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## **Chapter 1: Introduction**

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### **1. Introduction**

Over the past few decades researchers interested in linguistic aspects of human speech have made a concerted effort to strengthen the empirical foundation of their work by incorporating the methodologies and perspectives of the traditionally experimentally oriented fields such as phonetics, sociolinguistics, language acquisition, speech science, and psycholinguistics. This integrated and dynamic approach has led to fruitful collaborations across research specialties, and the current state of the field is diverse and intellectually stimulating. This volume offers a detailed picture of this increasingly influential research perspective called *laboratory phonology*.

In a narrow sense, laboratory phonology is associated with an approximately biennial conference (*LabPhon*), each of which has resulted in a published volume of papers. Starting with LabPhon 11, conference papers appear in the recently founded Association of Laboratory Phonology's journal, *Laboratory Phonology*. In a broader sense, laboratory phonology is a scientific perspective of an expansive community of scholars who are dedicated to bringing multidisciplinary approaches to bear on the critical questions concerning how spoken language is structured, learned, and used. Laboratory phonology is not a specific theory. Rather, researchers with this perspective draw on theories and tools from various branches of the cognitive and natural sciences to elucidate the nature of human speech (see Pierrehumbert, Beckman, and Ladd 2000/\*\*this volume\*\* for fuller discussion of this point, see also Croot 2010). Thus *laboratory* is understood here in a very broad sense, representing systematic experimental approaches.

The laboratory phonology approach has advanced our understanding of questions about human speech that have commonly been framed in terms of traditional definitions of phonetics and phonology. Central insights into the nature of these questions arise by placing them in the wider context of cognitive and biological systems, particularly through integrated investigation of production, perception, and acquisition. Laboratory phonology is an intellectual space. Embracing a variety of theoretical approaches leads to innovative research questions, and this eclectic outlook means that techniques are ever evolving. The focus of this volume is on where laboratory phonology is headed. In this introduction, we first briefly review the development of laboratory phonology in the context of the motivation for this volume (§2). We then turn to the goals and structure of this volume (§3).

## 2. Motivation for the volume and brief history of laboratory phonology

While handbooks exist for phonology, phonetics, sociolinguistics, and psycholinguistics, there is to date no handbook for laboratory phonology. Although not a field or subfield in the strict sense, with a 25-year history, the growing body of literature within the laboratory phonology approach and the rich set of results in this shared endeavor deserves a state-of-the-art assessment. In addressing this need, this handbook presents research results and methodological approaches, while reflecting on them in light of broader themes and directions concerning the study of human speech.

The term *laboratory phonology* was coined by Janet Pierrehumbert in the planning stages of the first conference which took place at The Ohio State University, in June 1987. LabPhon I was co-organized by Mary Beckman and John Kingston, with one of the central goals being to bridge the distinct subfields and subcultures of phonology and phonetics. It also established the foundational premise that progress would be achieved more successfully through integrated methodologies, as stated in the introduction to the LabPhon I volume (Beckman and Kingston 1990/ **\*\*this volume\*\*** ##ADD page #) and repeated here:

“Therefore, we ask: how can we use the physical models and experimental paradigms of phonetics to construct more viable surface phonological representations? Conversely, what can we learn about underlying phonetic representations and processes from the formal cognitive models and computational paradigms of phonology? Determining the relationship between the phonological component and the phonetic component demands a hybrid methodology.”

Since that time, the LabPhon conferences have brought together an increasingly large community of scholars with diverse backgrounds, but shared interests, addressing the fundamental question of the nature of human speech and phonological systems. Over the years, the importance of the conference and the impact of related work have grown, as attested to by the strong attendance at the biennial conferences, now including a truly international audience (see Pierrehumbert and Clopper 2010 for a network analysis of the increasing intellectual influence of this work). In this volume, we use the term *laboratory phonology* to refer to this body of research and we use the term *LabPhon* to refer to the conferences.

Over the past quarter century, there has been an evolution of issues and themes central to laboratory phonology (see Cohn 2010 for more detailed discussion). As mentioned above, the first LabPhon conference set out to bridge the gap between phonology and phonetics, to redefine

the questions being asked, and to promote more integrated methodologies. For the first several meetings, the questions and methodologies were defined in terms of phonology and phonetics. Laboratory phonology brought into focus some of the central questions of the time, such as the nature of the interface, and the language-specific nature of phonetics (contra the view espoused by Chomsky and Halle 1968 *The Sound Pattern of English*), leading to the now commonly accepted concept of phonetic knowledge.

