Paradigmatic Contrast in Polish*

Anna Łubowicz
University of Southern California

Abstract:

This paper examines allomorph distribution in the locative of masculine and neuter nouns in Polish. Locative allomorph distribution is opaque and is accounted for in terms of preserving contrast. The key idea is that the different allomorphs of the locative suffix keep apart forms that the regular phonology would otherwise neutralize. This contributes to the body of work on morphological opacity and the role for paradigmatic contrast.

1. Introduction

The study of allomorphy has received considerable attention in Optimality Theory (OT) (Prince & Smolensky 1993). There is a research program in OT which accounts for allomorphy in terms of the well-formedness of the output. Allomorph distribution has been shown to be determined by phonological factors, such as *stress* (Antilla 1997, Drachman et. al 1995, Kager 1996, Mester 1994), *syllable structure* (Bonet 2004, Hargus & Tuttle 1997, Łubowicz et. al. 2006, Mascaró 1996, McCarthy & Prince 1993, Prince & Smolensky 1993, Rubach & Booij 2001, Tranel 1996, 1998), and *phonotactics* (Antilla 2002, Bermúdez-Otero forthcoming, Oostendorp 1998, Yip 2004).[1]

Allomorphy that cannot be explained by the properties of the output (Kiparsky 1997, Oostendorp 1998), which I will call *opaque allomorphy*, seemingly presents a problem for this line of research. This article proposes a solution to opaque allomorphy in this research program in terms of preserving contrast. For related approaches, see Gafos & Ralli (2002), Kenstowicz (2005), Kurisu (1998), McCarthy (2005), Rebrus & Törkenczy (2005), Steriade (1997), (2000), and Urbanczyk (1998), (1999).

This article investigates the role of contrast in allomorph selection. The case study is locative allomorphy of masculine and neuter nouns in Polish (Feldstein 2001, Grzegorczykowa et al. 1984, Gussmann 1980, Jaworski 1986, Rubach 1984, Szober 1969, among others). It is argued that the distribution of the locative allomorphs is opaque and can be determined by paradigmatic contrast. The key idea is that the different allomorphs of the locative suffix preserve contrasts that would be otherwise neutralized on the surface due to palatalization. The analysis is couched within the framework of Contrast Preservation Theory (Łubowicz 2003, 2004), which is extended to the area of allomorphy. This study contributes to our understanding of morphological opacity and the role for contrast.[2]

* I would like to thank Brett Borchardt, Gosia Ćavar, Tracy Hall, John McCarthy, Armin Mester, Nicole Nelson, Jaye Padgett, Meghan Sensenbach, Daylen Riggs, Anne-Michelle Tessier, and two anonymous *JSL* referees for comments. Thanks also to participants of WCCFL 25 and GLOW 29.

[1] For non-OT accounts of allomorphy, see Carstairs-McCarthy (1988), Hudson (1974), and Siegel (1974). For a more complete list of references, see McCarthy (2004).

[2] The terms 'morphological opacity' and 'opaque allomorphy' are used interchangeably.

The rest of this article is organized as follows. Section 2 describes the problem. Section 3 introduces the framework. Section 4 presents the solution. Section 5 discusses typological predictions of the proposal and compares it with alternatives. Finally, section 6 is the conclusion.

2. Statement of the Problem

In Polish, there is a process of Coronal Palatalization (Gussmann 1980, Rubach 1984), by which alveolars and dentals turn into prepalatals before front vowels (see Section 4). The following are examples of palatalization before the locative singular suffix [-e]. Below, I illustrate the alternations with the nominative singular and locative singular of masculine and neuter nouns in Polish. For the purposes of the presentation of the argument, I do not indicate final devoicing. I will be consistent with this throughout the paper.[3]

(1) Coronal Palatalization: /t d n s z/ → [ć dź ń ś ź]/_e

		nominative sg.	locative sg.	gloss
t → ć	:	lis[t]	o liś[ć] + e	'letter'
d → dź	:	obia[d]	o obie[dź] + e	'dinner'
n → ń	:	ok[n] + o	o ok[ń] + e	'window'
s → ś	:	bruda[s]	o bruda[ś] + e	'dirty man'
z → ź	:	łobu[z]	o łobu[ź] + e	'troublemaker'

Interestingly, underlying prepalatals take the back high vowel [–u] suffix in the locative and not the front mid vowel [–e] suffix. Again, I show the examples in the nominative singular and the locative singular of masculine and neuter nouns.

(2) Original prepalatals

		nominative sg.	locative sg.	gloss
ć	:	liś[ć]	o liś[ć] + u	'leaf'
dź	:	narzę[dź] + e	o narzę[dź] + u	'tool'
ń	:	ko[ń]	o ko[ń] + u	'horse'
ś	:	łoso[ś]	o łoso[ś] + u	'salmon'
ź	:	pa[ź]	o pa[ź] + u	'type of butterfly'

This is an example of opaque allomorphy. As shown in (1) and (2), there are two allomorphs for the locative singular suffix, [-e] and [-u]. From the surface form alone, the selected allomorph cannot be determined. The core observation is that the choice of the locative allomorph depends on whether the prepalatal in stem final position is underlying or derived. Derived prepalatals, as in (1), take the [-e] ending, while original prepalatals, as in (2), take the [-u] ending.[4]

[3] In this article, I will use the following transcription system: *c* – voiceless alveolar affricate, *dz* – voiced alveolar affricate, *š* - voiceless postalveolar fricative, *ž* - voiced postalveolar fricative, *č* - voiceless postalveolar affricate, *dž* - voiced postalveolar affricate, *ś* - voiceless prepalatal fricative, *ź* - voiced prepalatal fricative, *ć* - voiceless prepalatal affricate, *dź* - voiced prepalatal affricate, and *ń* - prepalatal nasal.

[4] There are two other mappings that undergo coronal palatalization: r → ž (rowe[r] ~ o rowe[ž] + e 'bicycle'), and w → l (ko[w] + o ~ o ko[l] + e 'circle'). In both cases, the locative suffix is [-e], whereas the same segments present underlyingly take the [-u] suffix, e.g. ryce[ž] ~ ryce[ž]+u 'knight', and po[l]+e ~ po[l]+u 'field'.

The main question is why original and derived prepalatals take different suffixes in the locative. In an output-oriented approach to phonology, such as Optimality Theory (OT) (Prince & Smolensky 1993), there should be no difference between underlying and derived prepalatals in their choice of the allomorph. Since derived and underlying prepalatals are articulated in the output in the same way (Wierzchowska 1971), they should select the same suffix in the locative. In this paper, I will provide an explanation for why original and derived prepalatals take different suffixes in the locative using the principle of contrast.

The key argument is that the allomorph distribution in the locative, [-e] vs. [-u], preserves the original contrast between dentals/alveolars vs. prepalatals in stem final position, /list/ vs. /liść/ map onto [liść + e] vs. [liść + u]. If both forms took the same suffix [-e], the contrast between them would be neutralized on the surface due to palatalization, /list/ vs. /liść/ would both map onto [liść + e]. To put it differently, the original contrast between alveolars/dentals vs. prepalatals is preserved on the surface and manifested as a surface contrast in the choice of the allomorph, [-e] vs. [-u], respectively. The original contrast in the quality of the stem-final consonant is transformed into a surface contrast in the choice of the locative suffix.

An output-oriented approach to phonology, such as Optimality Theory (OT) (Prince & Smolensky 1993), offers new insights into Polish declension pattern. In the next section, I will introduce the framework.

