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NON-TELEOLOGICAL APPROACHES TO METATHESIS: EVIDENCE FROM DIALECTS OF POLISH

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ABSTRACT

This paper discusses metathesis and other related processes attested in the North Mazovian dialects of Polish. Recently proposed functional approaches to sound change provide a framework for this analysis. It is argued that the transposition of segments with elongated phonetic cues is best analyzed as an instance of phonetically-based sound change. Copying a consonant across a rhotic finds a similar perceptual explanation involving the reinterpretation of the acoustic signal. In addition to perceptual metathesis, I consider cases that fall under coarticulatory metathesis and arise from varying degrees of gestural overlap. In comparison to previous approaches to metathesis, the role of syllable structure in driving metathesis is considerably diminished but not refuted. Structural optimization presumably operates in tandem with phonetic and perceptual factors. Language processing is called to attention in accounting for the long-distance transposition of similar segments. A connectionist approach that makes reference to activation and competition in a neural network of linguistic units is invoked to define this type of metathesis. On the whole, the Polish dialectal data support the hypothesis that sound change is fundamentally diachronic and non-optimizing.

KEYWORDS: Metathesis; Polish; phonetically-based sound change; language processing; teleology.

1. Introduction

In many analyses to date, metathesis had its roots in structural optimization. For instance, the fact that liquids were subject to transposition across an adjacent vowel in Late Common Slavic found an explanation invoking the optimization of syllable structure. It was argued that the shift from CVR to CRV (where R stands for a liquid) was driven by the dispreference for coda consonants (Bethin 1998). While this line of research provides an accurate account of metathesis, it does not sufficiently constrain the process. Specifically, if syllable structure is involved, it seems puzzling that metathesis is commonly limited to liquids and the transposition of a stop across an adjacent vowel

(VT → TV, where T stands for a stop) is unattested. Structural optimization is not compatible with another common type of metathesis: long-distance transposition of segments which share many phonological features.

In this paper, I attempt to apply the relatively recent functional approaches grounded in phonetics and language processing to metathesis in Polish. An overview of the North Mazovian dialects of Polish leads me to argue that metathesis is a heterogenic phenomenon that comprises processes that are phonetically-conditioned, on the one hand, and those that exhibit psycholinguistic grounding, on the other. Specifically, to handle the local transposition of liquids, this analysis employs the phonetically-based, listener-oriented model of sound change, as proposed by Ohala (1981), Blevins (2004) and Blevins and Garrett (2004). The other type of metathesis, the long-distance transposition of similar segments, is argued to fall from the difficulty of the processing of sounds that share many phonological features (Frisch 2004). It is also argued that, although teleological approaches that refer to syllable structure may play a role in facilitating metathesis, they do not explain the full range of the phenomenon. In particular, recourse to syllable structure is too robust in predicting which segments are likely to undergo transposition. More generally, the present analysis emphasizes the role of diachrony in shaping language change.

Section 2 provides the theoretical background by introducing the two functional models. In Sections 3.1–3.2, dialectal data from the North Mazovian dialects of Polish illustrate perceptual metathesis. We look at the transposition of a liquid across a vowel (Section 3.1), as well as the transposition of a consonant across a liquid (Section 3.2). Section 3.3 is concerned with coarticulatory effects and the varying degrees of gestural overlap which may give rise to excrescent segments or metathesis. Cases incompatible with the phonetic account are treated in Section 4. In particular, syllable structure is invoked in Section 4.1 and the language processing model is employed in Section 4.2, where the long-distance transposition of similar segments is exemplified and investigated. In addition, I outline an Optimality-Theoretic model that both formalizes the relations that obtain among similar segments and allows to predict which segments will be the most susceptible to metathesis. Section 5 summarizes the main conclusions.

2. Theoretical background

Previous approaches to metathesis have often invoked syllable structure. For instance, Bethin uses a constraint against codas to explain liquid metathesis in Late Common Slavic, the ancestor of contemporary Slavic languages (Bethin 1998: 38–39). The data below show reconstructed Proto-Slavic (PS) forms and their reflexes in contemporary Standard Polish (SP).[1]

[1] Data from most other contemporary Slavic languages can also serve to illustrate the point; see Bethin (1998: 46–84) for an overview.

(1)	PS	SP	Gloss
	*kaŕ̥u-ā	krowa	‘cow’
	*maŕ-zu	mróz	‘frost’
	*zâlt-a	złoto	‘gold’
	*párgu	próg	‘threshold’
	*melká	mleko	‘milk’

A considerable body of work rests on the assumption that metathesis in words like the ones in (1) was driven by the tendency to avoid codas. The formal account invokes the NoCoda constraint, which was highly ranked in Late Common Slavic. Syllable-based approaches commonly presuppose the optimizing character of metathesis.

