

Summary of academic accomplishments

1. Name and surname

Paula Orzechowska

2. Academic degrees and titles

- 2009** Doctor of Philosophy in Linguistics (02.03.2009)
Adam Mickiewicz University in Poznań (AMU)
Title of Ph.D. thesis: *English and Polish morphonotactics: A dictionary- and corpus-based study of word-final consonant clusters*
Supervisor: prof. dr hab. Katarzyna Dziubalska-Kołaczyk
Reviewers: prof. dr. hab. Piotr Gąsiorowski (AMU)
prof. Yishai Tobin (Ben-Gurion University of the Negev, Isreal)
- 2004** Master of Arts in English Philology, AMU
Title of M.A. thesis: *Factors facilitating and hindering the acquisition of a foreign language phonological system: The case of Polish learners' perception and production of selected English vowels*
Supervisor: prof. dr hab. Katarzyna Dziubalska-Kołaczyk
Reviewers: prof. dr. hab. Piotr Gąsiorowski (AMU)
- 2003** Bachelor of Arts in English Philology, AMU
Title of B.A. thesis: *A cross-cultural approach to male-female conversational interaction*
Supervisor: dr Joanna Pawelczyk

3. Employment in academic institutions

2009, Apr 1st – present

Assistant Professor, Department of Contemporary English Language
Faculty of English (until Sep. 2012: School of English)
Adam Mickiewicz University (2010 – 2013 research leave)

2011, Oct 1st – 2013, Sep 30th

Chair for the Department of Present-day English Language and Linguistics
Department of English and American Studies
University of Potsdam

4. Academic achievement stipulated in Art. 16.2 of the Act of 14 March 2003 on academic degrees and academic title as well as the degrees and title in arts (Official Journal of Laws 2017, Item 1789, as amended)

a) title of academic achievement

Complexity in Polish phonotactics: On features, weights, rankings and preferences

b) author, title, year of publication, place of publication, publisher, reviewers

Paula Orzechowska. 2019. *Complexity in Polish Phonotactics: On Features, Weights, Rankings and Preferences*. Singapore: Springer Nature.

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Reviewer: anonymous

c) summary of objectives, results and potential implications of the academic achievement (monograph)

4.1 Objectives of the academic achievement

One of the main areas of phonological investigation is focused on admissible combinations of segments in a language. *Phonotactics*, as a branch of phonology, studies the linear arrangement of vowels and consonants in larger linguistic units such as syllables and words. According to rich typological accounts such as *Universals of Human Language* (Greenberg 1968), the *World Atlas of Linguistic Structures* (Dryer and Haspelmath 2013) and the *World Phonotactics Database* (Donohue et al. 2013), a basic combination of segments is represented by a consonant and a vowel (the so-called *CV*), while sequences of adjacent consonants are largely disfavoured cross-linguistically. On oft-quoted example of a phonotactically complex language, which admits such *consonant clusters*, is Polish. Native speakers of the language are exposed to and produce words featuring hundreds of initial and final cluster types composed of two, three or four consonants on every-day basis. When viewed from a typological perspective, such sequences pose severe problems for speakers of the majority of the languages in the world.

Due to the cross-linguistic scarcity of clusters, phonologists have made numerous attempts to account for complex syllable and word margins in Polish. Depending on the adopted theory and the unit of phonotactic analysis, initial and final clusters in Polish have been considered to be either simple or complex, preferred or dispreferred. For instance, formal theories have stressed that the “enormous complexity of consonantal sequences” (Rochoń 2000) and a “formidable array” of “odd-looking” (Cyran and Gussmann 1999) and “unusual phonotactic possibilities” (Rubach and Booij 1990) in syllable onsets and codas are apparent. Similarly, acoustically-based approaches have argued for simple syllable and word margins. In turn, functional models reflecting the natural, physical constraints of the vocal tract and preferences of speakers have suggested that clusters at word edges are largely dispreferred. Although consonant clusters in Polish are described best among all Slavic languages, the differences in the treatment of clusters in the subject literature make room for further investigation. Therefore, in the monograph I have taken up the challenge of defining the complexity of Polish phonotactics in a new way.

*The only true voyage (...) would be not to visit strange lands
but to possess other eyes. (Marcel Proust)*

The main objective of *Complexity in Polish Phonotactics* is to offer a new perspective on the description, classification and representation of strings of consonants beyond principles, which have been used so far in the study of phonotactics. At the core of the analysis presented in Chapters 3-5 is

the modelling of the structure of consonant clusters at the level of the lexicon, processing and production. The analyses lay the foundations for a dynamic multi-dimensional model of phonotactic grammar of Polish. This model, as I demonstrate throughout the book, can be captured by means of several positional and weighted phonological features. Generally, this model is a permutation of ideas intrinsic to formal and functional approaches, which are enriched with statistical modelling, and tested in different areas of external evidence. Both constraints and preferences implicit in formal and functional theories serve as the theoretical underpinnings of this approach. Consonant clusters are here investigated in their phonetic, phonological and morphological depth, where novel concepts are developed and where empirical data are analysed to verify the theoretical premises. This phonological enterprise requires the study of Polish phonotactics from broader theoretical and empirical perspectives, combining diverse branches of formal linguistics (phonology, morphology), corpus linguistics, psycholinguistics and statistical modelling. This contribution also brings insights into the contemporary discussion on linguistic universals and language-specific preferences.

The goal of explaining the phonotactic complexity of Polish is reached by undertaking a study of word-initial and word-final phonotactic and morphonotactic clusters. Throughout the book, I pose a number of research questions, which represent the following overarching objectives:

1. What are the sources of phonotactic complexity in Polish?
2. In what terms is Polish (mor)phonotactics a well-motivated phenomenon?
3. What properties or principles motivate the structure of consonant clusters in different domains of language?

In answering the questions, I firstly demonstrate that complexity does not need to be defined in terms of violations of universals or commonly acknowledged principles such as sonority. To propose an alternative to the existing approaches, I argue that a necessary turning point consists in investigating sequences of segments at their basic level, namely in terms of sub-segmental properties of consonants forming clusters. Therefore, the first goal of the proposal is to demonstrate that complexity is encoded in structure, in patterns of (co-)occurrence and distribution of phonological features. These features pertain to the place of articulation, the manner of articulation and voicing. This goal is realized by employing an *exploratory approach*, which consists in providing an in-depth analysis of consonants within clusters and in discovering heretofore unidentified phonotactic constraints and preferences.