3. The Framework: Contrast Preservation Theory

Contrast plays an essential role in a number of phonological and morphological processes. Some of the early works on contrast include Gussmann (1976), Hualdé (1990), Kaye (1974, 1975), Kisseberth (1976), Martinet (1952), Trubetzkoy (1971), among others. More recently, there has been a great deal of work on the role of contrast in OT. Contrast has been used to account for phonological mappings (Łubowicz 2003, 2004, Tessier 2004), segmental inventories (Flemming 1995, 1996, 2004, Padgett 1997, 2001), historical change (Ito & Mester 2004, to appear, Padgett 2003, Padgett & Zygis 2003), feature co-occurrence restrictions (Cote 2000), morphological processes (Crosswhite 1997/1999, Horwood 2001, Kurisu 1998, Steriade 2000), tonal and accentual phenomena (Alderete 2001), and stress-epenthesis interaction (Łubowicz 2003).

This article investigates the role of contrast in allomorph selection. In the Polish locative, the key claim is that the grammar maintains contrast between forms that the regular phonology would otherwise neutralize. Specifically, forms that are distinct in the stem-final consonant in the input take different suffixes in the locative and thus map onto distinct outputs. The analysis will be couched within the framework of Contrast Preservation Theory (PC theory) (Łubowicz 2003). In the rest of this section I describe the elements of PC theory. I first describe the candidate over which contrast is evaluated and then discuss the constraints that evaluate contrast.

3.1 The Candidate

To evaluate contrast, a candidate is a set of input-output mappings, called a scenario (Łubowicz 2003, cf. Flemming 1995, 1996, 2004, Padgett 1997, 2000, 2001, 2003, Tessier 2004). The key idea is that phonological mappings are not evaluated in isolation but in the context of other mappings in the same system. This is different from standard OT (Prince & Smolensky 1993), where mappings are evaluated in isolation. In OT, similar ideas are also

present in models of output-output faithfulness (Benua 1997, Gouskova 2004) and in the allomorphic model of Burzio (1998).

Below is the actual scenario in Polish over which contrast is evaluated. Forms that contrast in the quality of the stem final consonant, li[st] vs. li[ść], take different suffixes in the locative, [-e] vs. [-u], respectively. The contrasts are represented in bold font.

(3) The actual scenario (cf. (1) and (2))

Input		Output
li**st**, {+e, +u}	⟶	liść + **e**
li**ść**, {+e, +u}	⟶	liść + **u**

In case of affix allomorphy, the inputs of the scenario consist of a set of stems and allomorphs. The allomorphs are language-particular. In Polish, it is a set of two vowels {+e, +u}. Thus, each stem has a choice between [-e] or [-u] in the locative. It is standard to assume that the idiosyncratic allomorphs are listed in the lexicon. Since the choice of either [-e] or [-u] is unpredictable from the surface form of the stem, allomorphs must be stored in the lexicon as a set.

The input also contains stems to which allomorphs attach. In many accounts of contrast, contrast is seen as homophony avoidance (Kisseberth & Abasheikh 1974), and thus stems have to be the actual words of the language. But this presents a problem. When a stem does not have a contrasting form, contrast cannot be evaluated. To avoid this problem, I will follow Łubowicz (2003) and propose that input strings to which allomorphs attach are generated by the function GEN, similar to GEN in Correspondence Theory (McCarthy & Prince 1995). GEN takes an input string and emits a set of forms. The forms generated by GEN consist of any combination of phonological properties P which are essentially any properties governed by standard faithfulness constraints (Prince & Smolensky 1993), such as height, place of articulation, voicing etc.[5] Each form from the set of input strings generated by GEN is paired up with the language-particular set of allomorphs. These are the inputs of a scenario. This is represented below.

(4) The inputs of a scenario

Gen(list, {+e, +u}) = list, {+e, +u}; liść, {+e, +u}; teść, {+e, +u} etc.

The output of a scenario is a subset of the input. There is nothing in the output that is not also in the input. GEN pairs up each input with an output form.[6]

In effect, scenarios represent various mapping coexistence patterns. The scenario is a candidate, and thus, the actual scenario is compared to other scenarios in the same candidate set. Below are two competing scenarios in the Polish locative, the actual scenario and a contrast neutralizing scenario.

[5] Length contrasts are not discussed here.

[6] As pointed out by a reviewer, the claim that a linguistic analysis pertains to possible words of the language and not the existing words is true of both 'standard' OT and rule-based treatments, and is not an innovation of PC theory.

(5) Scenarios in a candidate set

Scenario	Actual		Contrast-neutralizing	
Output	[liść + e]	[liść + u]	[liść + e]	
Input	/list, {+e, +u}/	/liść, {+e, +u}/	/list, {+e, +u}/	/liść, {+e, +u}/

The scenarios above differ on the set of outputs. In the actual scenario, contrast is preserved between stems ending in dentals/alveolars vs. prepalatals, /list/ vs. /liść/ map onto [liść + e] vs. [liść + u]. In the contrast-neutralizing scenario, stems ending in dentals/alveolars vs. prepalatals are not distinguishable, /list/ vs. /liść/ both map onto [liść + e]. (There are other scenarios that need to be considered. For a complete typology, see Section 5.)

Scenarios are submitted for evaluation to EVAL. The optimal scenario is chosen by the constraints on contrast interacting with each other and with conflicting markedness constraints. There are also constraints on recoverability (see Section 5 for discussion). In this model, following previous work on allomorphy in OT, allomorph distribution is controlled by universal and violable constraints but allomorphs themselves need to be stored in the lexicon. A major contribution of this work is that the principle of contrast plays a crucial role in allomorph selection.

3.2 Constraints on Contrast

In generative phonology, contrast is a derivative of the grammar but there is increasing evidence that contrast exists as a separate principle in the grammar. There are various ways to formalize contrast. This proposal is similar to Flemming (1995, 1996, 2004), Padgett (1997, 2000, 2001, 2003), and Tessier (2004), but different from Alderete (2001) and Horwood (2001) who define contrast as anti-faithfulness constraints.

The core claim of this proposal is that contrast exists as an imperative in the phonological system. In Optimality Theory, this is formulated as a family of rankable and violable constraints on preserving contrasts, called PC constraints. They are defined as follows.

(6) PC(P)

For each pair of inputs contrasting in P that map onto the same output in a scenario, assign a violation mark. Formally, assign one mark for every pair of inputs, in_a and in_b, if in_a has P and in_b lacks P, $in_a \rightarrow out_k$, and $in_b \rightarrow out_k$.

"If inputs are distinct in P, they need to remain distinct in the output (not necessarily in P)."

The definition of what it means to contrast in P is given below.

(7) Contrast in P

A pair of forms, in_a and in_b, contrast in P, when corresponding segments in those forms, seg_a and seg_b, are such that seg_a has P and seg_b lacks P (same for outputs).

PC constraints require that forms that contrast in phonological property P in the input contrast on the surface in some way. PC constraints are like faithfulness constraints in that they evaluate two levels of representation, inputs and corresponding outputs, but they are different in that they look at pairs of inputs and outputs and not an individual input-output mapping.

Unlike standard faithfulness, PC constraints allow a given underlying contrast to be realized as a different surface contrast. In the Polish locative, the underlying contrast in the quality of the stem final consonant is manifested as a surface contrast in the quality of the allomorph (see (3)).

Finally, as will be shown below, PC constraints together with other constraints can determine which allomorph is selected in the output and in that respect resemble markedness constraints. As discussed in Kager (1999), faithfulness constraints cannot determine allomorph selection under the assumption that both allomorphs are present in the input.

