

Universal phonotactic and morphonotactic preferences in second language acquisition

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ABSTRACT

Phonotactics determines phonological conditions on the co-occurrence of sounds within words or syllables. Morphonotactics is a subcomponent of morphonology concerned with the co-occurrence of sounds at morphological boundaries. Due to the semiotic priority of morphology over phonology, morphonotactics allows us to explain the motivation for those consonant clusters that phonotactics has failed to account for. The aim of the study is to investigate the influence of universal phonotactic and morphonotactic preferences on the acquisition of consonant clusters in the process of second language acquisition. We hypothesize that phonotactically unmarked lexical clusters will be easier to learn and less susceptible to modifications than phonotactically marked ones. Phonotactic markedness will be measured according to the Net Auditory Distance Principle. As for the morphonotactic clusters, it is assumed that in spite of their phonotactically dispreferred status, second language learners will put some effort into their acquisition. The subjects in the study are Korean and Chinese learners of Polish.

KEYWORDS: phonotactics, morphonotactics, consonant clusters, SLA, auditory distance, universal preferences

1. Introduction

The aim of the study is to investigate the influence of universal phonotactic and morphonotactic preferences on the acquisition of consonant clusters in the process of second language acquisition. Phonotactics determines phonological conditions and constraints on the occurrence or co-occurrence of sounds (vowels and consonants) in a given language. Depending on its theoretical underpinnings, the domain of phonotactics can be the syllable or the word. In the present study, phonotactic preferences¹ concern the occurrence of consonant clusters in the lexical words of a language, i.e., the words which are (a) morphologically simple and (b) phonologically homogenous.

Morphonotactics, on the other hand, has been proposed by Dressler and Dziubalska-Kołaczyk (2006) as a subpart of morphonology concerned with the

1 We talk about preferences rather than structure conditions or constraints since our phonotactics is embedded in the theory of Beats-and-Binding Phonology which is a preference theory (cf. Dziubalska-Kołaczyk 2001) within the framework of Natural Linguistics.

co-occurrence of sounds at morphological boundaries. As a meeting point for phonology and morphology, morphonotactics allows us to explain the motivation for those consonant clusters that phonotactics has failed to account for. The main distinction that has to be made here is one between lexical (cf. above) and morphonotactic consonant clusters. The former appear within a single morpheme (e.g., the initial [ft] in *wtorek* ‘April’), whereas the latter can be found across morpheme boundaries (e.g., [ft] in *w+topić* ‘to melt in’). Morphonotactic clusters can be the product of concatenative or non-concatinative morphological operations. Concatenation is a morphological process which involves affixation (e.g. initial [fs] in *wsytać* ‘pour’), whereas as non-concatinative processes operating in Polish we can classify, for example, a non-productive deletion of a root vowel (e.g. *lew* ‘lion’ ~ *lwi* [lv]) and a productive zero-Genitive-Plural formation (e.g. *tratwa* ‘raft’ ~ genitive plural *tratw* [tf]). Moreover, there are two properties of morphonotactic clusters which are interesting from the phonotactic point of view: (a) very often morphonotactic clusters are phonotactically marked and (b) some morphonotactic clusters will never (or only rarely) occur in monomorphemic words.

We hypothesize that phonotactically unmarked lexical clusters will be easier to learn and less susceptible to modifications than phonotactically marked ones. That is to say, the hierarchy of the universal phonotactic preferability will correlate with the level of difficulty in pronouncing L2 lexical clusters. Universal phonotactic preferences will be measured according to the Net Auditory Distance Principle (Dziubalska-Kolaczyk 2002, 2009) which specifies the universally required perceptual distances between segments within clusters. As for the morphonotactic clusters, it is assumed that in spite of their phonotactically dispreferred status, second language learners will put some effort into their acquisition. The reason being that morphonotactic clusters carry morphological information, and their markedness is used to signal their function. In order to verify the above hypothesis, several Asian (mostly Korean and Chinese) learners of Polish have been tested. The subjects have been asked to read sentences containing words with double consonant clusters (both lexical and morphonotactic) in word initial, medial and final positions². Lexical clusters used in the