The line of research advocated here argues for a functional explanation by claiming that phonetics and language processing offer more insight into the underpinnings of metathesis. Abstract units such as the syllable are assumed to be secondary as conditioning factors. Here, we look at two functional approaches to metathesis: the phonetically-based sound change (Ohala 1981; Steriade 1990; Blevins 2004; Blevins and Garrett 2004) and the difficulty of serial encoding (Frisch 2004).

The present analysis attempts to shed light on the origin and conditioning of language change by reference to dialectal data. Data drawn from regional dialects are valuable for the study of language change for two important reasons. First, dialects resist standardization and exhibit variation. Regional dialects, in contrast to more prestigious varieties, show relatively little pressure towards standardization. Consequently, stigmatized variants, which frequently show the effects of phonetically-natural processes, are eliminated more readily from standard varieties but may persist in dialectal pronunciations. Second, dialects are characterized by a high level of inter- and intra-speaker variation. Synchronic variation is a prerequisite for diachronic language change. Thus, dialectal data can help verify models based on functional premises. It should be mentioned that the data presented here are not necessarily the result of the application of synchronic forces in contemporary Polish dialects. Metathesis presumably applied at an earlier stage and the resulting forms were subsequently lexicalized and passed on to the next generations of speakers. Thus, the instances of metathesis discussed in this paper need not reflect the synchronic grammars of Polish dialects spoken today but may instead be the residue of diachronic processes. In the next section, we focus on the aspects of phonetically-based sound change relevant to the discussion of metathesis. The predictions of the model are subsequently applied to Polish dialectal data.

3. Phonetically-based sound change

Ohala (1981) and Blevins (2004) make strong claims about language change.

(2) All sound change
  (a) is diachronic;
  (b) results from errors in transmission of sound patterns across generations;
  (c) is non-teleological and any apparent phonetic optimization happens by chance.

In other words, sound change can be seen as a reinterpretation of the speech signal executed by speakers who recreate a grammar during the process of acquisition. Sound change is always introduced by the listener. The proponents of the categorical statements in (2) question a large body of research to date that has underlined the optimizing nature of language change, exemplified by the above-mentioned analysis of metathesis as coda avoidance. Among the researchers contesting the diachronic perspective in (2) are Kiparsky (2004) and Kenstowicz (2005), who provide evidence in favor of the synchronic underpinnings of language change. One of the goals of this paper is to determine whether synchrony plays any role in conditioning the sound change in the Polish data.

Blevins and Garrett (2004) present a typology of metathesis and argue that the phenomenon is phonetically-driven. Metathesis falls into four categories.

(3) Types of metathesis (Blevins and Garrett 2004)
  (a) perceptual
  (b) compensatory
  (c) coarticulatory
  (d) auditory

We focus on perceptual and coarticulatory metathesis as these types are attested in the North Mazovian dialects of Polish (NMD).

3.1. Perceptual metathesis

In perceptual metathesis a segment is transposed across another segment (or segments) because the listener is unable to establish the exact location of that segment relative to the positions of neighboring segments. What is important, this type of metathesis applies to segments or features with elongated phonetic cues, such as rhotics and laterals. More concretely, when the phonetic cues of a feature span over one or several preceding segments the listener might attribute that feature to a segment that was not its source in the speaker's representation. Perceptual metathesis is known to affect such features as rhoticity, laterality, laryngealization, rounding and palatalization.

Experimental research suggests that rhotics and laterals are good candidates for perceptual metathesis. Tunley (1999) shows that rhotics lower the frequencies of F2 and F3 of (high) vowels, laterals have the opposite effect. Furthermore, the articulation of /r/

is accompanied by tongue retraction that can crucially extend to neighboring syllables (West 1999). Heid and Hawkins (2000) present acoustic evidence suggesting that rhotics span domains up to three or even five syllables long. West's (1999) perceptual experiments show that listeners are aware of such resonance effects and can use them, for example, to identify an upcoming word.[2]

Thus, it is not surprising to find cases of perceptual metathesis affecting /r/ in NMD. SP counterparts serve to demonstrate the direction of the process. The data are drawn from Zduńska (1965: 116–118) and Friedrich (1955: 128).[3]

(4)		SP	NMD	Gloss
	(a)	duršlak	druɕlak	'colander'
		dɛrkatɕ	drɛkatɕ	'to make a sound like a corn crake'
		turkafka	trukafka	'turtle dove'
		pjɛrɕtɕɛŋ	prɨɕtɕɛŋ	'ring'[4]
	(b)	pɔvrus	prɔvus	'cord'

where SP = Standard Polish and NMD = North Mazovian Dialects

Both local (4a) and long-distance (4b) metathesis of /r/ is attested, although the latter type seems to be less common. In (5) the directionality of metathesis is schematized.