4. The Analysis

This section presents the analysis. I first present the core argument (4.1), followed by allomorph distribution (4.2), the role of contrast (4.3), and the summary of the analysis (4.4).

4.1 Core Argument

As shown in Section 2, the front vowel allomorph [-e] causes palatalization of the preceding consonant. This is referred to as Coronal Palatalization (Rubach 1984). According to Coronal Palatalization, anterior consonants such as dentals and alveolars /s z t d n/ turn into prepalatals [ś ź ć dź ń] before front vocoids [i], [e], and [j]. This is stated as follows:

(8) Coronal Palatalization
[+anterior, +coronal] → prepalatal / _____ [-cons, -back][7]

Examples are repeated below.

(9) Coronal Palatalization (cf. (1))

nominative sg.		locative sg.	gloss	
t → ć	:	lis[t]	o liś[ć] + e	‘letter’
d → dź	:	obia[d]	o obie[dź] + e	‘dinner’
n → ń	:	ok[n] + o	o ok[ń] + e	‘window’
s → ś	:	bruda[s]	o bruda[ś] + e	‘dirty man’
z → ź	:	łobu[z]	o łobu[ź] + e	‘troublemaker’

Palatalization is an example of assimilation, where the consonant takes on some of the articulatory properties of the following vowel (see Gussmann 1980, Rubach 1981, 1984, 2003, Ćavar 2004, Kochetov 2001).

[7] A more precise formulation given in Rubach (1984) is: [+anter, +coron, -del rel, ∝ obstr] → [-back, +distr, +high, -anter, ∝ strid] / ____ [-cons, -back]. This excludes alveolar affricates and the lateral [l] from the input to palatalization. Two other mappings that undergo Coronal Palatalization but are not discussed here are: /w r/ → [l ž].

Coronal Palatalization creates derived prepalatals. As reported in Ladefoged (1996): "The sounds are produced with the body of the tongue in the front position. The tongue is tense and the lips are spread. The air escapes through a very narrow channel made between the post-alveolar region of the palate and the middle of the tongue". For the study of prepalatals, see Keating (1988), Styczek (1973), and Wierzchowska (1971), among others.

To account for palatalization, I propose that there exists a markedness constraint against the sequence of an anterior coronal followed by a front vowel (*se, *ze, *te, etc.), called PAL. As a result of palatalization, the contrast is neutralized between underlying and derived prepalatals. I will refer to this contrast as a contrast in height.[8] For palatalization to take place, the markedness constraint PAL must outrank the constraint on preserving contrast between underlying and derived prepalatals, called PC(high). The constraints and their ranking are given below.

(10) PAL
No anterior coronal followed by a front vowel.

(11) PC(high)
For each pair of inputs contrasting in height that map onto the same output in a scenario, assign a violation mark.

"If inputs are distinct in height, they need to remain distinct in the output."

(12) Palatalization ranking
PAL >> PC(high)

In effect, palatalization neutralizes the height contrast. This is represented in the following tableau. I compare two scenarios, one without palatalization, the contrast-preserving scenario A, and one with palatalization, the contrast-neutralizing scenario B. The forms are hypothetical and are meant to illustrate the consequences of palatalization in a phonological system.

(13) Palatalization neutralizes the height contrast

	Scenarios	PAL	PC(high)
A. Contrast-preserving	/pas + e/ → pas + e /paś + e/ → paś + e	*!	
B. Contrast-neutralizing ☞	/pas + e/ → paś + e /paś + e/ → paś + e		*

The scenario which fails to palatalize, scenario A, is eliminated. It incurs a fatal violation of PAL. The contrast-neutralizing scenario wins since it undergoes palatalization. With the opposite ranking, PC(high) >> PAL, no palatalization would take place.

The key observation in this article, as described in Section 2, is that locative allomorphy preserves the height contrast between derived and original prepalatals. This height contrast is preserved on the surface despite palatalization and realized by different suffixes. As illustrated in (1) and (2), underlying prepalatals take the [-e] allomorph while derived prepalatals take the [-u]

[8] Rubach (1984) describes prepalatals as [+high, -back].

allomorph. Thus, allomorphy preserves the contrast between underlying and derived prepalatals despite palatalization. This is represented schematically below.

(14) The role for allomorphy (cf. (3))

Input		Output
li**s**t, {+e, +u}	⟶	liść + **e**
li**ś**ć, {+e, +u}	⟶	liść + **u**

The choice of the allomorph keeps apart forms that would be neutralized on the surface due to palatalization. To put it differently, the original contrast in height, [li**s**t] vs. [li**ś**ć], is manifested as a surface contrast in the choice of the allomorph, [-e] vs. [-u].

Below I compare three scenarios: scenario A, in which both forms have the same allomorph [-e]; scenario B, in which the two forms have different allomorphs, [-e] and [-u]; and scenario C, which fails to palatalize.

(15) Allomorphy preserves the contrast in height

	Scenarios	PAL	PC(high)
A. Contrast-neutralizing	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + e		*!
B. Contrast-preserving ☞ (=Actual)	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u		
C. Contrast-preserving	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → liść + e	*!	

Scenario A fails since it neutralizes the contrast in height. In this scenario, two distinct underlying forms map onto the same output, and thus are not distinguished from one another. Scenario C fails since it does not palatalize and thus incurs a fatal violation of PAL. Scenario B is chosen as optimal since it palatalizes but also keeps apart the two distinct underlying forms. In terms of constraints, scenario B satisfies both PAL and PC(high).

The constraint PC(high) is satisfied in Scenario B because the two inputs, [list] vs. [liść], that contrast in the height of the stem-final consonant, [t] vs. [ć], contrast in the output in the quality of the suffix vowel, [-e] vs. [-u]. As was discussed in Section 3, PC constraints allow for contrast transformation where a given input contrast is manifested in the output in a different way than in the input.

In summary, though palatalization can neutralize the height contrast (see tableau (13)), the locative allomorphy preserves the height contrast, despite palatalization (see tableau (15)). In effect, allomorphy keeps apart forms that the regular phonology would otherwise neutralize. In Polish, allomorphy compensates for palatalization.

In addition to derived prepalatals, there exist underlying prepalatals in Polish. Consider the following minimal pairs:

(16)

a. Underlying dental/alveolar		b. Underlying prepalatal	
te[st]	‘test’	te[ść]	‘father in law’
li[st]	‘letter’	li[ść]	‘leaf’
ka[s] + a	‘register’	ka[ś] + a	‘Kate’

Since there are underlying prepalatals in Polish, it must be the case that the constraint on preserving the contrast in height dominates the constraint against prepalatals, which I will call *[+high, -back]. This is represented below.

(17) *[+high, -back]
No prepalatals.

(18) Prepalatals surface
PC(high) >> *[+high, -back]

According to the ranking above, underlying prepalatals are present in the output forms in Polish. This is represented in the following tableau. I compare two scenarios, a contrast preserving scenario, Scenario A, in which the underlying contrast in height is preserved in the output, and a contrast-neutralizing scenario, Scenario B, where there are no prepalatals in the output.

(19) Underlying prepalatals exist

	Scenarios	PC(high)	*[+high, -back]
A. Contrast-preserving ☞	/test/ → test /teść/ → teść		*
B. Contrast-neutralizing	/test/ → test /teść/ → test	*!	

Scenario A, in which prepalatals surface, is the winner. It satisfies PC(high) at the expense of segmental markedness. Scenario B is eliminated, since it neutralizes the contrast in height.