2 One of the reviewers asked whether the medial clusters were “tauto- or heterosyllabic”. Such denominations of clusters are used only within syllable-oriented theories of phonology. It needs to be re-emphasized that Beats-and Binding phonology is a syllable-less model: the syllable is redundant and at the most epiphenomenal in phonological structure. Preferred configurations of consonants in clusters emerge due to relations of auditory distances between consonants, and consonants and vowels as specified by the NAD Principle. As a result some clusters are preferred in word-initial position, some in word-medial position and some in word-final position. If a cluster is preferred in the word-medial position, it does not qualify either as initial or final. If a medially dispreferred cluster is found in a word-medial position, it tends to behave phonologically as either initial or final (depending on its characteristics), which creates a respective parsing. You do not need “the syllable” to explain any of this.

study represent all available perceptual distances between Polish consonants (both marked and unmarked) as measured by the present version of the NAD Principle. From dozens of double morphonotactic clusters in Polish [fs-], [fʂ-] and [fɕ-] have been chosen to represent those of concatenative source, and [fɕ-], [lɲ-], [lv-], [mx-], [fʂ-], [lz-] and [-tf] to represent those of non-concatinative source. It is also worth mentioning that all the subjects were native speakers of CV languages, which eliminated their L1 as a variable in the study.

2. Theoretical Background

2.1. Beats-&-Binding phonotactics

Beats-&-Binding phonotactics (Dziubalska-Kołodziej 2009) has been construed within Beats-&-Binding Phonology (Dziubalska-Kołodziej 2002) – a syllable-less theory of phonology embedded in Natural Phonology. The leading rationale of this model of phonotactics is the observation concerning sounds that larger modulations have more survival value than lesser ones and therefore will persist in languages (Ohala 1990). Consequently, the CV is a universal constituent type which occurs in all languages while clusters of consonants tend to be avoided, subject to the universal CV preference. As shown by Maddieson (2008) on the basis of a sample of 486 languages:

- 2.5% 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).

There is ample evidence showing that more complex structures reduce to CV in various linguistic contexts, e.g., in phonostylistics, first language acquisition, aphasia and other types of language disorders, in language change or in language games and manipulations. At the level of the word, medial clusters are tolerated much more than peripheral ones, of which in turn final clusters tolerate longer stretches than initial ones, while at the same time they reduce more heavily (unless inhibited by morphology). Word shape preferences stem both from lexical search/information load criteria and from purely phonetic/phonological criteria (for example, a medial cluster is anchored to vowels on both sides).

Beats-&-Binding phonotactics predicts that clusters, in order to survive, must be sustained by some force counteracting the overwhelming tendency to reduce towards CV's. This force is a perceptual contrast between segments, achieved by auditory distance. There is a preferred pattern of distances between segments to

maintain an unmarked, or natural, sequence. The preferred pattern is specified for clusters in all three positions in the word – initial, medial and final – by means of NAD (Net Auditory Distance) Principle.

2.2. Net Auditory Distance (NAD) Principle

The principle reads:

A phonotactic sequence (=cluster) is preferred if it satisfies a pattern of distances specified by the universal phonotactic preference relevant to its position in a word.

NAD is a measure of distance between two neighbouring elements of a cluster in terms of differences in MOA (manner of articulation) and POA (place of articulation) which bring about a particular auditory impression. Let us demonstrate the operation of the NAD Principle on the word initial two-consonant clusters C1C2V.

NAD (C1,C2) ≥ NAD (C2,V)

i.e.

NAD CC = |(MOA1 - MOA2)| + |(POA1 - POA2)|

NAD CV = |MOA1 - MOA2|

The preference reads:

In word-initial double clusters, the Net Auditory Distance (NAD) between the two consonants should be greater than or equal to the Net Auditory Distance between a vowel and a consonant neighbouring on it.