The major theme which constitutes the foundation of the approach refers to the distinction between *inviolable constraints* and *graded preferences*. I show that both terms – although ontologically different – are complementary. Inviolable constraints specify the obligatory conditions which underlie the structure of all clusters in the lexicon. In turn, preferences reflect choices of speakers at the cognitive and articulatory levels. Here, they are inferred from latency responses and spontaneous speech. Since the proposed model is not based on *a priori* principles or markedness conditions, which determine a universally preferred structure of clusters, it reveals what the structure of consonant clusters in Polish is like, rather than what should be like. As a result, there emerges a new approach to phonotactic modelling, where complexity is derived from the data at hand. This means that complexity is attributed to rankings of features which are (1) rare in the lexicon, (2) processed with greater cognitive effort and (3) avoided by speakers in casual conversations.

Another goal of the book is to develop the notion of *feature weight* and to explore the validity of *featuretactics* as a potential area of study in phonotactics. Both terms were introduced in my previous publications. I put forward a hypothesis that out of the whole range of universally available features, each language selects a subset of features which play a role in phonological generalizations and which are particularly active in phonotactics. Therefore, a recurring theme in the empirical chapters is that phonological features vary in weight depending on: their placement in a cluster,

their position in a word and language domain. *Positional feature weight* reflects the relative importance of features such as [coronal], [dorsal], [\pm strident], [\pm continuant], from which phonotactic constraints and preferences arise. With the help of statistical methods, I demonstrate that features with the greatest weight (1) have the greatest discriminatory potential when constructing cluster inventories, (2) are cognitively easier by being processed faster and (3) facilitate articulation and trigger specific casual speech processes. Although sequences of consonants in Polish are certainly among the most remarkable ones reported in the literature, their 'backbone structure' is simple and well-defined according to tactic patterns of features.

In general, the volume opens a new area of study in phonotactics. Broad traditions of scholarship, varied methodologies and sources of external evidence are here brought under a unified approach. At the theoretical level, a permutation of ideas of formal and functional theories constitutes a solid methodological and factual base for the feature-based approach. At the empirical level, the study of three linguistic domains in chapters 3, 4 and 5 provides insights into the complex trajectories of the preferred cluster structure in the lexicon, processing and articulation, respectively. Additionally, the proposed model constitutes a testing ground for some principles such as sonority, contrast, clarity of perception and ease of articulation.

4.2 Structure of the book

The book is composed of seven chapters: two theoretical (Chapters 1-2), three empirical (Chapters 3-5), a synopsis of research findings (Chapter 6) and Conclusions. The volume starts with Preface, where I show how my ideas on phonotactics have developed over the years, eventually leading to the writing of *Complexity in Polish phonotactics*. Ideas presented in the book were inspired by research conducted in collaboration with, above all, Katarzyna Dziubalska-Kolaczyk and Richard Wiese, and their research teams, as well as by consultations with experts in the field such as Harald Baayen, John Harris, Dafydd Gibbon. The book features 117 tables and 30 figures. Raw data used in the empirical chapters are detailed in Appendices 1-16. Each chapter ends with a list of references, whose total number outweighs 500.

The first chapter is devoted to the description of synchronic *sources of phonotactic complexity in Polish*. Therefore, the goal of the chapter is to provide a systematic outline of constraints and preferences which determine the structure and variety of clusters in syllables and words. Syllable margins embrace onset and coda clusters, which have been traditionally identified in the process of syllabification. Word margins, in turn, are represented by richer cluster inventories, which results from clusters' morphological complexity. Phonotactic generalizations presented in this chapter range from descriptive via theoretical to computational. First, I focus on the presentation of descriptive statements on existent and non-existent sequences, which date back to the earliest accounts on Polish phonology. Contributions by Bargierłówna (1950) and Kuryłowicz (1952) offer lists of existent clusters along with their morphological structure. Morphology is key in the description and classification of consonant sequences throughout the book. Following Dressler and Dziubalska-Kolaczyk (2006), a distinction is made between *phonotactic* clusters found within a morpheme and *morphonotactic* clusters which are triggered by morphological operations such as affixation or vowel - zero alternation. Among other sources of complexity, I discuss violations of phonological universals and principles on the example of selected theoretical approaches. Emphasis is placed on the distinction between inviolable constraints inherent in the formal tradition (e.g. Optimality Theory) and graded preferences embedded in the functional framework (e.g. Natural Phonology). Additionally, I discuss computational models which offer matrices and finite-state automata as visual representations of phonotactic constraints (i.e. Finite-state Phonology). The final sections of the chapter provide the compilation of representative lists of clusters depending on their position in a word (word-initial vs. word-final) and their morphological composition (phonotactic vs. morpho-

notactic). These cluster inventories constitute the basis for theoretical and empirical analyses presented in the following chapters of the book.

The amount of the relevant literature to be cited in relation to phonotactic generalizations necessitated making some decisions. I have deliberately curtailed the number of approaches presented in Chapter 1 to those which constitute a solid factual and methodological frame for the approach delineated in Chapters 3-5. It must be stressed that apart from descriptive, theoretical and mathematical constraints, the literature discusses other types of phonotactic generalizations, which are presented in other chapters of the volume. For instance, in Cognitive Linguistics, phonotactic constraints refer to *Gestalt* knowledge of types of clusters which exist in a language and which are well-formed. Such constraints are outlined in Chapter 4 in terms of the psychological reality of existence, well-formedness and frequency in works of prominent linguists such as John Coleman, Janet Pierrehumbert, Iris Berent and Michael Vitevitch. Moreover, in order to complete the overview of different types of constraints, in Chapter 3 I discuss weighted constraints in the model of Bruce Hayes and Colin Wilson. I do not explicitly mention morpheme structure constraints in Generative Phonology but discuss related issues, namely differences between phonotactic and morphonotactic clusters in terms of their phonological features and phonetic realization in casual speech in Chapters 3 and 5, respectively.