Altogether, the ranking is as follows:

(20) PAL >> PC(high) >> *[+high, -back]

Underlying prepalatals exist but palatalization can neutralize the contrast in height. The key argument is that allomorphy preserves the contrast in height despite palatalization.

4.2 Allomorph Distribution

In this section I further discuss allomorph distribution in Polish. The allomorphs in Polish are in near complementary distribution. The front vowel allomorph [-e] also occurs after labials and labio-dentals *p, b, m, w, f, v*. The back vowel allomorph [-u] occurs in addition after post-alveolars *š, ž, č, dž*, the palatal *j*, velars *k, g, x*, alveolar affricates *c, dz*, and the lateral *l*. I will refer to those two groups as front and back consonants.[9]

[9] This corresponds to Rubach's (1984) classification as [+anterior] for front consonants and [-anterior] for back consonants. The only exceptions are *c,dz* and *l* that are [+anterior] but pattern with back consonants. There is evidence from Polish that *c,dz* pattern together with post-alveolars. For example, both condition the process of vowel retraction. The patterning of *l* with [-anterior] might have to do with historical dark *l*. Thanks to an anonymous reviewer for comments on this point.

(21) Front and back stems[10]

a. Front consonants (labials and labio-dentals)

		nominative sg.	locative sg.	gloss
p → p'j	:	chło[p]	o chło[p'] + je	'peasant'
b → b'j	:	ara[b]	o ara[b'] + je	'Arab'
m → m'j	:	gra[m]	o gra[m'] + je	'gram'
f → f'j	:	gra[f]	o gra[f'] + je	'graph'
v → v'j	:	ró[v]	o ro[v'] + je	'ditch'

b. Back consonants (post-alveolars, the palatal, velars, alveolar affricates and the lateral)

		nominative sg.	locative sg.	gloss
š	:	ko[š]	o ko[š] + u	'basket'
ž	:	tale[ž]	o tale[ž] + u	'plate'
č	:	królewi[č]	o królewi[č] + u	'prince'
dž	:	bry[dž]	o bry[dž] + u	'bridge'
j	:	kra[j]	o kra[j] + u	'country'
k	:	so[k]	o so[k] + u	'juice'
g	:	ró[g]	o ro[g] + u	'corner'
x	:	stra[x]	o stra[x] + u	'fear'
c	:	ko[c]	o ko[c] + u	'blanket'
dz	:	wi[dz]	o wi[dz] + u	'viewer'
l	:	nauczycie[l]	o nauczycie[l] + u	'teacher'

As shown above, consonants articulated in the front part of the oral cavity take the front vowel allomorph [-e] (see (21a)). Consonants articulated in the back part of the oral cavity take the back vowel allomorph [-u] (see (21b)).[11]

This is also true of borrowings. Front consonants take the [–e] suffix while back consonants take the [–u] suffix.

(22) Borrowings

nominative sg.	locative sg.	gloss
gadże[t]	o gadże[ć] + e	'gadget'
Harwar[d]	o Harwar[dź] + e	Harvard'
autobu[s]	o autobu[ś] + e	'bus'
trape[z]	o trape[ź] + e	'trapèze' (French)
badminto[n]	o badminto[ń] + e	'badminton' (English)

[10] Two other palatalizations are shown in (21a): Labio-Velar Palatalization and Surface Palatalization. Following Rubach (1984), Labio-Velar Palatalization is formulated as: ∅ → j / [-coronal] ___ e. Surface Palatalization is formulated as: [+cons] → [+high, -back] / ____ ([-seg]) [-cons, +high, -back].

[11] Exceptions include three nouns that end in a bilabial or alveolar but can take either the [-u] ending: do[m] - o do[m] + u, sy[n] – o sy[n] + u, pa[n] – o pa[n] + u, or the front [-e] ending. There are also a few masculine nouns that pattern as feminine in the locative (not discussed here).

nominative sg.	locative sg.	
bry[dž]	o bry[dž] + u	‘bridge’ (English)
alkoho[l]	o alkoho[l] + u	‘Alkohol’ (German)
zam[š]	o zam[š] + u	‘Sämisch’ (German)
gara[ž]	o gara[ž] + u	‘garage’ (French)
Nowy Jor[k]	o Nowym Jor[k] + u	‘New York’

Diachronically, Polish allomorphy in the locative has been argued to follow a distribution where the so-called u-stems in Early Slavic take the [-u] ending and the so-called o-stems take the [-e] ending (Lunt 2001, Szober 1969). It is also described in terms of hard and soft stems, where stems ending in soft consonants take the [-u] ending. The term soft indicates consonants that are synchronically soft, such as prepalatals, or used to be soft, such as post-alveolars. The latter is referred to as “functionally soft” (Jaworski 1986, Szober 1969). Stems ending in hard consonants take the [-e] ending.

As shown above, the allomorphs are in near complementary distribution. The front vowel allomorph is preferred for front consonants and the back allomorph is preferred for back consonants. To express this generalization, I will assume that [u] is preferred over [e] (*e >> *u) but not after front consonants (*Front/u >> *e). The constraint *Front/u is a member of the family of no linkage constraints proposed in Ito, Mester & Padgett (1995). The constraints and their ranking are illustrated below.

(23) *Front/u
No back vowels after front consonants.

(24) Allomorph distribution
*Front/u >> *e >> *u

The ranking given in (24) is represented in the following tableaux. The tableau (25) represents a stem ending in a back consonant, a post-alveolar, and it selects the back vowel allomorph in the locative. The tableau (26) shows a stem ending in a front consonant, a labial, and it selects the front vowel allomorph in the locative.

(25) Back consonants select [-u]

/talež, {+u, +e}/	*Front/u	*e	*u
☞ a. talež + u			*
b. talež + e		*!	

(26) Front consonants select [-e][12]

/graf, {+u, +e}/	*Front/u	*e	*u
a. graf + u	*!		*
☞ b. graf’ + je		*	

[12] The presence of ‘j’ in candidate (b) is due to a regular phonological process in Polish, called Labio-Velar Palatalization (see Rubach 1984).

In effect, back consonants select the back allomorph (see (25)) while front consonants select the front allomorph (see (26)).

This preference is only active in allomorph selection. Both sequences surface when underlying. Kager (1996) refers to this type of markedness as morphological markedness in contrast to phonological markedness.

(27) Underlying sequences of Front/u

[du]x	'ghost'
[pu]zon	'trombone'
[nu]rek	'diver'
[su]pełł	'knot'

To ensure that there are words in Polish with a front consonant followed by a back vowel, preserving the contrast in vowel quality, PC(high)/PC(back)/PC(round), is more important than avoiding back vowels after front consonants, *Front/u. The constraints on preserving contrast in vowel quality are members of a family of PC constraints defined in Section 3. They are formulated under the assumption that vowels in Polish can be defined in terms of height, backness and rounding (Rubach 1984). The ranking is given below.

(28) PC(high), PC(back), PC(round) >> *Front/u

I will compare two existing forms of Polish, [dux] 'ghost' vs. [dex] 'breath'. The relevant tableau is given below.

(29) Underlying Front/u sequences surface

	Scenarios	PC(high)	PC(back)	PC(round)	*Front/u
A. Contrast-preserving ☞	/dux/ → dux /dex/ → dex				*
B. Contrast-neutralizing	/dux/ → dex /dex/ → dex	*	*	*!	