The distances in terms of manner and place of articulation are calculated on the basis of Table 1 (see below). The manners and places assumed in the table are selected according to their potential relevance: (a) six manners (stop, affricate, fricative, sonorant stop, approximant³, semivowel), where affricates and semivowels are, tentatively, attributed half a distance due to their ambiguous nature and (b) five places (labial, coronal, dorsal, radical and laryngeal or glottal). Manners refer to the most generally acknowledged version of the so-called sonority scale, while places are taken from Ladefoged (2006: 258). This set-up (MOA and POA) is preliminary, and might be extended, both in the number of the parameters themselves (e.g., by adding acoustic cues) as well as parameter-internally, to include more features. In fact, one would need to investigate from the auditory perspective as many acoustic/articulatory cues as possible which potentially contribute to the overall perceptual impression brought about by phonotactic sequences. This, however, is a wider research perspective reserved for the future investigation. In the present study NAD has been calculated as

3 other than semivowel

demonstrated below for the initial cluster prV according to the criteria specified above.

$$\text{pr: } |(MOA1 - MOA2)| + |(POA1 - POA2)|$$

$$|4 - 1| + |1 - 2| = |3| + |1| = 4$$

so, NAD CC = 4

$$\text{rV: } |MOA1 - MOA2| = |1 - 0| = 1$$

NAD CV = 1

the preference $\text{NAD}(C1, C2) \geq \text{NAD}(C2, V)$ is observed because $4 > 1$

Table 1. Distances in manner (MOA) and place (POA) of articulation.

4		3		2		1		0	
obstruent				sonorant					
stop		fricative		sonorant stop		approximant		V	
		affricate				semiV			
p	b	ɸ	β	m		w		labial	1
		f	v	ɱ					
t	ɖ	θ	ð	ɳ		r	l	coronal	2
t	d	ʃ	ʒ	n					
t	ɖ	s	z						
		ʂ	ʐ						
		ʧ	ʤ						
k	g	ç	ʝ	ɲ		j		dorsal	3
c	ɟ	x	ɣ	ŋ					
								radical	4
ʔ		h						laryngeal (glottal)	5

2.3. Morphotactics

Morphotactics has been proposed and argued for (Dressler and Dziubalska-Kořaczyk 2006) within the semiotically based model of morphonology (Dressler 1985, 1996) and the phonotactic model of Beats-and-Binding phonology (Dziubalska-Kořaczyk 2002). It is the area of interaction between morphotactics and phonotactics. The interactions may be cooperative and result in clusters which are already present in monomorphemic words of a language, while most of the time they are conflictual and result in marked phonotactic clusters. The latter are at the focus of the present study, in comparison to the monomorphemic lexical clusters.

3. The experiment: method and results

3.1. Method

There were 16 subjects participating in the experiment: 8 Koreans, 7 Chinese and 1 Thai. The informants aged 19-40 and at the time of the experiment they had been learning Polish for 1,5 years. The subjects were speakers of CV languages, which eliminated their L1 as a variable in the study.

The informants were given a reading task consisting of forty words with two-consonant clusters in initial, medial and final position. All the words were embedded in a carrier phrase *Słowo X jest proste* 'The word X is easy'. Two types of clusters were tested: lexical and morphonotactic. As far as the lexical clusters are concerned, two criteria of cluster selection were applied: (a) universal phonotactic preference measured by the NAD Principle and (b) lexical frequency calculated on the basis of 60 thousand entries extracted from *The new Polish-English and English-Polish Kosciuszko Foundation Dictionary*⁴. Table 2 presents the set of lexical clusters chosen for the test, with gray-shaded clusters following the NAD preference.

Table 2. Lexical clusters chosen for the experiment.

Cluster initially	Frequency	Cluster medially	Frequency	Cluster finally	frequency
pş	1973	nt	1399	çç	1662
pr	809	vj	1334	zm	648
st	536	sk	798	nt	442
tr	396	tk	616	st	107
vj	311	kt	579	tr	106
sk	288	tr	501	sk	61
zm	109	pr	440	kt	59
çç	63	çç	393	pr	7
kt	10	pş	297	pş	2
tk	10	zm	123	vj	-
nt	-	st	16	tk	-

What the table does not show is that (a) in 60 thousand words, ca 300 double clusters were initials, 600 medials and 120 finals, respecting the expected distribution in numbers of clusters among positions in the word, and (b) high lexical frequency of the dispreferred cluster pş- is accounted for by the great majority of words being or beginning with prefixes *przy*, *przed*, *przeciw* and *prze*

⁴ We owe the frequency data to Michał Jankowski whose help is herewith greatly acknowledged.