Chapter 2 presents selected *theoretical approaches to phonotactic complexity of Polish*. The chapter introduces the notion of *markedness* and illustrates how contemporary approaches to phonotactics differ in the treatment and classification of clusters. To illustrate the differences, I propose to distinguish between two directions in the study of markedness, namely approaches which are based on well-formedness conditions and approaches which are not based on well-formedness conditions. The first type of approaches aims at answering the following question: Do clusters follow the established set of principles and possibly to what extent? In order to observe whether Polish clusters meet well-formedness conditions, and possibly to what degree, two markedness principles are applied to initial and final clusters: the well-known but also criticized *Sonority Sequencing Generalization* (Selkirk 1984) and an alternative richer in well-formedness conditions, namely *Net Auditory Distance* (Dziubalska-Kołodziejczyk 2009, 2014). The analysis demonstrates that the degree of detail employed in the well-formedness requirements stipulated by the principles and the units to which they apply (syllables vs. words) lead to substantially different conclusions on phonotactic markedness in Polish. While different sonority scales classify more clusters as unmarked (well-formed), the auditory principle classifies more clusters as marked (dispreferred). These views on Polish are complemented by the second tradition of scholarship, which is represented by approaches not based on well-formedness conditions. Such approaches provide an in-depth analysis of subsegmental properties of consonants forming clusters with a view to identifying minute phonetic and phonological properties which motivate the structure of clusters. The core question addressed by the approaches is the following: What properties or principles motivate the phonological structure of clusters (disregarding whether they are classified as well-formed or ill-formed)? The main representative of this type of approaches is a non-derivational paradigm of Government Phonology (e.g. Kaye et al. 1985, Harris 1990) and Element Theory (Harris and Lindsey 1995), where relations between segments and the sonority hierarchy are derived directly from the representational complexity, i.e. the number of primes in a segment. In this chapter, I omit to present markedness in relation to syllable structure in Generative Phonology, Lexical Phonology and Optimality Theory as aspects of these theories relevant for the present argumentation are captured in terms of constraints, features markedness and morphological complexity in Chapters 2 and 3.

The analyses presented in Chapter 2 suggest that the views on phonotactic complexity in Polish vary depending on the adopted approach. Therefore, in order to gain new insights into the structure of consonant clusters in Polish, I argue for an exploratory analysis, which aims at discovering the subsegmental motivation for the phonological structure of phonotactic and morphonotactic clusters.

Therefore, in Chapter 3 I propose a type of a *statistical modelling of phonotactic constraints and preferences*. The study material comprises initial and final clusters found in words extracted from dictionaries and corpora, and listed in Chapter 1. The analysis leads to discovering prevalent feature patterns in clusters and formulating heretofore unidentified phonotactic generalizations for the structure of the Polish lexicon. The novelty of this type of an analysis has been captured by the term *featuretactics*, which is rooted in a premise that phonotactic constraints and preferences are encoded in *weighted phonological features*. These terms were coined in my my previous publications, but they are described more extensively in Chapter 3 where feature weights are compared for initial, final, phonotactic and morphonotactic clusters. I analyse 26 phonetic and phonological parameters related to the place of articulation, manner of articulation, voicing and structural complexity and employ several statistical methods to identify the backbone structure of Polish clusters. The statistical method of principal component analysis (PCA) and PCA loadings make it possible to allocate statistical weights to features which play the greatest role in cluster discrimination. Random forests and heatmaps are used to identify features which differentiate between datasets, namely initial vs. final clusters as well as phonotactic vs. morphonotactic clusters. Overall, the analysis shows that Polish initial and final (mor)phonotactics are a well-motivated phenomenon. The complexity of Polish clusters seems to be attributed to the fact that different cluster sets operate on different phonological features pertaining to place and manner. Preferred clusters are generally formed on the basis of features such as stridency, voicing and coronality, while dorsal segments are preferred in word-final position.

The idea of the relative weight of phonological features is further pursued in psycholinguistic experiments. In order to explore the role that place and manner features play in online processing, Chapter 4 investigates the role of *sonority and place constraints in Polish CC clusters in reaction time experiments*. I report on two experiments, which explore the psycholinguistic reality of three factors: (1) *existence*, (2) *well-formedness* and (3) *distance* in word-initial clusters (experiment 1) and in word-final clusters (experiment 2). Existence distinguishes between clusters which are part of the phonotactic inventory of Polish, and which are hypothetical. Well-formedness is associated with the sonority profile of CC clusters, which is either sonority-violating or sonority-obeying following the hierarchy of segments: plosive – affricate – fricative – nasal – liquid – glide. The concept of distance refers to the proximity of places of articulation of adjacent consonants on a scale: bilabial – labio-dental – dental – alveolar – alveolo-palatal – palatal – velar. Since large-scale experimentation would be required to determine the weight of place features such as labiality, coronality, dorsality and anteriority in online processing, the analysis focuses on a single parameter of distance. For both experiment, two types of data were collected: accuracy rates and response latencies. Both sets of data were analysed with the help of the *generalized additive model* and *quantile regression*, respectively, leading to the following conclusions. First, I demonstrate that existence and well-formedness in terms of sonority affect only accuracy rates, and do not contribute to the online processing of word-edge phonotactics. In turn, response latencies are facilitated by the place of articulation distances. Reaction times are the longest for medial distances, and the shortest for large distances. The processing of large contrast such as bilabial – velar, bilabial – palatal, dental – velar involves the least cognitive effort, and lends support to the principle of the clarity of perception. The findings contribute to the ongoing discussion on sources of phonotactic knowledge and the role of place and manner features in online processing and intuitive judgement of native speakers of Polish.

The core theme of the last empirical chapter is the study of clusters in casual speech in native speakers of Polish. To provide new insights into the weight of phonological features at the level of motor control, Chapter 5 investigates *phonological processes in spontaneous speech*. Processes, which are accountable in word-initial and word-final clusters involve deletion (elision), substitution or insertion (epenthesis). The data were extracted from a *Dictionary of Phonetic Variation in Con-*

temporary Polish (Madelska 2005): they constitute lists of phonetic variants of word forms found in natural, informal and unmonitored speech. Two types of clusters were distinguished: target forms, which reflect the pronunciation of a word in isolation, and casual speech forms of clusters, which tend to be modified. The comparison of target and modified forms aims at identifying phonological (and non-phonological) factors which contribute to cluster modification, on the one hand, and which influence the type of a process, on the other. The analysis is based on the classification and regression trees, an explanatory technique which estimates the relevance (i.e. weight) of individual variables. The results of the analysis are threefold. First, different modification preferences were identified depending on word position. Initial cluster modification is primarily triggered by lexical frequency of words containing such clusters, while final cluster modification is induced by phonological properties, namely stridency of the first consonant, quality of a vowel neighbouring on a cluster, a number of coronals in a cluster and the presence of a continuant in absolute word-final position. Subsegmental properties of clusters also motivate a specific modification type. For example, a strident consonant in cluster-initial position leads to the elision of the whole initial sequence, while the presence of [+continuant] and [-continuant] segments in absolute word-final position leads to cluster substitution. Third, word-initial position, being phonologically more salient, supports a greater variety and severeness of cluster modifications.

