectrograph provided spectrograms and power spectra, again to a single user. The typical phonetics research lab would have both kinds of machines, and non-specialist departments would have just the spectrograph. Today, these two machines have merged in function, and any department or lab acquiring a "spectrograph" can have easy access to a wide range of fast acoustic analysis. But better yet, personal computers provide other, even less expensive, means for acoustic analysis, thus allowing multiple users and even portable labs. It is possible to have an IBM- or Macintosh-based system that performs most or all of the functions of the DEC machine of ten years ago. Even five years ago these were not commonly used for speech work in N. America (Keating and Anderton [1]), but now they are being acquired even by non-specialist departments. Another factor here is the availability of several commercial packages for acoustic analysis for these machines. One further change to be expected in this regard is that the availability of inexpensive processors and grey-scale printers will make computer-generated spectrograms the norm. This development will feed another development to be discussed below, the growth in acoustic phonetic description. New computers do not just make the old phonetics lab less expensive. They also make new applications available to more users. In addition to large speech databases, they include digital imaging techniques, multi-channel data collection, articulatory modelling and synthesis, especially complex models of the vocal cords and tongue, and parallel distributed processing/neural networks.

2.2. Trends and Change

2.2.1. Speech Production. It seems clear that right now the most energy and enthusiasm in academic phonetics, at least, is focused on speech production studies, and this situation is likely to continue for at least a few more years. Another contributing factor would appear to be some waning of interest in the dominant approaches to speech perception from the 1970s. There are two theoretical driving forces as well. Some research is based in a concern for more general biological properties of movement and motor coordination (especially at Haskins Labs). Other research seeks to provide a full description of speech, including time-varying properties. There is relatively
little information at hand about
time-varying properties of articulation, and this creates a
need for many new studies. The one problem I see for this area of
research is that it is in conflict
with the goal of moving away from "laboratory speech", towards the
study of more natural speech, on
which more below.

The theory and techniques
developed as part of a dominant
research trend generally have a "trickle-down" effect. However, this I
mean that work on normal adults is
carried over into the areas of e.g.
speech development and clinical
research. We can expect this to
occur in the present case of speech
production. Thus some responses to
my questionnaire from linguists
trained in speech production
research mentioned these as
promising areas for future work.
There have always, of course, been
speech production studies of
children and clinical populations,
given the fact that many
researchers in speech production are
in Speech and Hearing
departments. In the future, however, such studies should be
more common. These will
complement the acoustically-
oriented studies of the 1980s.

2.2.2. Speech Perception. The
remarks above on speech
production are not meant to imply
that speech perception has been
abandoned. One trend is to discuss
speech perception in terms of more
general models of the auditory
system; another is to discuss it in
terms of more general models of
psychological category formation.
It seems reasonable to expect that
these two trends will be brought
m
together in the near future, so that
the physical and psychological
aspects of perception will be given
equal attention. A further topic of
interest is the use of dynamic
information in speech and, more
generally, the perception of
connected speech.

2.2.3. "Real" Speech. There is
growing interest in the acoustic
properties of more natural speech,
especially speech production, and cognitive science.

2.3. Other Change

2.3.1. Language Description.

There is surprisingly little thorough phonetic data available on most languages. Among phoneticians, linguists have this responsibility; yet they often work only on English. However, the increased availability of good systems for acoustic analysis should change this situation somewhat, allowing descriptive linguists who are not from major phonetic research centers to carry out more instrumental phonetic studies. Also, the revival of the Journal of the IPA as an outlet to publish descriptive phonetic work will help. Thus we should see more basic data, especially acoustic phonetic data, available on many of the more "exotic" sound types.

At the same time, the development of speech databases for certain major languages e.g. in Europe will result in more thorough and comprehensive descriptions of these languages. Another development is that portable computers can be used to digitize and store audio and physiological signals, and also for acoustic analysis. Such systems make it possible to use computers for instrumental phonetic fieldwork. But it's not just that more cross-language work will be done, and that perhaps we will build up more comprehensive acoustic descriptions of certain languages. It's also that this descriptive work will be more sophisticated, in that it will be tied more directly with basic theoretical models and with analysis-by-modeling. We are beginning to see more kinds of acoustic measures being used, especially applied to less-common sounds and sound contrasts, in the way that Ken Stevens, Peter Ladefoged, and their colleagues have been doing since the 1960s. To some extent this change follows from developments in the acoustic theory of speech production, and its application to a broader range of cases.

It is also possible that we will see changes in which languages are studied by phoneticians. At least in the U.S., languages of the Pacific, especially the Asian languages, are taking on more importance, yet these are not much studied by phoneticians. At the other extreme, there seems to be more sensitivity among linguists generally to the fact that many indigenous languages are in or near their last generation of fluent speakers. Perhaps phoneticians will play a larger role in preserving a record of such languages.