The constraints against neutralizing the contrast between vowels of different height, backness, and rounding select the scenario where the contrast is preserved, scenario A. Scenario B violates the PC constraints.[13]

This is an example of "the emergence of the unmarked" or TETU effects (McCarthy & Prince 1994). The markedness constraints guiding allomorph selection are not otherwise active in the language since they are dominated by conflicting faithfulness (in my account, by PC constraints). They become active in allomorph selection since allomorphs are listed in the lexicon and are not governed by faithfulness constraints. For discussion of "the emergence of the unmarked" in allomorph selection, see Kager (1999), McCarthy (2004), among others.

[13] As pointed out by an anonymous reviewer, a permuted scenario is possible where the outputs are the same as in the actual scenario but they correspond to different inputs. For a discussion, see Section 5.

4.3 The Role for Contrast

Given the palatalization facts and the articulation of prepalatals, I assume that prepalatals followed by [-e] are unmarked. The argument for this is two-fold. First, the sequence of a prepalatal followed by a front vowel is the output of palatalization. It has been shown that a phonological process in OT must lead to a decrease in markedness (see Moreton 1996/1999). In addition, prepalatals are articulatorily similar to a front vowel, as the tongue body in the articulation of prepalatals is moved forward (see Ladefoged 1996, Rubach 1984: 24 via Wierzchowska pc.). Because of the position of the tongue body, prepalatals are described as [-back]. Given this evidence, the allomorph [-u] after original prepalatals is unexpected. The tableaux below show that, under the constraint ranking established so far, both derived and underlying prepalatals should select the same allomorph.[14]

(30) Derived prepalatals

/list, {+u, +e}/	*Front/u	*e	*u
a. list + u	*!		*
☞ b. liść + e		*	

(31) Underlying prepalatals – wrong result

/liść, {+u, +e}/	*Front/u	*e	*u
☜ a. liść + u	*!		*
b. liść + e		*	

As shown above, while derived prepalatals select the unmarked allomorph (see (30)), underlying prepalatals present a problem (see (31)). The winning mapping /liść/ → [liść + e] is not the actual mapping in Polish.

To ensure that derived and original prepalatals select different allomorphs, the constraint on contrast must compel the marked allomorph. Formally, the constraint on preserving contrast in height, PC(high), must outrank the markedness constraint against the marked allomorph, which in my analysis is *Front/u. This is illustrated below. The tableau compares two scenarios, a contrast-preserving scenario, scenario A, and a contrast-neutralizing scenario, scenario B.

(32) The role of contrast

	Scenarios	PC(high)	*Front/u
A. Contrast-preserving ☞	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u		*
B. Contrast-neutralizing	/list, (+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + e	*!	

Scenario A wins since it preserves the contrast between derived and original prepalatals by the choice of a different allomorph. Stems that end in a prepalatal in the input as opposed to the ones where the prepalatal is derived select different allomorphs. Scenario B loses since it neutralizes

[14] "Front" in my account includes prepalatals.

the contrast in height, even though it chooses the less marked allomorph. Thus, the marked allomorph retains the contrast between the two sets of pre-palatals.

4.4 Summary

In summary, palatalization takes place but allomorphy preserves the contrast in height despite palatalization. Contrast preservation and the need to palatalize compel the marked allomorph after underlying prepalatals. This is illustrated in the following tableau.

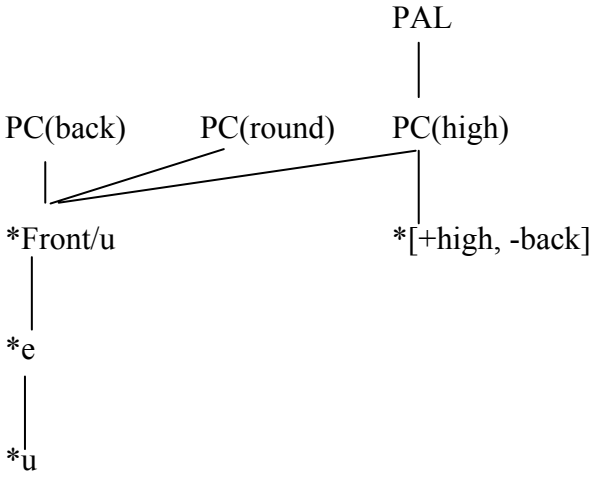
(33) Summary tableau

	Scenarios	PAL	PC(high)	*Front/u
A. Contrast-neutralizing	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + e		*!	
B. Contrast-preserving ☞ (=Actual)	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u			*
C. Contrast-preserving	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → liść + e	*!		

Scenario B wins since it preserves the contrast in height and palatalizes. In terms of constraints, it satisfies both PAL and PC(high). Scenario A loses since it neutralizes the contrast in height, thus violating PC(high). Scenario C loses since it fails to palatalize, thus violating PAL.

The ranking established so far is given below. This is followed by the ranking arguments.

(34) Ranking established so far



(35) Ranking arguments

Ranking	Argument
PAL >> PC(high)	Palatalization neutralizes the height contrast.
PC(high) >> *[+high, - back]	Underlying prepalatals are acceptable.
*Front/u >> *e >> *u	Allomorphs are in complementary distribution.
PC(high) >> *Front/u	Contrast compels the marked allomorph.
PC(back/round/high) >> *Front/u	Underlying Front/u sequences are acceptable.

The key idea is that by different allomorphs in the locative for derived and underlying prepalatals, palatalization is non-neutralizing. The contrast in height is preserved despite palatalization.

5. Predictions and Comparison with Previous Approaches

In this section I discuss predictions of the contrast approach to allomorphy. I first discuss other logical scenarios in the Polish locative (5.1), and then compare the predictions of the contrast account with alternative approaches to allomorphy (5.2).

5.1 Other Scenarios

In PC theory, a candidate is a scenario. In the actual scenario, derived prepalatals take the [-e] allomorph while underlying prepalatals take the [-u] allomorph. But there are other scenarios that need to be considered. We need to ensure that under our analysis the actual scenario wins over other possibilities. Formally, considering the two inputs, /list/ vs. /liść/, and the two allomorphs {+e, +u}, there are 16 logical scenarios to consider. These are shown below. The actual scenario is number (1) and is represented in a bold box. I divide the scenarios into contrast-preserving and contrast-neutralizing.

(36) Logical scenarios

Contrast-preserving scenarios			
1.	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u	9.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → liść + e
2.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → liść + e	10.	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → list + u
3.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → liść + u	11.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → list + u
4.	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → liść + e	12.	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → list + e
5.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → list + e	13.	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → list + u
6.	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → liść + u	14.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → list + e
Contrast-neutralizing scenarios			
7.	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + e	15.	/list, {+e, +u}/ → list + e /liść, {+e, +u}/ → list + e
8.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → list + u	16.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → liść + u

The scenarios represent various mapping coexistence patterns. They have the same inputs but differ on the set of outputs (compare (1) and (7)) and/or input-output relations (compare (1) and (9)). Scenario (1) is the actual scenario in Polish where the two inputs take different allomorphs. Scenario (7), on the other hand, represents a language where both inputs take the same allomorph [-e].[15]

Some scenarios are eliminated, given the constraint ranking established so far. Any scenario that does not palatalize is ruled out. This rules out scenarios (4)-(6), (12)-(14), and (15). Also, any scenario that neutralizes the height contrast is ruled out. That rules out scenarios (7), (8), (15), and (16). These are the shaded scenarios. We are left with 6 scenarios to consider. The remaining contrast-preserving scenarios are given below.

[15] As will be shown at the end of this section, some of the logically-possible scenarios represented in (36) are harmonically-bounded and will never win, given the constraint inventory postulated in this work.

