

## Introduction

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Phonotactics refers to the principles according to which languages allow sound combinations and segment sequencing to form larger units such as syllables and words. In the study of phonotactics, we are faced with a series of apparent contradictions and empirical problems that require critical comparisons of alternative explanatory models and, most often, an investigation of the ‘interfaces’ between phonotactics and other levels of linguistic organization, particularly phonetics and morphology. One problematic aspect is due to the fact that phonotactics is part of the phonological grammar of a language, and at the same time it is regulated by a number of non-categorical, probabilistic constraints and preferences. It is thus not surprising that the awareness among linguists regarding the role of probability, so crucial in accounting for changes and variations across languages and historical stages (Bod *et al.* 2003), has developed early in connection with observations on the variability in the ‘phonotactic grammar’ of speakers (e.g. Scholes 1966) and on the changing degrees of ‘acceptability’ of word-sized strings (later called ‘wordlikeness’ – a term that explicitly presupposes a probabilistic view of the phonology). A second challenging issue related to phonotactics has to do with the universal versus language-specific nature of phonotactic rules and preferences. Asking what is common to all linguistic systems and what, by contrast, is implemented in individual phonologies under specific conditions has promoted the adoption of a variety of empirical methodologies ranging from the survey of big samples of languages to the psycholinguistic study of how phonotactic structures are processed and acquired, and from probability computations to the investigation of how consonantal and vocalic sequences are produced and perceived.

This paper collection originated as the Second International Workshop on Phonotactics and Phonotactic Modeling (PPM 2013), which was held in Pisa, Italy in November of 2013 and jointly organized by the Scuola Normale Superiore di Pisa and the Université de Paris Ouest.

The articles collected here are a selection of the papers that were presented at the workshop; we warmly acknowledge the authors for their enthusiasm in engaging in this project, their intellectual work

on the initial proposals, and their patience in complying with the many requests from reviewers and guest editors.

This volume can be considered a continuation of the 2014 thematic issue of *Language Sciences* (Elsevier) “Theoretical and empirical approaches to phonotactics and morphonotactics” (Calderone, Celata & Laks 2014), which originated during the First International Workshop on Phonotactics and Phonotactic Modeling (Cortona, Italy) and the thematic session of the 43th Poznań Linguistic Meeting 2012 “Theory and evidence in the study of phonotactics”. It therefore testifies to the living interest in the cross-linguistic, empirically grounded study of phonotactics and in its interfaces. As this preface is being written, the call for papers for PPM 2015 - Third International Workshop on Phonotactics and Phonotactic Modeling (University of Vienna, 26<sup>th</sup>-27<sup>th</sup> November, 2015) has just been circulated.

The presentations that were given at PPM 2013 were centred around three thematic sessions: “Phonotactics and frequency, phonotactic modelling”, “Phonotactics and language acquisition”, and “Phonotactics and speech production”. Although the three issues of frequency, acquisition and production are indeed related to each other and most papers deal with more than one issue at a time, the organization of the present volume can be seen as broadly following that thematic partition.

The first three papers deal with cluster complexity and frequency from a typological perspective. The paper by Stefan A. Frisch (University of South Florida) examines the distribution of sonority sequencing (i.e. the preference for clusters having larger steps in sonority difference toward the peak of the syllable) and sonority modulation (i.e. the preference for clusters having larger steps in sonority difference, regardless of sequencing) in a sample of forty-seven languages, and in the phonology of Spanish (according to the frequency count of Spanish medial clusters in the lexicon). Both preferences have been said to be articulatorily or perceptually motivated (e.g. Lindblom 1983, Ohala & Kawasaki-Fukumori 1997), and as such, are expected to be typologically found across languages as well as quantitatively represented in the frequency with which specific clusters occur within a language. The hypothesis is confirmed by the typological survey and the frequency analysis of Spanish clusters, and the paper thus demonstrates the probabilistic nature of functionally based phonological restrictions.

The paper by Katarzyna Dziubalska-Kołaczyk (University of Poznań) discusses implications of the NAD model of phonotactic combinations (Dziubalska-Kołaczyk 2009, 2014) for the theory of mark-

edness in consonant cluster acquisition. It shows that markedness, frequency and age of acquisition are not always straightforwardly correlated; language-specific systemic restrictions must be included to explain both the developmental paths attested in children's acquisition and the statistical biases of cluster occurrence in current use. Independent predictions based on markedness seem therefore to be more consistent with the phonology of languages than with corpus data. These observations open the question of whether it is either the type or the token frequency of phonotactic structures that is relevant for the speakers in the construction of phonotactic grammars and during lexical and morphological acquisition, speech segmentation, phonological categorization etc. (Richtsmeier *et al.* 2010, Calderone *et al.* 2014).