(5a) CVr → CrV
(5b) CVCrV → CrVCV

Two things become apparent in the process in (5). First, the process is anticipatory, rather than preservative. Thus, transposition from the prevocalic into the postvocalic position (CrV → CVr) is not attested. Second, the rhotic is moved to a more salient position. In (5a), the salience of /r/ is enhanced as it moves to the prevocalic position. In (5b), /r/ remains prevocalic, but it moves from an unstressed into a stressed syllable. This is in line with Blevins and Garrett (2004) who state that the phonetic cues are more readily perceived in more salient than in less salient positions because they are more robust there. Thus, metathesis is well-motivated as long as it enhances the prominence of the transposed segment. /r/-transposition in (4) motivates the following scale of promi-

[2] The above-mentioned experiments looked at English rhotics. It is reasonable to argue that applying the results from English experiments to Polish is unwarranted as the rhotics are different in the two languages. However, Ladefoged (1975) and Lindau (1978) observe that although rhotics constitute an articulatorily heterogeneous class, what unites them are their acoustic characteristics. Both an approximant rhotic (English) and a trill (Polish) show a lowered third formant that is manifested in the internal and transitional cues in an adjoining vowel. Following the sources, I assume that the unifying feature of rhotics are their elongated phonetic cues.

[3] Throughout this paper the non-IPA symbols /š ž tš dž/ stand for post-alveolars in Polish.

[4] An even more common form is [pšɨɕtɕɛŋ] with [r'] going to [š] (Friedrich 1955: 128).

nence: a stressed prevocalic position is more salient than a stressed preconsonantal position and both of these are more salient than an unstressed position. Despite recourse to salience, this account does not invoke teleology.[5]

An approach making reference to syllable structure along the lines of Bethin (1998) is available for the data in (4). As a strategy to avoid closed syllables, a consonant is moved from the coda into the onset. However, this analysis encounters serious problems. First, the syllable does not seem to drive the metathesis in (4b). Furthermore, reference to syllable structure does not explain why this type of metathesis is restricted to liquids. Why, say, the transposition of a stop across an adjacent vowel (CVT → CTV) is unattested. If NoCoda is the driver, the prediction is that it should indiscriminately apply to all coda consonants. Steriade (1990) adduces evidence from other languages that bears on the phonetic conditioning of the process. Liquids are known to transpose across a following vowel CRV → CVR (Winnebago, Early Latin, Sardinian) as well as take a non-peripheral position within a vowel, CVR → CVRV (Late Latin, Eastern Slavic). All these processes find a uniform account within the phonetically-based model. In contrast, the syllable approach fails to establish a link.

Teleology need not be completely dismissed. Syllable structure might have indeed played a role in the items in (4a), as well as in the Late Common Slavic data in (1). However, it did not so much initiate the process but rather became relevant at the stage of lexicalization of the sound change. At the stage of synchronic variation, both the CVR and CRV variants were attested. Later, however, the CRV variant prevailed, which was likely due to the preference for open syllables. Thus, in the lexicalization stage optimization probably worked in tandem with the pressure to enhance salience to produce CRV syllables. While structural factors are likely to facilitate phonetically-based sound change, it would be difficult to maintain that structure brings about sound change. In this event, all consonants would be expected to metathesize with adjacent vowels in a strategy to avoid closed syllables in NMD and Late Common Slavic.

3.2. Transposition across /r/

Metathesis in NMD is not limited to adjacent vowels and consonants. Also attested is the transposition of a consonant across another consonant (Zduńska 1965: 117–118).

(6)		SP	gloss	
	(a)	rdɛst	drdɛst ~ drɛst	‘buckwheat’
	(b)	rdza	drdza	‘rust’

[5] A reviewer points out that increased phonetic salience could be seen as a goal in itself. Blevins and Garrett (2004: 134) counter this argument: “if a segment (or feature) has extended cues of the sort responsible for perceptual metathesis, then if its linear origin is misperceived it is likelier to be misperceived as originating in a more perceptually salient (prominent) position”. Thus, in this approach increased salience is viewed as an emergent property of sound change, rather than its driver.