(the first three are also prepositions) while the dispreferred *kt-* appears only in 10 words, but has an expected high corpus frequency especially thanks to the words *kto* and *który*. These observations prove that no phonological measure can solely account for the shape of clusters, without recourse to the criteria which are external to phonology.

The morphonotactic clusters used in the test were presented in the Introduction above. All of these clusters except [ɲ-], [lv-], [mx-] are phonotactically marked.

4. Results

Generally, the speakers turned out to be too advanced and too conscious of their pronunciation in Polish. A number of potential criteria which may have influenced their behaviour emerged and require verification: firstly, their good knowledge of the Polish words tested in the experiment, secondly, the frequency factors related to *przy-* and *kt-* words discussed above, and thirdly, their overall familiarity with clusters from other languages, such as *st-* or *sk-*, triggering easy imitation.

A total of 640 word tokens with double consonant clusters (480 lexical and 180 morphonotactic) were produced by the speakers. 66% of these renderings were correct, whereas 34% of them were different from the expected clusters (see Table 3).

Table 3. Results for all types of clusters.

%	all	lexical	initial	medial	final	morphonotactic
correct	66	75	84	78	62	37
incorrect	34	25	16	22	38	63
substitution			54	18	7	8
pause insertion			4	23	4	1
vowel insertion			22	13	22	41
metathesis			0	0	0	1
reduction			4	5	5	10
cluster status change			8	0	47	5
CC into CCC change			0	8	0	0
Substantial mispronunciation			8	33	15	34

4.1. Lexical clusters

The speakers rendered 480 word tokens that were supposed to contain a lexical cluster. 25% of these clusters were modified by the subjects (cf. Table 3).

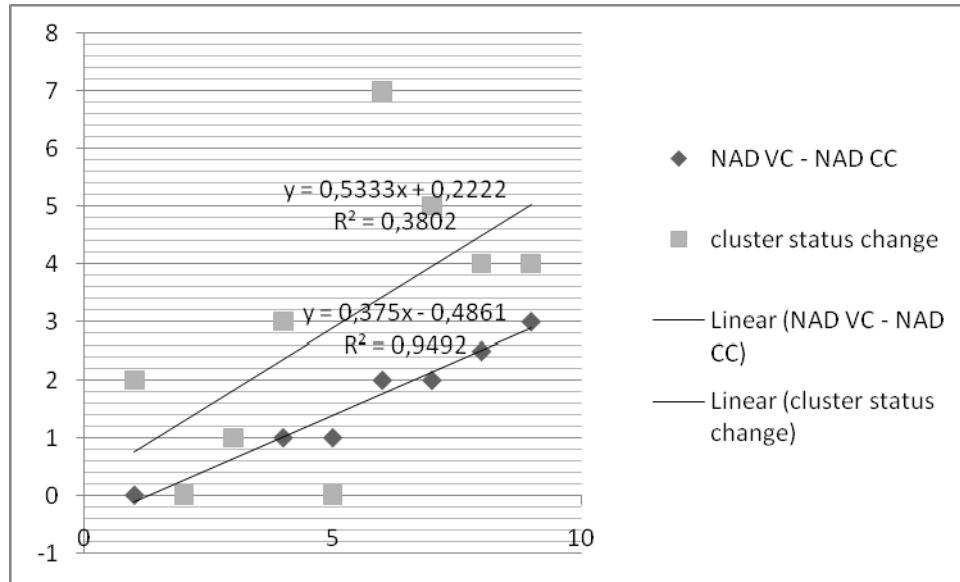
A total of 160 utterances that were expected to contain an initial lexical cluster were obtained in the experiment. Table 3 shows general results for this type of cluster as well as presents different strategies to which the speakers resorted in order to avoid producing the target cluster. Since reductions to CV structures and mispronunciations play a marginal role in initial cluster modifications applied by the informants, it is clearly visible that the speakers tried to preserve as much of the input as possible. This tendency may result from the semiotic salience of the word-initial position, which carries high informational load.