Again from a corpus-based perspective, the paper by Wolfgang U. Dressler, Miroslava Hlinicanová, Matej Durco, Karlheinz Mörth and Katharina Korecky-Kröll (University of Vienna & University of Banská Bystrica) explores type and token frequencies of Slovak and German word-initial, word-medial and word-final consonant clusters (both monomorphemic and across morphemes). It shows that the two languages differ to the extent that German has a proliferation of word-final clusters while Slovak is much richer in word-initial clusters. This difference is related to historical phonology as well as to different morphological processes characterizing the two languages, thus reinforcing the idea of phonotactics as cueing morphological information, in addition to the phonological one. The paper also shows that type and token frequency do not provide entirely overlapping figures, with token frequencies radicalizing the asymmetries found in type frequency. The specificity of adult child-directed speech and its relevance for the study of phonotactic and morphological acquisition is also discussed. Both Dziubalska's and Dressler *et al.*'s papers invite critical reflection upon the methodological choices related to the selection, collection and analysis of different linguistic materials (corpus data, dictionaries, adult speech, child speech etc.), and the impact that such choices may have upon the generalizations that linguists may advance concerning the phonotactics of different languages (or different varieties of the same language).

The two subsequent papers are particularly concerned with language acquisition. The first one, by Laila Kjærbaek, Ditte Boeg Thomsen, Claus Lambertsen and Hans Basbøll (University of Odense) analyzes the early lexical acquisition of Danish by two twin sisters from nine to twenty-nine months old. The focus is on how children increase the length and complexity of their first words when

acquiring the Danish language, which provides very few cues regarding syllable structure and which bears a monotonous sonority envelope – a consequence of its historical development. Making reference to Basbøll's (2005) Sonority Syllable Model, the authors show that in the course of acquisition the two children increase not only the words' length – as calculated by the number of segments and syllables – but also, and perhaps more significantly, the words' phonotactic complexity – as calculated in terms of number of sonority types (i.e., the five major classes of segments as predicted by the Sonority Syllable Model, from vocoids to obstruents with spread glottis) and sonority rises in each produced word.

The paper by Chiara Celata, Katharina Korecky-Kröll, Irene Ricci and Wolfgang U. Dressler (Scuola Normale Superiore di Pisa and University of Vienna) reports on two behavioural experiments testing the reactions of Austrian adults and adolescents to word-final homophonous clusters in intra-morphemic versus cross-morphemic position. The analysis starts from the prediction (contained in Dressler & Dziubalska-Kołodziejczyk 2006, Dressler *et al.* 2010) that morphonotactics, i.e. the speakers' knowledge of the phonotactics of morpheme concatenation, can affect the processing and acquisition of lexicon, morphology and phonology of a language. The data in fact show that the speakers are either facilitated (in production), or inhibited (in perceptual monitoring) by phonological sequences containing a morpheme boundary, as compared to homophonous monomorphemic sequences. Younger speakers tend to be more sensitive than adults to the morphonotactics of consonant clusters. Thus the results indicate that in processing the phonotactic structures of their native language, the speakers use information from where they are located not only in the word (initial, medial, final) but also in the morphemic structure of the word (within one morpheme or across a morpheme boundary).

The two final papers of the collection deal with the interface between phonotactics and phonetics. The paper by Sylvia Moosmüller (Acoustics Research Institute, Austrian Academy of Sciences) investigates resyllabification in two varieties of Austrian German, namely, Standard Austrian German and the Viennese dialect. The paper highlights differences between the Austrian varieties of German, showing resyllabification before unstressed vowels, and Standard German German, in which resyllabification of word-final consonants is blocked by glottalization. Resyllabification is a syllable-optimizing process generating CV structures and is cued, at the phonetic level, by the temporal reduction of the consonant being produced as syllabic onset. The paper thus demonstrates how changes in the phonotactic organi-

zation of sound sequences impact fine-grained aspects of segment production such as their absolute and relative temporal properties and, finally, are interwoven with the rhythmical output of languages.

The final paper, co-authored by Nathalie Vallée, Thi Thuy Hien Tran, Paolo Mairano, Silvain Gerber & Solange Rossato (CNRS & Université Grenoble Alpes, and Turin University), seeks to provide a phonetic basis for the general phonotactic principle of maximization of syllable onsets and minimization of codas by investigating the jaw oscillatory movements in the repetition of different types of syllables in French and Vietnamese. The results indeed show that the opening phase is generally shorter, faster, and of smaller amplitude than the closing phase (with some minor exceptions). The authors also discuss the findings in a cross-linguistic perspective by pointing out that for other languages, previous studies have found that jaw opening and jaw closing gestures do differ in duration, velocity and amplitude, but in the opposite direction (jaw opening lasted longer and was of greater amplitude than jaw closing). Similar observations emphasize the importance of adopting a cross-linguistic perspective and comparing languages with different phonetic and phonological characteristics in order to uncover the motivations of universal phonotactic preferences, as well as the gestural characteristics of vowel-consonant and consonant-vowel sequence production.

We hope that this special issue will provide interesting suggestions for further investigation, including interdisciplinary approaches, within the domain of the typological, cognitive and physical aspects of sound organization in languages, thus contributing to our knowledge of how human speech structures are mentally organized, acquired, and physically produced.

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