The synopsis of the research findings is given in Chapter 6. I provide an overview of the ideas proposed in the book, where the notion of ‘statistical weight’ in the lexicon presented in Chapter 3 is reconciled with feature weights inferred from the experimental data. *Quo Vadimus?* A preliminary response to the question are *elementary particles*. In the final sections of the monograph I propose positional feature weight for clusters depending on (1) word position in which they occur (initial and final) and (2) a language domain (lexical, cognitive and articulatory). Chapter 6 is an attempt at demonstrating that the feature-based specifications proposed for lexical, cognitive and articulatory phonotactics: (a) determine the default structure of cluster types attested in Polish, (b) facilitate on-line processing and (c) facilitate production according to phonetic norms. An overview of the results reveals a basic and preferred structure of Polish consonant clusters. Featuretactics and feature weight open areas of study which enable an insightful description and typological classification of cluster-rich languages. When viewed from a broader perspective, the proposed approach eventually leads to open speculation on the existence of elementary particles in phonology, which determine the phonological backbone of language sub-groups, language families or all system. The work ends with a call for the investigation on such particles, which would contribute to more complete understanding of the human phonological component.

4.3 Research results and implications

The monograph provides new insights into the relevance of Sonority Sequencing Generalization, the sonority scale that holds in Polish as well as principles of phonotactic well-formedness based on distance. New data on Polish presented in the book verify the principles which have a long-standing place in the history of phonological theory, on the one hand, and make it possible to propose and develop new principles, on the other.

Relative weight of features

One of the goals of my academic achievement was to verify my earlier proposal on the relative importance of phonological features in a language. The empirical chapters lend support to the concept of positional weight of phonological features and rankings of preferences arising from such features. In chapters 3-5, I have identified up-till-now undiscovered phonotactic preferences for three distinct linguistic domains: lexical, cognitive and articulatory.

Lexical preferences motivate the structure of a representative set of cluster types. Out of 26 parameters employed in the study, the greatest discriminatory potential is allocated to stridency, voicing and coronality in both initial and final clusters. Generally, there is a preference for plosives and sonorants to be placed in cluster positions immediately preceding and following a vowel. Although coronal segments are favoured in both word positions, place features are more relevant word-finally, where a dispreference for dorsal consonants has been identified. *Cognitive preferences* are inferred from the shortest reaction times. In both word positions, extreme articulatory gestures represented by bilabial + velar or velar + bilabial sequences facilitate online processing. This preference lends support to the principle of clarity of perception, according to which perceptual contrast is listener-friendly. While adjacent labial and dorsal segments ensure maximum contrast, the presence of coronals in a cluster would increase the propensity of smaller articulatory/perceptual distances due to the centrality of dental, alveolar and post-alveolar places of articulation. *Articulatory preferences* are derived from correct renderings of clusters in casual speech. In initial phonotactics, the ease of articulation is related to uniform directionality of the movement of the tongue. This preference is a reflex of the preferences for place of articulation distances and cluster size. Word-finally, strong preferences for stridency, coronality and continuance have been identified. Again, the findings point to the prime importance of place distances: clusters featuring extreme places of articulation represented by labials and dorsals are articulatorily disfavoured and trigger reduction.

Overall, the findings contribute to the discussion on the principles of ease of articulation and clarity of perception. Although coronality is universally unmarked (Hall 1997; Paris and Prunet 1991), and hence favoured in the constructions of consonant and cluster inventories, its preferability depends on a language domain. In production, coronal consonants are favoured since they minimize articulatory distances. In turn, labial and dorsal consonants are favoured in processing: they enhance perceptual contrast, and are the least costly for processing. Such predictions have been employed in the form of fortitions and lenitions in Natural Phonology (Donegan and Stampe 2009).

The results of the empirical work make it possible to bridge a gap between some theoretical approaches. For example, Natural Linguistics (Donegan and Stampe 1979, Dressler 1985, Wurzel 1984) argues for the relevance of gradient phenomena, processes and output. In my proposal, weighted features give rise to preferences which apply to the majority of clusters on a continuum ranging from strong to weak default. The extremes of the continuum are occupied by prerequisites and inert features. The first correspond with inviolable constraints, which have their conceptual equivalents in Optimality Theory constraints. The latter do not show to contribute to cluster structure, processing or linguistic behaviour. In such a way, the feature-based approach bridges combines functional and post-SPE theories by demonstrating that constraints and preferences, although ontologically different, can be reconciled under a unified approach. A solid and large-scale investigation would be required to identify phonotactic prerequisites and a comprehensive set of preferences. However, at the present stage, the monograph paves the path for a new area of study and more oriented explorations.

The conclusion that features vary in the extent to which they are exploited in phonotactics goes in line with vast work of Clements, who provides ample evidence in favour of the fact that only a subset of phonological features is relevant in the languages of the world. The principle of *Marked Feature Avoidance* (Clements 2009) states that some feature values are omitted cross-linguistically. For instance, nasal vowels, fricatives and sonorants are marked with respect to oral vowels, stops and obstruents. A similar idea is captured in the *Accessibility Hierarchy* (Clements 2001), and its refined version, *Robustness Scale* (Clements 2009), which show that some phonological features (e.g. [coronal], [consonantal], [+sonorant]), are preferred in the formation of phonemic systems over others (e.g. [glottal] and [+voice]). Clements' work specifies features which motivate universal consonant inventories, while the present model specifies features which motivate combinations of

consonants in Polish. However, the pararellism of the findings gives every reason to believe that in spite of varying methodologies, the two approaches can complement each other. The relevance of the feature-based ordering, next to the commonly acknowledged phoneme-based ordering in phonotactics, lays the foundations for new phonotactic modelling.

