

Book Reviews

Articulatory Modeling and Phonetics—R. Carre, R. Descout, and M. Wajskop Eds. (Brussels: G.A.L.F., Groupe de le Communication Parlée, 1977, 307 pp.). *Reviewed by Thomas Baer.*

This book comprises the proceedings of an international conference sponsored by the G.A.L.F. (Association of French-Speaking Acousticians) and held in Grenoble, France, July 10-12, 1977. It contains reprints of 20 papers loosely organized into three conference sessions entitled:

- I. Determination of the area function
- II. Articulatory modeling and phonetic theory
- III. Articulatory modeling and speech synthesis; models of vocal and noise sources.

Each of these three groups of papers is accompanied by a report from the session chairmen introducing and providing an overview of the topic and summarizing the ensuing discussions. This assemblage is accompanied by a Preface by Max Wajskop and an Introduction by Gunnar Fant.

The stated objective of the meeting is to advance, through modeling studies, knowledge of the mechanisms controlling speech production. The attendees, numbering 28, represent a strong but, of course, not complete sampling of investigators from Europe, North America, and Japan interested in speech processing and articulatory physiology and modeling. Although the subject matter of the papers seems at first glance quite disparate, they are drawn into a coherent framework by Fant in the short introduction and by the session chairmen. All are concerned with relationships between acoustic properties of speech and their underlying articulatory counterparts. The first session is concerned with the transformation of acoustic information to area functions. The necessity for this is seen as the need to supplement or replace incomplete instrumental measures of speech articulatory activity for phonetics research. The second session is more directly related to phonetic issues. These papers are concerned with modeling acoustic and articulatory data, or modeling articulatory strategies for producing speech. The third session includes two papers

related to laryngeal models (Flanagan and Ishizaka; Guerin, Degryse, and Boe), one on a dynamic vocal-tract simulation technique (Maeda), and one, apparently misplaced, on a technique for estimating articulatory parameters by regression from acoustic parameters (Moller, Strube, and Kretschmar).

Methods for deriving area functions discussed in the first session include direct analysis of the speech wave (El-Mallawany; Wakita) and indirect acoustic methods (Descout, Tousignant, Lefevre, and Lecourse; Sondhi). In addition, the session includes papers concerning a method of analysis by synthesis (Genin), and a study accounting for the acoustic effects of vocal-tract dynamics (Jospa). Along with the chairmen's reports, this session provides a fairly complete presentation of the issues and viewpoints concerning prospects for the accurate transformation from acoustic data to area functions, and about the relative merits of different methods.

In the second session the introductions by the chairmen (Lindblom, Perkell) have nearly the status of papers. Lindblom's introduction stresses the use of articulatory modeling for interpreting the nature of acoustic patterns. Perkell's introduction provides a classification of past modeling efforts, and stresses the need for modeling to account for the way in which discrete linguistic input units become encoded into the continuous articulatory and acoustic output stream. Within the session, the same two authors (Lindblom, Lubker, and McCallister; Perkell) present papers dealing with global models for the organization of speech production. Both arrive at the notion of speech articulation coded in terms of sensory targets, with ongoing control performed with respect to an internalized predictive simulation model of the articulatory system. Lindblom *et al.* describe studies of articulatory compensation. Perkell's paper also contains a brief review of a muscle-based, dynamic, biomechanical tongue model. Three papers (Fujisaki; Shiginaga and Ariizumi; Sonoda) show that various acoustic and articulatory data can be functionally modeled as responses of second-order linear systems to relatively simple (step function) inputs. Timing of these inputs is discussed by Fujisaki. Three additional papers (Fujimura; Simon, Han, and Brock; Guerin and Mrayati) discuss patterns of articulation for different classes of sounds. The first two deal with motor organization as indicated by data from X-ray studies. Fujimura shows that reorganization of interarticulator timing accounts for a class of syllable-final voicing distinctions and for the redistribution of segment durations through out the syllables. Simon *et al.* deal with articulatory contrasts associated with Korean stop consonants differing in laryngeal features. From a modeling study, Guerin and Mrayati suggest the need for articulatory adjustments supplementary to velar lowering to account for acoustics of vowel nasalization in French. A paper by Kiritani and Sekimoto deals with functional modeling of data from X-ray tracking studies. A principal component analysis of articulatory trajectories for vowels defines the dimensions of articulation, confirming the articulatory reality of some traditional phonetic dimensions. Finally, Mermelstein and Rubin argue for the use of articulatory synthesis to prepare stimuli for perceptual studies of speech, and describe a synthesizer for this purpose.

The significant strength of this volume is that it represents a fairly complete sampling of research issues and results relevant to modeling of articulation and articulatory data, with particular emphasis on work from France and Belgium. Sections dealing with mathematical relationships between articulatory variables or area functions and acoustics are especially useful. There is, however, some overlap between the contents of this book and other publications—particularly other conference proceedings. Naturally, some of the papers also appear as articles in subsequent publications. This Grenoble conference follows by seven months a U.S.-Japan Joint Seminar on Dynamic Aspects of Speech Production held in Tokyo in

December, 1976, the proceedings of which were also published [1]. It is perhaps with this publication that the overlap is most complete. The Grenoble conference is, as noted by Fant, a logical successor to the one in Tokyo since the Tokyo conference emphasized advances in instrumentation and their implications. The advent of instrumentation, such as computer-controlled microbeam X-ray, has dramatically increased the wealth of articulatory data and thus both necessitates and supports increased activity in articulatory modeling. Issues to be investigated and specific modeling results are discussed in some detail within the proceedings of the Tokyo conference, however, and this overlaps significantly with the contents of both sessions I and II in the Grenoble conference.

A weakness of *Articulatory Modeling and Phonetics* is the lack of editing for grammatical and typographical errors. In addition, its usefulness for some readers will be limited by the fact that five of the articles and some of the discussion are published in French, with only abstracts in English. In general, this volume is not suitable as a classroom text, but it is suitable for investigators seeking an overview and status report on issues of phonetics and articulatory modeling. For some, the proceedings of the Tokyo conference should also be considered.

Copies of this book may be ordered from the Institute of Phonetics, University of Brussels, 50 F. D. Roosevelt Ave., 1050 Brussels, Belgium.

REFERENCES

- [1] M. Sawashima and F. S. Cooper, Eds., *Dynamic Aspects of Speech Production*. Tokyo, Japan: University of Tokyo Press, 1977.

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