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State of the art: current methodological innovations in sociophonetics

Innovation is a buzzword at many levels of society, business and science. We as researchers are constantly urged to focus on the new and the ground-breaking, and on moving forward to new frontiers, enabling exploration of new knowledge in new combinations and from new perspectives. This as is true of sociophonetics, the study of socially grounded phonetic variation, as it is of any discipline. Technological breakthroughs and boundary-crossings happen every day at the cutting-edge of science, and the methodological and theoretical consequences of these movements are often rewarding to spend time on. This was our motivation in setting up a series of seminars in Groningen, Roskilde and Edinburgh that brought together a wide-ranging group of sociophoneticians and sociolinguists between 2014 and 2017. We called our seminar series *IMPS/IMS: Innovative Methods in (Phonetics and) Sociophonetics*, and the special issue of *Linguistic Vanguard* that you are presently reading is one result of those several years of collaboration with a particular focus on innovative methods in our disciplines, and their consequences.

Scientific methods are never ends in themselves, but our methodological choices necessarily reflect the theoretical premises and preconceptions we bring to our research. Use of either established methods of analysis, or new and innovative ones – sometimes under interdisciplinary influences – often stems from a desire to have the data speak more clearly to us, and as technology develops, so do the methodological possibilities. If methods and methodological frameworks that are established among a group of scholars are confronted by new epistemologies, data, and insights, our analytical techniques have the opportunity to move and change accordingly. New sociolinguistic and sociophonetic questions often result in particular challenges to both data collection and analysis.

In recent years, we have seen an increase in the public freeware availability of what were previously highly specialized laboratory-based techniques for acoustic phonetics. This has meant that the specific challenges that are posed by the kind of data obtained from sociolinguistic fieldwork are now open to many different sorts of treatment with a sophisticated array of tools alongside the spectrographic analysis packages that have long been indispensable for our work (for instance, ultrasound technology, electropalatography, and a variety of brain imaging techniques). Along with recent developments in theoretical sociophonetics and the spread of scientific statistical computing over the past decade, we have seen new methodological techniques emerge, built on new research questions, and new ways of thinking about our discipline and about language and language data itself.

We began our reflections in 2014 with a conference workshop that foregrounded "vowels" and "systems of vowels"/"the vowel system" as theoretical concepts and the methodological implications that followed on from that. This arose as a focus because the study of variations in vowel production and within vocalic

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configurations (often conceptualized as "systems" and "subsystems" within sociolinguistic theory, e.g. in Labov 1994) forms part of the paradigmatic foundation of sociolinguistics. Recently, new developments in the methods employed in the quantitative study of vowels have emerged, both in terms of methodologies of measurement and of graphical representation of vowel configurations or "systems". While formant extraction has been the key form of instrumental analysis in acoustic phonetics since Joos 1948 and Peterson and Barney 1952, and in sociolinguistics since Labov et al. 1972, techniques deriving from speech recognition work, for example, have recently made inroads into the field, and speech perception has taken a leading role within sociophonetics in particular. Forced alignment and programming in R for new quantitative analysis and visualization methods are becoming ever more widespread tools.

In the light of these new ways of looking at vowels, we wanted to ask for example whether there is a need for sociolinguistics/dialectology to challenge the fundamental idea of the vowel system as a "system" in the first place. To what extent can the system be thought of as a theoretical convenience, or is it "real" in some sense, and what arguments and evidence dominate each position? Why do we think of the vowels of language X as operating as a coherent and homeostatic series of contrasts, and what are we claiming when we present evidence of the system changing in some way? We wanted to open up the possibilities these new analytical techniques provide, and to ask how these methodologies and analytical approaches might have consequences for the ways in which we conceptualize vowel variation theoretically.

The history of the phonetic sciences has indeed been punctuated by such sudden advances made possible by significant methodological innovations that aid the capture of speech signals and the measurement of their key properties. Without a doubt, the most important of these were the advent of sound recording and the invention of sound spectrography. Other major milestones have been the development and later the commercialization of direct vocal tract imaging technologies such as electropalatography or ultrasound, computerized methods for acoustic signal manipulation and analysis, and speech recognition and synthesis systems. Thanks to these techniques, the scope and volume of empirical research in phonetics and its offshoot disciplines, including sociophonetics, have increased spectacularly.

Research methods, once they are established in a field, can sometimes tend to take on a life of their own as unreflected choices, and assumed to represent best practice. It took some time for the analysis of vowels to move on from mid-point formants to systematic consideration of formant trajectories. It is now clear that from the perceptual as well as the linguistic change point of view, that vowels are often better treated as complex, dynamic events rather than as phonetic entities represented by a single point on a two-dimensional plane.

We believe that as sociophoneticians we should continually reappraise the epistemological impetus that drives our search for solutions to the problems we identify as especially worthy of our attention, and that there is a case to be made for re-evaluating and, where necessary, re-calibrating the tools we use for our investigations. Looking laterally for inspiration from cognate fields (mainstream phonetics, laboratory phonology, cognitive psychology, etc.) is one important source of fresh thinking that will offset the risk of sociophonetics stagnating, or becoming excessively insular and self-referential.