Phonotactic principles

One of the results of the empirical studies is that no sonority differential is required between obstruents in Polish. This finding lends support to Rubach and Booij's (1990) scale of sonority, in which plosives, fricatives and affricates are subsumed under a single class. For example, I have observed that the modification of clusters in natural speech is affected not only by their sonority profile but also by the sonority distance. In initial obstruent + sonorant clusters, a sonorant tends to be deleted, which results in an increase in the sonority distance between an obstruent and a vowel. In turn, no sonority-motivated pattern was observed in the group of obstruent + obstruent clusters. The relevance of the 5-point scale in Polish (vowels > glides > liquids > nasals > obstruents) has been confirmed on the basis of syllabification strategies employed by native speakers of Polish, and reported in numerous contributions. This monograph leads to the same result based on new data, and different task. What is more, the general discussion on sonority distances goes in line with a wide range of approaches which make predictions on the preferred distribution of sonority distances in a sequence of consonants (Steriade 1982; Selkirk 1984; Harris 1983; Clements 1990; Dziubalska-Kořaczyk 2002; Parker 2012).

Cluster rankings in Chapter 3 provide further verification of the aforementioned conclusions. The highest-scoring initial and final clusters feature mainly nasals and liquids in the prevocalic and postvocalic positions, suggesting that sonorants /m n ŋ l r/ constitute the most natural transition between cluster margins and a vowel. This observation corroborates Clements' (1990) *Sonority Dispersion Principle*. The principle predicts, among others, that the most natural CCV sequence should involve a sharp but steady rise in sonority. This is true for obstruent + liquid clusters in Polish, in which the medial consonant (i.e. /l r/) is symmetrically dispersed between a marginal obstruent and a nuclear vowel following the sonority hierarchy: vowels > glides > liquids > nasals > obstruents. However, as I have demonstrated in the reaction time experiments, online processing is facilitated by large place of articulation distances, not by the sonority profile. A model which employs place distances in the computation of phonotactic preferability is Dziubalska-Kořaczyk's (2009, 2014) principle of *Net Auditory Distance*. The studies in Chapter 5 support the premises underlying the model by showing that the place of articulation and place distances are key in the perceptability of clusters, in the computation of their preferability and in phonotactic classification. What is more, the reaction time experiments constitute the first empirical data on the psychological reality of the place distances and place features in phonotactic well-formedness. Although the processing of phonotactics has been extensively studied cross-linguistically, so far all the accounts have investigated the role of sonority based primarily on the manner features. The new data presented in the monograph not only constitute a valuable contribution to the debate on phonotactic well-formedness but also offer the first set of experiments on consonant clusters in Polish using latency responses in reaction times.

The discussion of the results in relation to other studies on Polish (mor)phonotactics leads to heretofore undiscovered facts about the role of sonority in the language. On the basis of the acquisition, production, psycholinguistic and neurolinguistic data available in the literature, my previous work and the present findings, I put forward a hypothesis that the effects of sonority in phonotactics are task-dependent and should be interpreted only in relation to a specific experimental setting. In Polish, sonority appears not to be consulted in the evaluation of words but is a facilitative factor in learning-related tasks.

The ideas captured in the volume can lead to new interpretation of well-known and well-defined phenomena, making room for: (1) possible modification of the sonority hierarchy, (2) assigning weights to the computation of manner, place and voice distances in the *Net Auditory Distance* principle, (3) introducing different well-formedness conditions for initial and final (or onset and coda) clusters, (4) proposing different well-formedness conditions for various linguistic domains and finally (5) proposing new definitions of (phonotactic) markedness and methods of cluster classification.

5. Other academic achievements

5.1. Multidisciplinary areas of research

In my research, I have pursued several themes which can be subsumed under a broad category of prosodic typology. These themes refer to word stress, psycholinguistics, neurolinguistics and phonotactic typology.

Word stress

I have worked on stress assignment in Slavic and Germanic languages. My first contribution on the topic *Stress “deafness” in a language with fixed word stress: An ERP study on Polish* published in *Frontiers in Psychology* reported on the results of a neurolinguistic experiment on the processing of word stress in Polish. The literature reports on some difficulties in the processing and representation of prosodic information in Polish as the language has fixed penultimate stress but several well-defined exceptions. The study uses event-related potentials (ERPs) and the methodology of encephalography (EEG) to investigate (1) the predictability of stress and (2) the prosodic structure in terms of metrical feet. Polish native speakers were presented with correctly and incorrectly stressed Polish words and instructed to judge the correctness of the perceived stress patterns. The results have shown that for some stress violations, an early negativity (N400) was interpreted as the ability to detect errors in the stimuli heard. In addition, exceptional and post-lexical stress patterns (i.e. antepenultimate and initial stress) evoked a task-related positivity effect (P300) which is correlated with the degree of deviation from an expected pattern. In contrast, violations involving the default (i.e. penultimate) stress did not produce such an effect. This asymmetrical result shows that Polish native speakers are less sensitive to the default pattern than to the exceptional or postlexical patterns. Behavioural results are orthogonal to the electrophysiological findings showing that Polish speakers have difficulties to reject any kind of stress violation. Thus, on a meta-linguistic level, Polish speakers seem to be stress-“deaf” for any kind of stress manipulation, whereas the neural reactions differentiate between the default and lexicalized patterns.

In my further work on stress placement, I have conducted quantitative analyses based on large corpora. Two cross linguistic analyses investigated the interplay between the metrical structure and phonotactic complexity in English (*Prosodically-conditioned syllable structure in English*) and in Russian (*Struktura sylaby a akcent wyrazowy w języku rosyjskim: badanie korpusowe*). The studies were a response to other contributions on the topic found in the literature. The two languages have lexical stress and rich inventories of consonant clusters. The analysis of a dictionary- and corpus-based lists of thousands of polysyllabic words lead to two major observations. Although English and Russian are considered to be languages which do not display an interaction between stress placement and the presence of onsets and onset structure, the present studies demonstrate that the distribution of onsetless syllables is correlated with the stressed syllable. First, there is a tendency for syllables with onsets to attract stress, and for onsetless syllables to repel it where zero onset or a single consonant are favoured. Second, the stressed syllable features a greater array of consonant clusters than the unstressed syllable. Moreover, the farther from the main stress, the less likely the unstressed syllable

ble is to contain a complex onset. This means that the number of words with initial CC(C) increases as the distance from the main stress decreases. This findings lend support to theories which consider the structure of onsets to contributes to syllable weight.