2.3.2. Non-Phonetician Users.

Another change I see happening now is that there are more of what I will call "users" of phonetic data. By "users" I mean people who learn how to use certain equipment and make certain measurements without having a more general interest in phonetics, without first having general training in phonetics, and with no long-term interest in setting up, maintaining, or perhaps even being affiliated with, a phonetics lab. "The use of speech data is much more common among non-phoneticians now than before, I think. First, psycholinguists who do not study speech per se are increasingly interested in working in an auditory modality. This means they use speech signals to create their experimental stimuli. This is a striking aspect of the speech lab set-up at the Max-Planck-Institut für Psycholinguistik, for example. Second, phonologists and linguists in language-area specialties seem ready to rely more on instrumental data at times where the ear alone, especially the untrained ear, is not reliable. For example, it is once again becoming the norm to see f0 traces in essentially phonological studies of intonation or of tone. (Use of instrumental data by phonologists is generally cyclic. A facilitating factor these days is the familiarity of personal computers to non-phoneticians, which makes the phonetics lab less threatening than it once might have seemed.) Third, second language researchers seem to be increasingly interested in phonetic analysis as a tool for contrastive analysis and for assessment. (This also will contribute to language description and to cross-language work.) As a result, researchers in all of these areas will want access to phonetics instrumentation. My impression of this situation is that laboratory phonetics is maturing as a "service" discipline, exactly parallel to the way that traditional impressionistic phonetics has become a service discipline. (I say this in light of the fact that phonetic transcription is a theoretical construct, as Ladefoged has recently made great efforts to stress.) The use of phonetics lab equipment for speech data analysis or manipulation is a service that phoneticians offer to other phonetics "consumers." The good side of this is that more people get involved in phonetics, bringing more data and new issues to the phonetician's attention. The bad side of this is that the non-phoneticians will come to think that this is the whole of instrumental phonetics. They may think that, just like impressionistic auditory phonetics, instrumental phonetics is an essentially non-theoretical discipline where everything has already been worked out, and where the only remaining challenges are descriptive. They may also think that qualifications in phonetics consist mainly of technical training. Such an impression of phonetics among non-phoneticians would not be good for our field. For example, the best students would tend not to choose to go into phonetics.

2.3.3. Historical Phonetics.

My own impression is that there is renewed interest among younger phoneticians in the area of sound change and historical phonetics, but not yet any unifying themes or strong theoretical innovations in their work. Generally this interest springs from work in particular language families or areas. Not only might we hope for increased phonetic sophistication in theories of sound change, but data from sound change might be expected to provide test data for general phonetic theories.

2.3.4. Funding. It seems clear that phoneticians are able and willing to work with engineers have a much better time in the funding situation. The same obviously applies to phoneticians interested in more applied kinds of work. Our European colleagues benefit financially from collaborations with industry, but caution us about the problems that arise (lack of freedom to do basic research, and bureaucratic/administrative problems). Many (American) academic respondents to my questionnaire already complained that speech technology seems to be driving the field more than they would like. Almost everyone in academia responding to my questionnaire thought that funding considerations were going to become more important in the future, that is, that they would have to choose their topics based more on considerations of funding possibilities than they have in the past.

3. CHANGES IN EMPLOYMENT, ETC.

3.1. Retirement, Hiring Patterns.

Although all the new reports assure us that academic jobs will be booming in this decade, and although there is more hiring going on in U.S. universities, a disturbing pattern is that there has been no increase in long-term jobs for new phonetics Ph.D.s in linguistics. Linguists are going to Speech and Hearing departments (which seem to be a genuine growth area for linguists just now), and to industry. The situation in Europe, Australia, etc. is also not especially encouraging, and essentially jobs are scarce everywhere. Perhaps we faculty
could help our students by doing more — or leaning on these very students to do more! — to integrate phonetics better into cognitive science, since that does seem to be an academic growth area. Another strategy is to convince phonologists in more departments that they would benefit from having a phonetician as a colleague, while also pointing out that a reasonable phonetics lab can be started for less money than might have been expected. The other thing we can do is to call more attention to the availability of absolutely top-rate women and minority phoneticians; a university can do well in its affirmative action programs by expanding in phonetics.

3.2. What Students Should Be Studying For the Future

In my questionnaire I asked respondents to advise current students on how to prepare for their futures, including what they themselves look for in hiring. The responses were quite revealing, and can be summarized as follows. Most important for phoneticians generally is a solid ground in acoustic theory and speech acoustics. Also important are basic knowledge of experimental design and statistics and user skills in acoustic analysis and synthesis. The more computer experience a student has, the better, even in academia; programming in C and in an AI language are recommended for industry. Some background in linguistics is helpful for industry, and substantial background in phonology is helpful for academic linguistics departments. Another recommendation is experience with modeling and simulation; it reinforces knowledge of theory and demonstrates computer skills. Finally, students interested in an industry career should try to arrange an internship or some other kind of student job at a company or industry-related research center. My hope is that students can use this report as a guide in considering possible
directions for their own research or future careers. There are many exciting research questions to choose from, most of which can be directed to either academic or industry careers. The classic advice, to find an interdisciplinary niche, remains relevant today for both academia and industry. Students should also think about how theoretical developments from various areas might translate into applications, or contribute to progress in applications-oriented research. Students should not wait for industry to realize that their skills are needed, because they themselves can help create the market for those skills.

4. References


5. ACKNOWLEDGMENTS


Price, B. Repp, C.-Y Tseng, M. Withgott and a couple of unidentified respondents. Thanks also to Louis Goldstein and to members of the UCLA Phonetics Lab.