Taking a chronological look, our first seminar was a special panel presented at the Methods in Dialectology XV Conference in Groningen in August 2014. The panel was entitled *Of vowels and "systems": New methods for the study of vocalic variation*, and was convened by Anne Fabricius and Dominic Watt. It featured papers by Josef Fruehwald, Tamara Rathcke & Jane Stuart Smith, Tyler Kendall & Charlotte Vaughn, Robert A. Fox & Ewa Jacewicz, Douglas S Bigham, and Nicholas Flynn. Finally, Roeland van Hout was discussant for the panel.

The second seminar, *Innovative Methods in Phonetics and Sociolinguistics*, was held in Roskilde in November 2014, organized by Anne Fabricius, and it featured papers by Anne Fabricius & Dominic Watt, Márton Sóskuthy, Lauren Hall-Lew, Nicolai Pharao & Jacob Thøgersen, Tyler Kendall, Gert Foget Hansen, Dominic Watt and Georgina Brown.

Finally, the third seminar, Innovative Methods in Sociophonetics II, was held in Edinburgh in conjunction with the 4th Workshop on Sound Change in April 2017, and was convened by Anne Fabricius, Nicolai Pharao and Lauren Hall-Lew. Two plenaries were included, by Jane Stuart-Smith and Josef Fruehwald, and further

papers were presented by Georgina Brown, Megan Jenkins and Jessica Wormald together with Dominic Watt, by Fergus O'Dwyer, and by Vincent Hughes & Jessica Wormald.

The special issue you are reading is a selection of papers from those three events, united by a curiosity about optimizing methods, of seeing consequences and wider implications and gaining a perspective for further reflection. To that end, all our presenters, discussants and audiences have contributed greatly to the success of our endeavors, and we would like to express our sincere thanks to them all.

The present collection begins with an exemplification of how we gain a richer understanding of speech variation and sound change by considering both static and dynamic factors in our analyses. Jane Stuart-Smith has analyzed spectral properties of sibilants in a corpus of recordings of Glaswegian. Using static measures of center of gravity and slope, she is able to show how the gendered differentiation in the production of sibilants changes in both real and apparent time. Adding a dynamic perspective to these analyses through the innovative use of discrete cosine transformation to analyze the spectral properties of sibilants, her paper shows how prosodic, linguistic and social conditions interact in the process of ongoing sound change in the sibilants.

Vincent Hughes and Jessica Wormald argue in the second paper for increased collaboration between the fields of sociophonetics and forensic phonetics. They argue that while the two disciplines may have rather different ultimate goals, they share an interest in the increased understanding of the factors that shape within-speaker variability at the phonetic level. Through a thorough review of some recent findings in both fields, the paper shows how forensic analysis may benefit from the detailed knowledge of different language varieties that can be found in sociophonetic studies, while also highlighting how a deeper understanding of technical issues concerning the recording of speech material coming from forensic phonetics may benefit sociophonetic analyses of variation.

The third paper, by Lauren Hall-Lew and Zac Boyd, looks at how the study of within-speaker stylistic variation in sociophonetics may benefit from employing methods from experimental phonetics in fieldwork. Through analysis of vowels elicited using both interviews and self-recordings as well as map tasks, diapix tasks and picture book narration conducted with the same speakers, their paper shows that variation is less sensitive to task type than to interactional context, and argues for the benefit of using laboratory based tasks for the study of infrequently occurring sociolinguistic variables.

More and more studies of speech variation have come to rely on tools for forced alignment of transcripts and recordings. The paper by Laurel MacKenzie and Danielle Turton compares the functionality of the FAVE and DARLA tools for this process by applying them to six different varieties of British English. Both tools were originally developed for use with American English, but the paper shows that they perform well also on British English varieties, showing that while inspection of the output of forced aligners by human analysts is still necessary, forced alignment is a reliable new tool in the sociophonetic toolbox.

The fifth paper in the collection takes a close look at one of the most common types of sociophonetic analysis: the acoustic study of vowel variability. In this paper, Tyler Kendall and Charlotte Vaughn use simulations to assess the variability introduced by variations in time points of measurement and LPC settings in the estimation of formants in read speech. The paper shows that some degree of variability must always be taken into account in the estimation of formants and urges sociophoneticians to consider these inherent limitations of LPC-based methods seriously in our continued effort to understand phonetic variation and change.

The final paper in the collection, by John Tøndering and Nicolai Pharao, explores listeners' sensitivity to prosodic information as a cue to speakers' regional background, in a country with a high degree of dialect leveling. By using new modifications of previously used techniques for isolating either segmental or prosodic cues in the speech signal, they show that features that have been found to be the most consistent difference between varieties in production studies are not necessarily sufficient for listeners to use in the identification of these varieties.

We hope that this collection will inspire constructive debate and fruitful collaboration within the growing community of sociophonetic researchers!

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