Language Sciences 46 (2014) 6–17

Contents lists available at ScienceDirect

Language Sciences

journal homepage: www.elsevier.com/locate/langsci

Explaining phonotactics using NAD

Katarzyna Dziubalska-Kołaczyk*

University of Poznań, Poland

ARTICLE INFO

Article history:
Available online 27 July 2014

Keywords:
Phonotactics
Net Auditory Distance
Morphonotactics
Beats and Binding Phonology
Polish

ABSTRACT

This paper presents a model of phonotactic grammar in which wellformedness of consonant clusters is measured by NAD. NAD stands for a Net Auditory Distance obtaining between segments in a cluster. The auditory distance is a net reflection of the differences between segments in terms of manner (MOA) and place of articulation (POA). It is calculated according to the Principle which states that a cluster is preferred if it satisfies a pattern of distances specified by the universal phonotactic preference relevant for its position in a word. Every position of a cluster in a word, i.e. initial, medial and final, is defined by a respective well-formedness ("goodness of cluster") preference. The NAD Principle makes finer predictions than the sonority sequencing generalization (SSG). For example, it predicts that initial pr- is "better" (more preferred) that tr-, and they are both better than ps- or rt-, while the latter two are of comparable value.

However, phonology alone does not fully account for clusters. Inflection, word-formation and compounding contribute to the creation of consonant clusters to an extent relative to a morphological type of a language. Therefore, a phonotactic grammar operates on basic, non-derived, lexical forms, while morphonotactics takes care of the remaining, morphologically complex, forms. Interaction between phonotactics and morphonotactics provides a richer insight into the understanding of cluster complexity.

1. Introduction

The model of phonotactic grammar presented here is embedded in the theory of Beats and Binding Phonology (B&B henceforth) which is in turn derived from the principles and assumptions of Natural Phonology (NP) and employs the epistemology of Natural Linguistics (NL). B&B phonotactics is based on universal preferences which are grounded in phonetics and expressed by means of the Net Auditory Distance (NAD) Principle. NAD functions as a measure of wellformedness of lexical (i.e. phonological) clusters. In clusters arising in morphologically complex words NAD Principle is often overridden by morphonotactics.

Having characterised the theoretical background, I will formulate the hypotheses with reference to the Polish data obtained in the project[1] and discuss the results of the analysis. In conclusion, NAD parameters and the NAD Principle as such will be placed under scrutiny and directions for future research will be suggested.

Abbreviations: NAD, Net Auditory Distance; MOA, manner of articulation; POA, place of articulation; SSG, sonority sequencing generalisation; NP, Natural Phonology; NL, Natural Linguistics; B&B, Beats and Binding; OT, Optimality Theory.

* Faculty of English, Adam Mickiewicz University in Poznań, Al. Niepodleglosci 4, Poznań, Poland. Tel.: +48 519 340 568.
E-mail address: dkasia@wa.amu.edu.pl.

[1] The new data from Polish (and English) obtained within a project *Phonotactics and morphonotactics of Polish and English*: *description*, *tools and applications* (N N104382540). My collaborators in the project have been Michał Jankowski, Piotr Wierzchoń, Paulina Zydorowicz, Paula Orzechowska and Dawid Pietrala (cf. e.g., Dziubalska-Kołaczyk et al., 2011, 2012).

http://dx.doi.org/10.1016/j.langsci.2014.06.003
0388-0001/

2. Epistemology

2.1. Beats and Binding Phonology

Beats and Binding Phonology (Dziubalska-Kołaczyk, 2002) is a syllable-less theory of phonology embedded in Natural Phonology. The structure usually referred to as "the syllable" in other models is epiphenomenal here or emergent due to principled phonotactic forces. The latter are responsible for different degrees of intersegmental cohesion (Bertinetto et al., 2006) which, in turn, determines the behaviour of segments and creates the impression of syllable structure.

B&B Phonology was proposed out of a need for better, more comprehensive and holistic explanations of phonological phenomena than the ones prompted by the syllable.[2] Basic units, beats (mostly vowels) and non-beats (always consonants, including glides), are connected into an alternating sequence by means of bindings according to the principle of perceptual salience. Such alternation is both acoustically and physically grounded:

> "To construct a useful signalling system out of sound, there must be some differentiation between different parts of the signal in time. It appears that a basic organization of this differentiation of sound in all (spoken) languages consists of an alternation between louder and quieter levels of sound, with a period not too far from 150-200 ms" (Maddieson, 1999: 2525)

This amounts to

> "[a] fairly regular wave-like alternation of amplitude peaks and valleys. The occurrence and timing of this pattern have been suggested to be related to a natural frequency of the jaw, which can be approximately equated with a comfortable mastication rate" (Maddieson, 1999: 2525)

The alternating sequence is cut into pieces called words and morphemes on its way from the prelexical to lexical level. Clusters of non-beats are "accidents" due to some distortions of the alternating sequence (e.g., dropping or breaking of some beats). The occurrence and subsequent behaviour of consonant clusters is controlled by phonotactic preferences (and morphonotactics).

Bindings are used in B&B Phonology to account for both segmental and prosodic structure. In this paper, however, the focus is on phonotactics.

2.2. Natural Phonology and Natural Linguistics

The explanation pattern in B&B Phonology is epistemologically grounded in Natural Phonology (Stampe, 1979; Donegan and Stampe, 1979) and Natural Linguistics (Dressler, 1996 and other publications). Basic thesis of NP has been that phonological systems are phonetically motivated. The way to understand it is that processes and sounds have phonetic grounding in all speakers. It does not mean that the same processes will apply in all languages or that they will derive identical outputs across a variety of contexts. Sounds, apart from being contrastive, also have sub-categorical features. NL has an expanded epistemology in order to be able to account for all the components of language. It is a functionalist framework with semiotic underpinning. It is a preference theory which heavily relies on general non-linguistic principles as well as on sources of the so called "external" evidence. Language user is central to the explanation, since "preference" implies a human agent who behaves functionally in his/her linguistic performance. However, the goals of a given performance may be contradictory and the circumstances highly complex. Therefore, NL attempts a holistic explanation, expressed in terms of hierarchies of preferences according to complex sets of relevant criteria.

The explanatory model of NL may be summarised as in the table below (Table 1). The starting point is a higher order non-linguistic principle from which a linguistic preference is derived and measured by respective parameters, which in consequence provides an explanation for a given language-specific structure.

2.3. B&B phonotactics

The model of phonotactic grammar with NAD is part of B&B Phonology. While beats and non-beats alternate on the basis of perceptual contrast (as discussed above in Section 2.1), actual auditory distances between sounds in a sequence become relevant when the melody (phonetic content) is filled in and we deal with vowels and consonants.

Clusters of consonants tend to be avoided, subject to the universal CV preference. Typologically, the CV is a universal constituent type which occurs in all languages. As shown by Maddieson (2009) on the basis of a sample of 486 languages:

- 12.5% of the languages allow only CV's
- 56.6% of the languages have the moderately complex structure CCVC, with limitations, however, on which consonants may appear in the CC cluster, the second consonant typically being a liquid or a glide
- 30.9% of the languages have complex structures (C)(C)(C)V(C)(C)(C)(C).

[2] The syllable itself has always been problematic to define, while the various syllable-based explanations have often been supported by such circular notions as 'extrasyllabicity' and 'ambisyllabicity'. For a comprehensive discussion of the syllable-related issues, including the history of approaches to the syllable, cf. Dziubalska-Kołaczyk (2002).