Currently, together with collaborators within the project that I am the head of *The role of phonological feature in phonotactics: Badanie struktury i przyswajania zbitek spółgłoskowych w jęz. słowiańskich i germańskich* (Sonata Bis, NCN), we are in the process of analysing corpus data from Polish and preparing comparable dataset for Ukrainian with a view to testing the same hypotheses.

Interdisciplinary studies

One of my core interests is the investigation of mental processes. Therefore, during my reseach stay at the University of Marburg, I have been invovled in a series of experiments using the method of encephalography and the analysis of event related potentials. Apart from the experiment on word stress (see above), I have worked on the online processing of phonotactics in Polish and German, which resulted in publishing two papers in prestigious journals. The article entitled *Structural Principles or Frequency of Use? An ERP Experiment on the Learnability of Consonant Clusters*, published in *Frontiers in Psychology*, reports on a two-session EEG experiment in which Polish-speaking adults learned nonce words with final consonant clusters. The same methodology and directly comparable stimuli were designed for a parallel experiment on German, which was reported in a publication *The role of phonotactic principles in language processing*, published in *Language, Cognition and Neuroscience*. The studies investigated the role of two factors which potentially play a role in the learning of phonotactic structures: the principle of sonority and the (non-)existence (or frequency). In both experiments, EEG responses in two different time windows (N400 and P600) show that linguistic processing in native speakers of Polish and German is sensitive to both distinctions, with some differences in cognitive effort between the two groups. In general, the studies the main effect for sonority was observed only in German participants, and lowered sensitivity to sonority violations in Polish participants. That is, the learning process at the neural-physiological level is strongly affected by sonority particularly in a phonotactically simpler language.

These findings have laid the foundations for a series of other psycholinguistic experiments. More specifically, I have been interested in discovering whether the sonority principle as well as place and voice features also affect reaction times. Therefore, I have pursued a series of studies on the psychological reality of these variables in Polish, German and Berber. Two of such studies are discussed in the monograph in Chapter 4. Other studies were conducted in collaboration with colleagues form Adam Mickiewicz University, University of Marburg and University of Paris III-Sorbonne.

One of the experiments focused on intuitive judgements in Polish based on a reduplicative rhyming task using words similar to nursery rhymes (see Parker 2003). The goal of the experiment was to test the relevance of the first consonant sonority law, which predicts that the ordering of conjuncts in rime pairs is based on higher sonority of the first consonant in the first word. The study demonstrates that the sonority profile of first consonants in words has an impact on the evaluation of well-formedness of rhymes. This means that C1 sonority law has psychological reality for Polish speakers. The paper entitled *The psychological reality of the sonority principle: Evidence in Polish* has been submitted for the *Interspeech* conference in Vienna (September 2019).

A reaction time study on German conducted at the University of Marburg aimed at investigating the processing of three phonetic variants of the cluster spelt <qu>, namely [kʋ], [kv] and [kf]. The variants differ in terms of their sonority profile expressed by the manner and voicing features of the constituent consonants. The results of the study show that – unsurprisingly – there are systematic differences in the processing of words and non-words as well as in the processing of the cluster variants. The longest response latencies were observed for [kf], which suggests that the cluster is cognitively most costly for German speakers, while [kv] and [kʋ] involve shorter response latencies.

The results demonstrate the relevance of the voicing profile within a cluster, which lends support to featuractics. The paper *On the feature-based variation of <qu> words in German and its consequences: Evidence from lexical decision* is in preparation.

Inspired by the research results, I have also conducted a reaction time study with the Moroccan population of native speakers of Tashlhyit Berber at Ibn Zohr University in Agadir. The goal of the study was to investigate the role of the sonority profile in the processing of two-member word-initial clusters in Tashlhyit Berber. This type of research offers a valuable contribution to the discussion on minority languages, which tend to be understudied, and in which collecting data is problematic. The latency and behavioural data are being analysed. Similar studies on Russian, Ukrainian and English are planned as a part of my project *The role of phonological features in phonotactics*.

Phonotactic typology

The field of phonotactic typology is largely underdeveloped: it is difficult to pursue due to methodological inconsistencies and the absence of a uniform approach in data collection, description and analysis. Nevertheless, a handful of contributions on the topic provide ample evidence allowing to put forward the following hypothesis: Phonotactic complexity is determined by different properties and principles in different languages. For instance, Maddieson's (2013) systematic comparison of 486 languages suggests that Polish, Russian, Ukrainian, English, German and Tashlhyit Berber have complex (i.e. long) onsets and codas. However, given that the languages differ substantially in the number of permitted clusters, the classification seem to be too simplistic. This means that the classification of languages in terms of universals and well-formedness principles such as sonority is not sufficient.

I have initiated studies on phonotactics in Slavic, Germanic and Afro-Asiatic systems. I employed the same methodology based on feature weight. Let me provide an overview of the finding based on initial clusters. I analysed representative lists of word-initial consonantal strings: 460 Polish, 327 Russian, 58 English, 54 German, and 436 vowelless verbal roots in Tashlhyit Berber. The analysis revealed that the structure of the lexicon in each of the languages is based on two to four parameters. The top-most rank is occupied by parameters related to voicing in Slavic languages, manner-related parameters in German and Berber, or cluster size in English. What is more, the importance of parameters varies in each language. For instance, the voicing of the pre-vocalic consonant plays a greater role in Slavic and Germanic languages than in Berber. This feature is particularly important in Slavic systems, in which voice agreement between consonants forming clusters is preferred. In turn, the distinction between sonorants and obstruents serves cluster discrimination only in Berber. These findings were published (in co-authorship) in *Exponents of sonority in Slavic and Germanic languages* (2018), *The structure of vowelless verbal roots in Tashlhyit Berber* (2018), *In search of phonotactic preferences* (2016) and in *Preferences and variation in word-initial phonotactics: a multi-dimensional evaluation of German and Polish* (2015). Additionally, a detailed analyses for Polish and English are found in two papers, which – after the first round of reviewing - were admitted for resubmission, namely *Complexity of initial clusters in Polish: An exploratory feature-based approach* (*Lingua*) and *Feature Activity in English Phonotactics* (*Journal of Linguistics*).