(37) Remaining contrast-preserving scenarios

1. Actual	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u	9.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → liść + e
2.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → liść + e	10.	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → list + u
3.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → liść + u	11.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → list + u

All the scenarios given above satisfy PAL and PC(high). They differ, however, on how contrast is actually preserved.

Contrast-preserving scenarios (2), (3), (10), and (11) differ from the actual scenario on the set of outputs. While the actual scenario contains a prepalatal followed by the back vowel [u], the other four scenarios contain an alveolar followed by [u]. It has been shown that allomorphs in the locative are distributed on the front-back dimension where front consonants take the front allomorph and back consonants take the back allomorph. This fact is expressed by a contextual markedness constraint *Front/u. The difference between the actual scenario and the other competing scenarios above argues that consonants which are classified as front, such as alveolars and prepalatals, need to be further differentiated. In this case, I propose that the contextual markedness constraint *Front/u is divided into *Alveolar/u and *Prepalatal/u, where *Alveolar/u dominates *Prepalatal/u. It is worse for the alveolar consonant to be followed by [u] than for the prepalatal. The alveolar is more front than the prepalatal and thus more different in place of articulation from the back vowel. The ranking is given below:

(38) The scale of "frontness"
*Alveolar/u >> *Prepalatal/u[16]

The consequence of this ranking is that the Alveolar/u sequence is less optimal than the sequence of Prepalatal/u. This is illustrated below. I compare the actual scenario to a competing scenario with a more marked output.

(39) The role for markedness

		PAL	PC(high)	*Alveolar/u	*Prepalatal/u
A. ☞	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u				*
B.	/list, {+e, +u}/ → list + u /liść, {+e, +u}/ → liść + e			*!	

The actual scenario, scenario A, wins since it contains a less marked output.

We are now left with one more scenario to consider. This is scenario (9), which has the same set of outputs as the optimal scenario but the outputs are permuted. The permuted scenario is recalled below. It is represented alongside the actual scenario.

[16] An alternative would be to have a specific constraint *Alveolar/u outranking *Front/u.

(40) Permuted Scenario
/list, {+e, +u}/ → liść + u
/liść, {+e, +u}/ → liść + e

(41) Actual Scenario
/list, {+e, +u}/ → liść + e
/liść, {+e, +u}/ → liść + u

Both scenarios satisfy markedness and contrast equally. They have the same outputs but these outputs correspond to different inputs. In terms of constraints, there is a tie between the permuted scenario and the actual scenario. The tie is represented in the following tableau.

(42) A tie between scenarios

	Scenarios	PAL	PC(high)	*Front/u
A. Permuted	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → liść + e			*
B. Actual	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u			*

Both candidates satisfy PAL and PC(high). They also both incur a violation of *Front/u since they each contain an output where a prepalatal consonant is followed by the back vowel.

To break the tie, I propose a constraint on the recoverability of input contrasts from the way contrasts are represented in the output. Such a constraint demands that the input contrast in P be retained in the output in the same direction as in the input. In Polish, this constraint demands that the higher the stem-final consonant, the higher the suffix. The constraint is defined below.

(43) RECOVER(P)
Let in_a and in_b contrast in P,
Let out_a and out_b contrast in P', where $in_a \Re out_a$ and $in_b \Re out_b$,
If in_a has P and in_b lacks P, then out_a has P' and out_b lacks P', and vice-versa.

"The input contrast in P needs to be preserved in the output in the same direction."

In Polish, the input height contrast needs to be read off from the output distribution of the allomorphs. This constraint demands that the higher the input stem-final consonant, the higher the suffix. This is formulated below.[17]

(44) RECOVER (high)
"The input contrast in height needs to be preserved in the output in the same direction."

[17] Following Łubowicz (2003), I will assume that recoverability constraints belong to the second stage of EVAL after PC and markedness apply. This is not crucial for the above analysis, and thus is not further discussed here. Irrespective of its ranking, recoverability breaks the tie between the two scenarios.

(45) The role of RECOVER

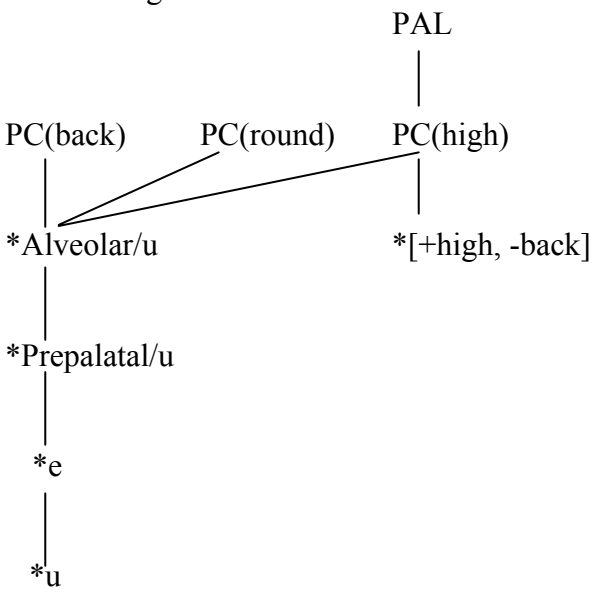
		PAL	PC(high)	*Alv/u	*Prepal/u	RECOVER(high)
A. ☞	/list, {+e, +u}/ → liść + e /liść, {+e, +u}/ → liść + u				*	
B.	/list, {+e, +u}/ → liść + u /liść, {+e, +u}/ → liść + e				*	*!

Scenario B loses since in this scenario the height contrast is permuted.

It is important to note that some of the logically-possible scenarios in (36) will never win given the constraint inventory. This is because they incur a superset of violation marks of other scenarios in the same candidate set. Such scenarios are called harmonically-bounded. For example, scenario (9) is harmonically-bounded by the actual scenario, scenario (1), given the constraint on recoverability. Similarly, scenario (6) is harmonically-bounded by scenario (1). Scenario (6) incurs the same violation marks as scenario (1) but in addition violates a constraint on palatalization.

The ranking is summarized below.

(46) Full ranking



Second stage of Eval: RECOVER(high)

Under this proposal, allomorph distribution follows from the principle of contrast and morphological markedness. The constraint on contrast, PC(high), together with a markedness constraint, PAL, force original prepalatals to take a different allomorph than underlying prepalatals. In consequence, allomorphy retains distinctions that would otherwise be neutralized in the output.

5.2 Comparison with Other Approaches

In the account of allomorphy formulated in this article, contrast in addition to markedness determines allomorph distribution. Thus, in PC theory, the constraint on preserving contrast between dentals/alveolars vs. prepalatals, PC(high), together with the constraint that results in palatalization, PAL, provide an explanation for allomorph distribution. Through the use of contrast as an imperative in a phonological system, PC theory predicts the kinds of allomorphy that are not admitted by other approaches. In what follows, I will compare the predictions of PC theory to markedness-only approaches to allomorphy and to subcategorization approaches.

In markedness-only approaches (see refs. in Section 1), allomorphs are distributed based on the properties of the output alone. Thus, output well-formedness is the only criterion by which allomorph distribution is determined. In terms of constraints, allomorph distribution is accounted for only by markedness constraints. As was explained in the introduction, markedness-only approaches fail to explain allomorphy that is determined by factors other than output well-formedness. Unlike markedness-only approaches, in PC theory, contrast in addition to markedness determines allomorph distribution. Thus, PC theory admits cases of opaque allomorphy which cannot be accounted for in markedness-only terms. Polish locative is an example of this kind of allomorphy. In addition, PC theory predicts the kinds of allomorphy that are predicted by markedness-only approaches since markedness is also present in allomorph selection in this framework.