A central result is an enriched awareness of variation, not just in terms of the details of physical realization (implicit in phonetics), but in terms of variation in all dimensions of language use, leading to the question of the role of variation in the knowledge of sound systems. Traditional linguistics has ignored some types of variation and divided up the rest according to sometimes rigid categorizations — variation has often been assumed to be either systematic or unpredictable, regular or random. These divisions were inspired in part by common views of the division of competence and performance. The laboratory phonology perspective eschews this division, acknowledging that the full range of variation is central to an understanding of linguistic representations and processing of speech. Attention to phonetics, both production and perceptual processes, as well as sociolinguistic and diachronic detail, have revealed the closely integrated nature of language competence and performance. Laboratory phonology has played a critical role in showing that only with greater attention to fine detail in our empirical studies will we be able to develop adequate models.

There has also been increased attention to questions that are central to psycholinguistics, including concerted attention to language acquisition and the lexicon, and highlighting the role of stochastic generalization in the organization and knowledge of sound systems (a critical alternative to viewing phonology and phonetics as separate modules related by mapping). Recent work continues to strengthen these themes while drawing in new empirical domains such as signed language, second language acquisition, and disordered systems. These threads of research have led to an enriched understanding of the complexity and the multiplicity of representation.

The focus on integrated methodologies in laboratory phonology has meant encouraging phonologists to extend their methods beyond the analysis of what Kenstowicz and Kisseberth (1979) term corpus-internal evidence; that is, the impressionistic transcription of a corpus of utterances. First, the increased attention to experimental data has highlighted the ways that relying on impressionistic data is both inadequate and misleading. The range of experimental methodologies employed highlights the complexity of linguistic behavior which is under speaker control. This shift also meant enhancing the quantitative, experimental methodologies of

phonetics with more formal analysis and modeling. Experimental approaches expanded from linguistic phonetics to include psycholinguistic experimental approaches resulting in an integration of processing and cognitive questions. These methodological shifts were fundamental to breaking down the way that practice in phonology and phonetics respectively led to “the assumed division of labor . . . [creating] a harmful illusion that we can compartmentalize phonological facts from phonetics facts.” (Beckman and Kingston 1990/\*\*this volume\*\*  
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Laboratory phonology’s “coming of age”, in terms of its successful development as a recognized approach to the investigation of human speech and sound systems, is attested to by the founding of the Association of Laboratory Phonology, celebrated at the recent LabPhon 11 meeting. The central goals of greater dialog across subfields, greater integration of methodology, and greater collaboration, have remained the hallmarks of laboratory phonology. The success of laboratory phonology is that those issues which at first were defined in an effort to bridge phonology and phonetics are now understood more broadly, as truly interdisciplinary questions, bridging linguistics with neighboring fields within the broader context of cognitive science. It is this rich research endeavor that is the focus of this volume.

### **3. Goals and structure of the volume**

This handbook is designed to serve as a guide to the results, mechanics, and philosophy of the laboratory phonology approach. It is meant to illustrate this field of research and the many ways to harvest it. It aims to introduce in-depth discussion of critical questions facing the field, as well as some of the important outcomes, while also surveying the many investigative approaches and tools that may be brought to bear on these questions. The goal is not only to characterize the current state of the art, but to lay the groundwork for future directions.

The thematic organization of early LabPhon conferences reflected the specific concern of integrating the study of phonology and phonetics, accomplished in part by focussing on particular themes. Yet, as discussed by Cohn (2010) and Pierrehumbert and Clopper (2010) and reviewed above, the field has evolved and the thematic coverage of research undertaken within the laboratory phonology approach has diversified. As a consequence, this handbook attempts neither to recapitulate this process of intellectual development, nor to comprehensively review each of these threads of research. Rather a selection of major research topics and areas of active and promising research are highlighted. We have intentionally chosen *not* to compartmentalize the volume into thematic parts as is often done in such works. Rather, fundamental issues are interwoven throughout the volume, and are treated through different lenses in the different parts

of the book. For example, questions related to prosodic constituents are covered in multiple chapters and from different points of views, including their effect on segmental variation, their status in a theory of prosodic representations, and the many analytic tools used to investigate their phonetic reality. Language acquisition also receives attention throughout the book, in terms of how sound structures and processes are acquired, current methods used to study such questions, and how results from the language acquisition literature inform other questions about the nature of sound structure, its representation, and human speech more generally. This integrated structure offers multiple access points for learning about and learning to do laboratory phonology.