Phonological models and principles

In parallel to the studies on feature weight, I have been involved in research on the evaluation of consonant clusters in English and Polish from the perspective of different phonological models. This line of research was initiated by a project conducted at the Faculty of English and headed by Katarzyna Dziubalska-Kołaczyk. The research focused both on morphologically simple and complex clusters from the perspective of the Net Auditory Distance model. The project aimed at verifying the hypothesis concerning the markedness of clusters in relation to their phonotactic or morphotactic character and phonotactic well-formedness in terms of the auditory model. The results of

the studies were described in a co-authored book *Phonotactics and morphonotactics of Polish and English: Theory, description, tools and applications* (2016).

This work became an incentive for further research on phonotactic models. In a co-authored paper *The study of Polish phonotactics: Measures of phonotactic preferability* (2017), I investigated Polish phonotactics from the point of view of two markedness models: *Net Auditory Distance* and the sonority principle. The analysis involved a distinction between phonotactic and morphonotactic clusters. The aim of the paper was to verify to what extent the principles reflect the complexity of clusters resulting from the intervention of morphology. The analysis shows that both principles generally capture a strong relation between cluster preferability and morphological complexity. However, there is a difference in cluster evaluation. NAD, as a more restrictive measure of phonotactics, classifies a larger portion of word-initial and word-final clusters as dispreferred. The extension of the study is discussed in a joint paper *Frequency effects and markedness in phonotactics* (2019), where we investigate the relationship between type and token (typy i okazy) frequencies and markedness of English and Polish clusters. The goal of the paper is to check whether there exists a correlation between the degrees of cluster preferability determined by NAD and sonority and corpus-based logarithmic frequencies. In the paper, we argue that there is no relationship between cluster markedness and their frequency.

Further studies on the topic are in preparation. In collaboration with Katarzyna Dziubalska-Kołaczyk, I have conducted a comparable study for German. The analysis is based on the evaluation of initial clusters in terms of NAD, and observing the frequency effects for the most and the least frequent clusters. Tentative results were presented at a conference on phonotactic modelling in Vienna. The paper is in preparation. A similar pilot study on German was conducted in collaboration with Richard Wiese, whose goal was to test the relationship between logarithmic frequencies and sonority. The comparison of different models was also pursued in another paper which is in review. *Approaches to phonotactic modelling: A comparison* in collaboration with Katarzyna Dziubalska-Kołaczyk provides a systematic comparison of NAD and the feature based model, illustrating different aspects of phonotactic reality which are described by the two models. The paper was submitted for the *Interspeech* conference in Vienna.

5.2. Research activities and international collaboration

My varied research interests resulted in getting involved in numerous international projects. I have been employed as a collaborator in 5 projects: on phonotactics (*Phonotactics and morphonotactics of Polish and English: Description, tools and applications*, Poznań), prosody (*Word stress: Rules and representations*, Marburg), diachronic phonology of German (*The fate of Schwa*, Marburg) and English (*Evolution of consonant clusters in English*, Vienna) as well as on interactive teaching aids (*Polish English Literacy Tutor*, Poznań). I have also worked abroad on 5 short term grants (1 week to 5 months) financed by *German Academic Exchange Service* (DAAD) and the European Commission (Net Words, AMU: A Unique Graduate = Possibilities).

I presented my work on 27 international conferences and congresses in Austria, England, France, Germany, Holland, Hong Kong, Hungary, Poland, Portugal, South Korea, Switzerland, the USA, where I presented 32 papers or posters. Additionally, to disseminate research results and consult my work, I delivered 18 (co-authored) guest talks in Austria (University of Vienna), France (University Sorbonne Nouvelle), Germany (University of Saarbrücken, Goethe University Frankfurt, University of Marburg), Morocco (Ibn Zohr University) and Poland (AMU).

My recent research interests encompass the sound system of selected Afro-asiatic languages. Motivated by the need to discover phonological principles, which determine the structure of consonant clusters, in 2016 I have initiated research on Tashlhyit Berber. In 2017 I established the network of experts in the field in France (University Sorbonne Nouvelle, Paris III) and in Morocco (Ibn Zohr

University in Agadir, Mohammed V University in Rabat). Research visits to the institutions resulted in getting familiar with the phonology of Amazigh, participation in the conference *Journées des Jeunes Chercheurs en Langue et Culture Amazighes* in Agadir, co-authoring a publication and conducting a psycholinguistic experiment on the Berber population at the University of Ibn Zohr in Agadir. The anthropological dimension of this research activity determines the direction of my future work, which will involve the phonology of Moroccan Arabic and cultural anthropology.

My particular interests in typology are also manifested in active applying for financing of research on Slavic, Germanic and Berber languages. Within the time span of two years, I have submitted 4 individual grants to the European Commission within the *Horizon 2020* framework, namely *ERC Starting Grant* (2015), *ERC Consolidator* (2018) and *Marie Skłodowska Curie Actions* (2016, 2017). The goal of the projects was to create large research teams of experts for the study of Polish, Ukrainian, Russian, German and English phonotactics using neurolinguistic methodologies, and to conduct work on Berber and Arabic phonology in expert institutions abroad. Moreover, given these phonological interests I have become a member of a team applying for a project of the National Science Centre in Poland to create the *Centre of Scientific Excellence Dioscuri in Phonological Evolution* at the Faculty of English at AMU. Due to severely competitive environment of EU grants and a lack of financing for the aforementioned projects, I personally established the collaboration with various research centres in the world and experts in the field, which makes it possible for me to carry out the projects.

I would like to emphasize that applying for the aforementioned funding required improving my skills in terms of writing European grants. Therefore, I participated in a number of workshops, such as *ERC Day* (Wrocław, 2016), *Millions for ideas!* (Poznań, 2017), *Become an expert of the European Commission!* (Poznań, 2017) and worked with numerous Polish and foreign consultants specializing in grant applications (e.g. *Regional Contact Points for Research Programmes of the EU in Poznań and Warsaw*, *Polish Academy of Science in Warsaw*, consultant for Research and Higher Education Grant management in Paris).