In a subcategorization approach (Booij & Lieber 1993, Paster 2005), allomorph distribution is accounted for by rules that refer to the properties of the input. This is a very different approach from the research program developed in this article. In a subcategorization approach, there are no limits on what is a possible rule and thus there are no limits on what is a possible kind of allomorphy. Unlike the subcategorization approach, PC theory developed in this article is significantly more restrictive. In PC, there are restrictions on the possible distribution of allomorphs since these patterns should fall out from universal constraints on markedness and contrast.

In summary, PC theory can compel allomorphy in cases where allomorphy is unexpected based on the well-formedness of the output (as in markedness-only approaches) or based on the properties of the input (as in the subcategorization approach). PC theory can also block allomorphy in cases where allomorphy is expected based on the well-formedness of the output (as in markedness-only approaches) or based on the properties of the input (as in the subcategorization approach). Finally, PC theory gives an account of opaque allomorphy within the framework of parallel OT. No special mechanism is required to account for opaque allomorphy since in this approach contrast is an inherent property of the grammar.

6. Conclusion

In this article, I have accounted for Polish allomorphy in the locative of masculine and neuter nouns. I have shown that locative allomorph distribution is opaque and can be accounted for in terms of preserving contrast.

A formal account of contrast preservation in the case of affix allomorphy has been proposed. The key idea is that the different allomorphs of the locative suffix keep apart forms that the regular phonology would otherwise neutralize. Under this proposal, allomorph

distribution follows from the principle of contrast and markedness. Predictions of this account have been compared to previous approaches and found to be superior in several respects.

References

Alderete, John. (2001) Morphologically Governed Accent in Optimality Theory. Routledge Publishing Series, Outstanding Dissertations in Linguistics, New York: Routledge.

Anttila, Arto. (1997) Variation in Finnish Phonology and Morphology. Ph.D. dissertation, Stanford U.

Anttila, Arto. (2002) "Variation & Phonological Theory". In The Handbook of Language Variation & Change. Oxford: Blackwell.

Benua, Laura. (1997) Transderivational Identity: Phonological Relations between Words. Ph.D. dissertation, U. of Massachusetts, Amherst.

Bermúdez-Otero, Ricardo (forthcoming 2006). "Morphological structure and phonological domains in Spanish denominal derivations". In Colina, Sonia & Fernando Martinez-Gil (eds), Optimality-theoretic studies in Spanish phonology. John Benjamins.

Bonet, Eulàlia. (2004) "Morph Insertion and Allomorphy in Optimality Theory". International Journal of English Studies 4: 73-104. Universidad de Murcia.

Booij, G. & R. Lieber. (1993) "On the simultaneity of morphological and prosodic structure. In: Hargus, S. & E. Kaisse (eds.) Studies in Lexical Phonology. 23-44. San Diego: Academic Press.

Burzio, Luigi. (1998) "Multiple correspondence". Lingua 103: 79-109.

Carstairs-McCarthy, Andrew. (1988) "Some Implications of Phonologically Conditioned Suppletion". Yearbook of Morphology 1988: 67-94.

Ćavar, Malgorzata E. (2004) Palatalization in Polish: An Interaction of Articulatory and Perceptual Factors. Ph.D. dissertation, U. of Potsdam.

Cote, Marie-Helene. (2000) Consonant Cluster Phonotactics: a Perceptual Approach. Ph.D. dissertation, MIT. [ROA-584.]

Crosswhite, Katherine. (1997/1999) Intra-paradigmatic homophony avoidance in two dialects of Slavic. Ms., UCLA.

Drachman G., R. Kager and A. Malikouti-Drachman. (1995) "Greek Allomorphy: an Optimality Account". M. Dimitrova-Vulchanova and L. Hellan, eds. Papers from the First Conference on Formal Approaches to South Slavic Languages. Plodiv, October 1995, 345-61.

Feldstein, Ron F. (2001) A Concise Polish Grammar.

Flemming, Edward. (1995) Auditory Representations in Phonology. Ph.D. dissertation, UCLA.

Flemming, Edward. (1996) "Evidence for Constraints on Contrast: The Dispersion Theory of Contrast". Chai-Shune Hsu, ed. UCLA Working Papers in Phonology 1, 86-106.

Flemming, Edward. (2004) "Contrast and Perceptual Distinctness". B.Hayes, R.Kirchner and D.Steriade, eds. Phonetically-Based Phonology. Cambridge University Press, 232-76.

Gafos, Diamandis and A. Ralli. (2002) "Morphosyntactic features and paradigmatic uniformity in two dialectal varieties of the island of Lesvos". Journal of Greek Linguistics 2: 41-73.

Gouskova, Maria. (2004) Minimal Reduplication as a Paradigm Uniformity Effect. B. Schmeiser, V. Chand, A. Kelleher, and A. Rodriguez, eds., Proceedings of the 22nd West Coast Conference on Formal Linguistics. Somerville, MA: Cscadilla Press, 265-278.

Grzegorczykowa, Renata, Roman Laskowski and Henryk Wróbel (eds.). (1984) Gramatyka Współczesnego Języka Polskiego: Morfologia. Warszawa: PAN.

Gussmann, Edmund. (1976) "Recoverable Derivations and Phonological Change". Lingua 40: 281-303.

Gussmann, Edmund. (1980) Studies in Abstract Phonology. Cambridge, Mass.: The MIT Press.

Hargus, Sharon and Siri G. Tuttle. (1997) "Augmentation as affixation in Athabaskan languages". Phonology 14: 177-220.

Horwood, Graham. (2001) Anti-faithfulness and Subtractive Morphology. Ms., Rutgers University. ROA-466.

Hualde, José. (1990) "Compensatory Lengthening in Friulian". Probus: International Journal of Romance Linguistics 2: 31–46.

Hudson, Grover. (1974) "The representation of non-productive alternation". J. Anderson and C. Jones, eds. Historical Linguistics. Amsterdam: North Holland, 203-29.

Ito, Junko and Armin Mester. (To appear) "Systemic markedness and faithfulness". CLS 39.

Ito, Junko and Armin Mester. (2004) "Morphological contrast and merger: Ranuki in Japanese". Journal of Japanese Linguistics 20. 1-18.

Ito, Junko, Armin Mester, and Jaye Padgett. (1995) "Licensing and Redundancy: Underspecification in Optimality Theory". Linguistic Inquiry 26, 571-614.

Jaworski, Michał. (1986) Podręczna Gramatyka Języka Polskiego. Warszawa: Wydawnictwa Szkolne i Pedagogiczne.

Kager, René. (1996) “On affix allomorphy and syllable counting”. Ursula Kleinhenz, ed. Interfaces in Phonology. Berlin: Akademie Verlag, 155-171. (Studia Grammatica 41.)

Kager, René. (1999) Optimality Theory. Cambridge: Cambridge University Press.

Kaye, Jonathan. (1974) “Opacity and Recoverability in Phonology”. Canadian Journal of Linguistics 19: 134-49.

Kaye, Jonathan. (1975) A Functional Explanation for Rule Ordering in Phonology. CLS: Papers from the Parasession on Functionalism, 244-52. Chicago: Chicago Linguistics Society.

P. A. Keating. (1988) Palatals as complex segments: X-ray evidence. UCLA Working Papers in Phonetics 69: 77-91.

Kenstowicz, Michael. (2005) “Paradigmatic Uniformity and Contrast”. Downing, Hall & Raffelsiefen, eds., Paradigms in Phonological Theory. Oxford: Oxford University Press.