As far as medial lexical clusters are concerned, the informants produced 176 word items with this kind of clusters expected. Again, Table 3 shows the proportion of correct to incorrect renderings as well as the types of errors made by the speakers. Importantly, despite various types of modifications undergone by medials, their status is never changed. In other words, medial clusters never change into initials or finals, which points to the higher tolerance for medial clusters than for peripheral ones.

In the experiment, there were 144 word tokens produced which were supposed to include a final lexical cluster. 62% of them were rendered as expected, whereas the rest 38% were modified by the speakers (cf. Table 3). The large number of cluster status changes from finals into medials deserves closer attention. This is demonstrative of two things. Firstly, word-final clusters are more susceptible to changes because they are less semiotically salient. And secondly, medial clusters are tolerated better than other types of clusters, so such change is an improvement.

Additionally, there is a correlation between the NAD value of final clusters and the frequency with which the informants changed them into medial clusters (see Figure 1). The correlation shows clearly that less preferred finals are more likely to become medials.

Figure 1. Correlation between NAD VC – NAD CC and cluster status change.



4.2. Morphotactic clusters

A total of 160 words with expected morphotactic clusters were obtained in the experiment. In Table 3 above one can see the number of correct and modified renderings of the clusters as well as the types of changes applied by the speakers to the modified clusters. The high percentage of mispronunciations and vowel insertions proves that L2 learners prefer to avoid phonotactically dispreferred clusters.

5. Conclusions and implications

The aim of the study was to investigate the influence of universal phonotactic and morphotactic preferences on the rendering of Polish consonant clusters by second language learners whose mother tongues lack clusters. The collected data has turned out to be insufficient to show interdependence between NAD or frequency and the obtained renderings. Only one correlation was significant, i.e. between the NAD value of a final cluster and its change by a subject to a medial one: the less preferred a final, the more likely it was to change its status to a medial one. Otherwise, the data was inconclusive in this respect and more needs to be collected.

Position in the word was a relevant criterion, as expected. Less preferred final clusters were rendered as medial and thus ‘repaired’ while initial preceded medial preceded final in the general ease of production. The types of modifications

employed by the speakers aimed at maintaining this order, for instance, substitutions prevailed in initial clusters to preserve them (54% > 18% > 7%) while change of cluster status predominantly concerned finals and none of the medial's (8% > 0% < 47%). Vowel insertion was less likely in the medial position than in the other two (22% > 13% < 22%).

The subjects had demonstrably more problems with morphonotactics than phonotactics, with 34% of substantial mispronunciations. The reasons may have been that (a) the morphonotactic clusters were almost all highly phonotactically dispreferred initials and thus, simply, difficult to produce, (b) the test words were not nouns and thus at least some of them may have been less known to the learners, and (c) these clusters are much less typologically present ones across the languages of the world. The difficulty with morphonotactic clusters goes counter the hypothesized behaviour of the learners who were expected to be able to put some additional effort to produce them in order to mark morphological boundaries. This prediction may thus be valid only for children acquiring their native language. In first language acquisition the difference between lexical and morphonotactic structures is important from the start: marked morphonotactics is acquired earlier as more salient and immediately useful. In second language acquisition both structures need to be learned simultaneously so their status is leveled out. Consequently, morphonotactic clusters, being marked, are equally difficult as the dispreferred phonotactic ones, no matter their status.⁵

Overall, phonotactic finals and morphonotactic clusters appeared to be the most problematic for the learners and indeed these categories contain the highest percentage of dispreferred clusters, which speaks for the NAD Principle as a good measure of difficulty.

It is evident in this discussion that, as we have already stated above, there is no one phonological criterion governing clusters of consonants. Their complexity reflects the complexity of criteria defining them.

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5 One of the reviewers points to Eckman, Elreyes and Iverson 2003 “Some principles of Second Language Phonology”, *Second Language Research* 19:3, 169-208 who found that whenever there is a conflict between L1 and L2 phonemics, target patterns are acquired first in basic (tautomorphemic) contexts, then in derived (heteromorphemic) contexts. This indeed may be of relevance here but requires further research.

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