In planning the specific contents and structure of the volume, our goals were to gather a wide range of perspectives, across subfields and disciplines, and to highlight the complementarity of different approaches and backgrounds. We have emphasized multidisciplinary and encouraged co-authorship, both within specific contributions, and often, within collections of two or more contributions constituting individual chapters. The volume thus affirms the benefits gained through collaborative effort in the advancement of science.

The handbook is organized into five main parts. **Part I: *Introduction***, sets the stage with this introduction and the reprinting of two foundational pieces: Beckman and Kingston's (1990) introduction to *Papers in Laboratory Phonology I* and Pierrehumbert, Beckman, and Ladd's (2000) "Conceptual foundations in phonology as a laboratory science." These together aim to provide a conceptual and historical framework upon which the rest of the work stands. The core of the volume is divided into **Parts II-IV** covering topics addressing fundamental issues (what and why) and **Part V** covering methodologies and resources (how) that together constitute laboratory phonology approaches to these questions.

In Parts II-IV, the key to the organization is conceptual coverage. A broad range of topics are covered, such as phonological contrast and representation, prosodic organization, structure and role of the lexicon, phonological and phonetic variation, sociophonetics, typological generalizations, speech perception and production, language acquisition, and historical change. Questions related to these topics are addressed from the perspective of how laboratory phonology approaches have provided insight into human speech and language structure. Authors were asked to frame the essential questions, review contribution of work in laboratory phonology, and identify current developments and promising approaches.

In Part II: *Nature and types of variation: Their interpretation within a laboratory phonology*

*perspective*, the contributions examine different sources of variation in speech, speaker related, message related, and system related. This set of contributions demonstrates the critical importance of engaging with this multifaceted and complex variation. This work highlights the benefits of an integrated approach, rather than separating some aspects of variation as fundamental and other aspects as outside the domain of investigation.

In Part III: *Multidimensional representations of knowledge of sound structure*, the contributions examine the content, access, and evolution of representations of speech, with special attention to the variety and richness of linguistic representations, relationships between levels of representation, and the challenges these offer to current and future models of linguistic representations. This part starts with different perspectives on the nature of lexical representations and then turns to how different aspects of what have been traditionally understood as phonological structure are represented and organized, acquired, and changes over time.

In Part IV: *Integrating different perspectives: New insights from production, perception, and acquisition*, the contributions offer insight into how laboratory phonology has informed traditional themes within the study of phonology, phonetics, and human speech more generally. How do the methodologies and ways of framing testable research questions through a laboratory phonology approach advance our understanding of these long-standing questions? Rich multidisciplinary work offers varied perspectives on the issues of the nature of production and perception and their integration, as well as the relationship between language acquisition and the human capacity for language.

In Part V: *Methodologies and resources*, the topics treated in the other parts are approached through a direct consideration of methodologies, paradigms, tools, and resources that together constitute how people *do* laboratory phonology. Authors were asked to present a critical overview of available techniques, including examples of research using these techniques and how they have increased our understanding of human speech. The contributions highlight the multidisciplinary and diversity of methods that are the essence of the laboratory phonology perspective. This part presents selected methodologies and resources that have proven useful, with attention to the types of theoretical issues these approaches have been (and can be) appropriately applied to.

This volume is intended for a wide audience: graduate students, faculty, and other researchers in phonetics, phonology, psycholinguistics, sociolinguistics. We hope it equally well proves useful

to others whose work does not address directly theoretical linguistic issues regarding speech, but which is critically concerned with speech and language, such as computational linguists, speech pathologists, neurolinguists, biologists, and anthropologists. We hope that the totality of contributions in this handbook will serve both the novice and the more advanced researcher alike, with its cross-cutting approach to themes and methodologies providing a fabric enabling readers to understand and engage with the material at a variety of levels.

The book is designed to be read either from start to finish, or by focusing on specific parts and chapters, and we hope the reader will use the abundant cross-referencing to take advantage of the connections between the many pieces. Since the book is not linear in its organization, the table of contents and index become all the more important as tools. To this end the index includes entries for major topics which are covered in multiple places in the book, with references to chapters and sections of chapters in addition to specific page references. We invite the reader to jump in!

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