Kiparsky, Paul. (1997) LP and OT. Handout of from Cornell Linguistic Institute, July 1997.

Kisseberth, Charles. (1976) “The Interaction of Phonological Rules and the Polarity of Language”. A. Koutsoudas, ed. The Application and Ordering of Phonological Rules. The Hague: Mounton, 41-54.

Kisseberth, Charles and Mohammad I. Abasheikh. (1974) A case of systematic avoidance of homonyms. Studies in the Linguistic Sciences 4(1): 107-24.

Kochetov, Alexei. (2001) Production, Perception, and Emergent Phonotactic Patterns: A Case of Contrastive Palatalization. Ph.D. dissertation, U. of Toronto.

Kurisu, Suzuki. (1998) A Typological Investigation of Dissimilation. Ph.D. dissertation. U. of Arizona.

Ladefoged, Peter and Ian Maddieson. (1996) The Sounds of the World’s Languages. Blackwell.

Lunt, Horace G. (2001) Old Church Slavonic Grammar. Mouton de Gruyter: Berlin; New York.

Łubowicz, Anna. (2003) Contrast Preservation in Phonological Mappings. Ph.D. dissertation, U. of Massachusetts, Amherst. [Published by GLSA.]

Łubowicz, Anna. (2004) **“**Counter-Feeding Opacity As a Chain Shift Effect”. G. Garding and M. Tsujimura, eds., Proceedings of the 22nd West Coast Conference on Formal Linguistics. Somerville, MA: Cascadilla Press, 315-27.

Łubowicz, Anna, Nathan Go, Nancy Huang, and Sara McDonald. (to appear) **“**Nickname formation in Polish: the case of allomorph selection”. Proceedings of Formal Approaches to Slavic Linguistics 15.

McCarthy, John. (2004) A Thematic Guide to Optimality Theory. Cambridge: Cambridge University Press.

McCarthy, John. (2005) “Optimal paradigms”. Laura Downing, Tracy Alan Hall and Renate Raffelsiefen, eds. Paradigms in Phonological Theory. Oxford: Oxford University Press.

McCarthy, John and Alan Prince. (1993) “Generalized Alignment”. G. E. Booij and J. van Marle, eds. Yearbook of Morphology. Kluwer: Dordrecht, 79-153.

McCarthy, John and Alan Prince. (1995) “Faithfulness and Reduplicative Identity”. J. Beckman, L. Walsh Dickey, and S. Urbanczyk, eds., UMOP 18: Papers in Optimality Theory. Amherst: GLSA, 249-384.

Mascaró, Joan. (1996) “External allomorphy as emergence of the unmarked”. Jacques Durand and Bernard Laks, eds. Current Trends in Phonology: Models and Methods. Salford, Manchester: European Studies Research Institute, U. of Salford, 473-83. (Reprinted in McCarthy 2004.)

Martinet, Andre. (1952) “Function, Structure, and Sound Change”. Word 8, 1-32.

Mester, R. Armin. (1994) “The quantitative trochee in Latin”. NLLT 21: 1-61.

Moreton, Elliott. (1996/1999) Non-Computable Functions in Optimality Theory. Ms., U. of Massachusetts, Amherst. [ROA-364.]

Oostendorp, Mark van. (1998) Opacity in allomorphy: The case of Aalst Dutch. GLOW, April 1998.

Padgett, Jaye. (1997) Candidates as Systems: Saussure Lives! Handout from Hopkins Optimality Workshop.

Padgett, Jaye. (2000) The Role of Contrast in Russian (Historical) Phonology. Handout of talk given at MIT, May 12, 2000.

Padgett, Jaye. (2001) “Contrast dispersion and Russian palatalization”. Elizabeth Hume and Keith Johnson, eds. The role of speech perception in phonology. Academic Press: San Diego, CA, 187-218.

Padgett, Jaye. (2003) “Contrast and post-velar fronting in Russian”. NLLT 21(1): 39-87.

Padgett, Jaye and Marzena Zygis. (2003) “The evolution of sibilants in Polish and Russian”. Hall, T. A. and Silke Hamann, eds. ZAS papers in linguistics 32. ZAS, Berlin, 155-74.

Paster, Mary. (2005) Subcategorization vs. output optimization in syllable-counting allomorphy. Proceedings of the 24th West Coast Conference on Formal Linguistics.

Prince & Smolensky (1993) Optimality Theory: Constrain Interaction in Generative Grammar. Rutgers U.

Rebrus, Péter and Miklós Törkenczy. (2005) Uniformity and Contrast in the Hungarian Verbal paradigm. Downing, Hall & Raffelsiefen, eds. Paradigms in Phonological Theory. Oxford: Oxford University Press.

Rubach, Jerzy. (1981) Cyclic Phonology and Palatalization in Polish and English. Warszawa: Wydawnictwa Uniwersytetu Warszawskiego.

Rubach, Jerzy. (1984) Cyclic and Lexical Phonology: The Structure of Polish. Dordrecht: Foris.

Rubach, Jerzy. (2003) "Polish palatalization in derivational optimality theory". Lingua 113: 197-237.

Rubach, Jerzy and Geert Booij. (2001) "Allomorphy in Optimality Theory: Polish Iotation". Language 77: 26-60.

Siegel, Dorothy. (1974) Topics in English Morphophonology. Ph.D. dissertation, MIT.

Steriade, Donca. (1997) Lexical Conservatism and its Analysis. Ms., UCLA.

Steriade, Donca. (2000) "Paradigm Uniformity and the Phonetics-Phonology Boundary". Michael B. Broe and Janet B. Pierrehumbert, eds. Papers in Laboratory Phonology 5. Cambridge, UK; New York, N.Y.: Cambridge University Press, 131-34.

Styczek, Irena. (1973) Badania Eksperymentalne Spirantów Polskich s, š, ś ze Stanowiska Fizjologii i Patologii Mowy. Wrocław: Wydawnictwo Polskiej Akademii Nauk.

Szober, Stanisław. (1969) Gramatyka Języka Polskiego. Warszawa: Państwowe Wydawnictwo Naukowe.

Tessier, Anne-Michelle. (2004) "Input "Clusters" and Contrast Preservation in OT". WCCFL 23.

Tranel, Bernard. (1996) "French liaison and elision revisited: A unified account within Optimality Theory." Claudia Parodi, Carlos Quicoli, Mario Saltarelli, and Maria Luisa Zubizarreta, eds. Aspects of Romance Linguistics. Washington, D.C.: Georgetown University Press, 433-55. [ROA-15.]

Tranel, Bernard. (1998) "Suppletion and OT: On the issue of the syntax/phonology interaction". E. Curtis et al., eds. Proceedings of WCCFL 16. Stanford, CA: CSLI, 415-29.

Trubetzkoy, N. Sergeevich. (1971) Principles of Phonology. Berkeley: U. of California Press. [1939]

Urbanczyk, Suzanne. (1998) Avoidance of the Marked. Ms., U. of British Columbia & U. of Victoria.

Urbanczyk, Suzanne. (1999) “A-templatic reduplication in Halq’eméylem”. WCCFL 17.

Wierzchowska, Bożena. (1971) Wymowa Polska. Warszawa: Państwowe Zakłady Wydawnictw Szkolnych.

Yip, Moira. (2004) Phonological Markedness and allomorph selection in Zahao. Language and Linguistics. 5.4: 969-1001.