5.3. Didactic experience

One of the most rewarding aspects of the academic positions I have held has been the opportunity to teach and interact with students. My interdisciplinary and cross-linguistic research interests and collaborative spirit have resulted in the offering of courses of a broad thematic scope. I have taught numerous courses embracing virtually all branches of linguistics. I have conducted seminars, lectures and other types of classes in Poland (Adam Mickiewicz University in Poznań), Germany (University of Potsdam, Bielefeld University), Morocco (Ibn Zohr University) and France (University of Paris III: Sorbonne Nouvelle). While some of the courses constitute a part of the curricula, most of the seminars proposed at the University of Potsdam were motivated by my personal goal of feeding varied and ever-changing needs of current and potential students. Therefore the topics of B.A. and M.A. courses ranged from core linguistics to interdisciplinary topics. I have taught courses on phonetics and phonology, morphology and morphonology, syntax, computational methods in linguistics, sociolinguistics as well as written and spoken discourse analysis. I have also been in charge of classes and lectures on general linguistics: *Introduction to Synchronic Linguistics: Part 1 and 2* (phonetics, phonology, morphology, lexical semantics, syntax) and advanced level: *Topics in Linguistics* (phonetics and phonology, morphonology, sociolinguistics, discourse analysis, linguistics and marketing: sound symbolism, brand naming). Theoretical courses embraced linguistic material from English, Polish and German.

M.A. courses and lectures:

1. Topics in linguistics (Poznań, 2015-2016) - lecture
2. English morpho-phonology (Potsdam, 2011-2012)
3. Aspects of derivation and inflection (Potsdam, 2012-2013)

4. Phonological universals and language-specific preferences (Potsdam, 2012-2013)
5. Topics in sociolinguistics (Potsdam, 2012-2013)
6. Generative and computational approaches to grammar (Potsdam, 2011-2012)
7. Practical English segmental and suprasegmental phonetics (Poznań, 2004-2017)

B.A. courses:

1. English phonetics and phonology (Poznań, 2004-present)
2. Contemporary topics in phonology: An overview (Poznań, 2018-2019)
3. The phonological structure of words (Poznań, 2016-2017)
4. Complexity in phonotactics (Poznań 2015-2016)
5. Introduction to synchronic linguistics: phonetics, phonology, morphology, lexical semantics, syntax (Potsdam, 2011-2013)
6. Speech production: From sound intention to utterance (Potsdam, 2011-2012)
7. Analysing spoken and written discourse (Potsdam, 2011-2013)
8. Word formation in English (Potsdam, 2012-2013)
9. How to handle speech (Bielefeld, 2005-2006)
10. Practical English at university level: phonetics, speaking and grammar (Poznań, 2004-present; Potsdam, 2011-2012)

My favourite aspect of teaching lies in working with students individually as an advisor. Therefore, I have promoted 6 B.A. theses and 3 M.A. theses at the Faculty of English in Poznań and at the Department of English and American Studies in Potsdam. The topics encompassed phonetics, phonology, sociolinguistics and various areas of external evidence such as phonostylistics, first and second language acquisition.

In Potsdam, I used the opportunity to serve as an advisor for 20 students writing full-length research papers (15 to 50 pages) in partial fulfilment of passing a linguistic or teaching module (the so-called *Modularbeiten*). The papers embraced both core linguistic and interdisciplinary topics. The study languages involved English, German, Russian and Ukrainian.

1. Phonetics and phonology: pronunciation mistakes and teaching pronunciation, Russian syllable structure, sound symbolism, phonological contrastive analyses
2. Morphology: morphological phenomena, morphological theories, inflection and derivation, theories of affix ordering, historical morphology
3. Sociolinguistics and discourse analysis: language and gender, male-female conversational interaction, code switching, (critical) discourse analysis

The exchange with students of various cultural and linguistic backgrounds has not only given me the privilege of guiding students' discoveries but inspired ideas for my own research. This is why, apart from courses taught as a part of my teaching load, I have searched for new teaching experiences by offering tutorials on English and German phonology during my student *Erasmus* stay at the University of Bielefeld, conducting guest classes at the University Paris 3-Sorbonne Nouvelle as a part of *Erasmus Plus* program and at the Ibn Zohr University in Ait Melloul (Morocco). I have also attended trainings on teaching methods for and interacting with disabled students at AMU such as *Creating available e-learning content for the disabled* (2018) and *Feel the Disability* (2019).

My interest in offering competitive learning and teaching conditions has also materialized by actively collaborating on the development of curricula and study programs. Since 2016/2017, I have been a member of a team developing a new study program *English Linguistics: Theories, Interfaces, Technologies* at the Faculty of English, which was introduced as a major in 2017. At the initial stages of preparation, I proposed a preliminary version of a three-year undergraduate program, which constituted the basis for further work of team members. I have also (co-)designed syllabi for two learning

modules (involving module aims, outcomes, content, methods of teaching, learning and assessment): *Linguistic theory: Phonology 2* and *Linguistic theory: Morphology 1*. I was involved in similar activities at the University of Potsdam, where I collaborated with other professors and chairs on the development of courses *Introduction to Synchronic Linguistics: Part 1 and Part 2*. To promote research to the general public, I have offered phonetic courses to high school students during the *Poznań Festival of Science and Art* (2016, 2018).

5.4. Organizational activities

Over the years, I have gained vast administrative and organizational experience. Only 2 years after the defence of my Ph.D. dissertation (2009), I was offered a chair position for *Present-day English Language and Linguistics* at the Department of English and American Studies at the University of Potsdam. For 2 years (2011 - 2013), I acted as full professor at the Department fulfilling administrative, research and didactic activities. My responsibilities included, among others, providing leadership of subordinates (PhDs, doctoral students, assistant), management and records of budget requests, fund distribution at the Department (planning conferences and invited speakers, purchasing equipment), cooperation with the Dean's Office on faculty matters (such as space planning, equipment management, leaves of absence, assistant employment). I have also aided curriculum development for courses and regularly cooperated with other chairs to administer workload based on individual qualifications and abilities of institute members. My duties also involved holding meetings with subordinates and ensuring that relevant documents, invitations, announcements relevant for the chair were circulated well in advance. Administrative obligations at the Faculty of English (AMU) involved in serving as a year tutor for daytime and extramural students for several years, being responsible for foreign academic visitors and students at the School of English and planning timetable.

I was a member of the organizing committee of the *36th Poznań Linguistic Meeting* (2005) and the initiator of the *P&P Workshop: Phonology, Phonetics, Praat* at the University of Potsdam (2012) featuring John Harris. When employed at the Faculty of English, I represented the Faculty to the President of the University and the President of Poznań on several occasions when applying for awards and medals for distinguished foreign professors, applying for funding, promoting and seeking marketing strategies for cultural events organized by the Faculty (e.g. artistic exhibition)s. I have also been involved in work of various committees and teams such as the *Committee for Institute and Faculty Promotion* (Faculty of Modern Languages and Literatures, AMU) or the National English Competition (Poland).