(c)	zardzɛvjawɨ	zadrdzɛvjawɨ	'rusty'
(d)	rdzɛɲ	drdzɛɲ	'core'[6]

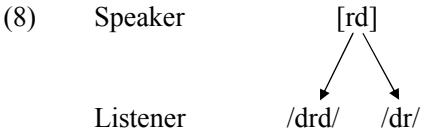
Just like in the data in (4), the metathesis in (6) involves /r/. However, unlike the data in (4), here an adjacent stop is transposed, the /r/ remains stable. The basic mechanism is sketched below.

(7) $rC_i \rightarrow C_irC_i \sim C_ir$

A voiced stop is copied across the preceding /r/. In a different realization, the prevocalic stop is dropped and only the emergent copy of the stop remains. This is illustrated in the NMD item in (6a), where synchronic variation reflects the preservation/loss of the prevocalic stop. In the remaining items in (6b–d), an affricate is involved. Interestingly, transposition is not complete, a homorganic stop is copied and the affricate remains in its position. Notice that strictly speaking only the $rC_i \rightarrow C_ir$ is traditionally classified as metathesis. The other variants exhibit copying of a consonant (or a part of it) across another consonant. The data in (6) comprise no more than three roots. That items exhibiting this type of metathesis are uncommon is due to the scarcity of the initial *rd-* and *rdz-* clusters. The items in (6) basically exhaust the list of such roots and, crucially, all of them variably undergo broadly-understood metathesis. This proposal attempts to provide a uniform perceptual grounding for the processes in (6).

Regarding (6a), the underlying factor seems to be the acoustic similarity of /r/ – voiced post-alveolar trill – and /d/ – voiced dental stop. They both are voiced and involve (a) closure(s) made close to the alveolar ridge. Probably the timing of the longer closure of /d/ with respect to the shorter closures of /r/ proves problematic to recover and leads to various misanalyses.

(8)



Interestingly, metathesis does not apply in the *rt-* cluster (**trt-*) – /r/ and /t/ are not sufficiently similar to be perceptually confusable (opposite voicing). Moreover, /d/ does not appear in words with prevocalic *r-* ([rak] *[drak] 'crayfish'), which shows that the process does not involve the phonetic strengthening of the initial closure of /r/ and that

[6] The dialectal form of 'core' may in fact directly reflect an older form /drzɛɲ/ ~ /držɛɲ/ (Brückner 1970). In any case, the development of this word in Polish supports the analysis involving perceptual metathesis: Proto Slavic *strьžę → stržɛɲ → zdržɛɲ → držɛɲ → drzɛɲ → rdzɛɲ (Brückner 1970). The final stage of 'core' together with the data in (6) show that perceptual metathesis is bidirectional. This is another argument against the syllable as the conditioning factor.

the insertion of /d/ does not serve to provide a low sonority onset (Gouskova 2004 observes that low-sonority onsets are preferred over high-sonority onsets). The fact that metathesis fails to apply in these contexts lends support to the proposal that the process in (6) is grounded in perceptual similarity. Finally, in (6b–d), the transposition does not involve the noisy release of the affricate. Instead, partial metathesis applies. Apparently, full metathesis would involve segments that are acoustically dissimilar: /r/ versus /dz/.

In contrast to the data in (4), where syllable structure optimization could in theory be invoked, the process in (6) unequivocally supports the claim that sound change is non-teleological. The least that can be said about the /rd-/ → [drd-] change is that it does not improve syllable structure. If anything, the addition of a consonant to an already marked onset makes it even more marked. A phonetically-based model which allows for a reinterpretation of ambiguities in the speech signal offers a plausible alternative to the previously proposed structural explanations. In the next section we turn to a type of metathesis that is common in consonant clusters.

3.3. Coarticulatory metathesis

Coarticulation in consonant clusters can be held accountable for various segmental changes (Browman and Goldstein 1990). Specifically, varying degrees of gestural overlap explain deletion, insertion and assimilation. Two cases resulting from gestural overlap in VC_1C_2V are discussed: metathesis and excrescent segments.

3.3.1. Metathesis

Coarticulatory metathesis occurs if in the sequence C_1C_2 the closure and/or release of the two consonants are/is nearly simultaneous. As a result, the phonetic cues of C_1 follow those of C_2 in perception and the linear order of the consonants may be reversed $C_1C_2 \rightarrow C_2C_1$. This type of metathesis is unidirectional and has two subtypes (Blevins and Garrett 2004).

(9a) It applies to labial-velar clusters and turns them into velar-labial clusters.
(9b) It applies to coronal-noncoronal clusters and turns them into noncoronal-coronal clusters.

Only these clusters are amenable to metathesis because only these clusters can be produced overlapped without compromising their recoverability (Chitoran et al. 2002). This type of metathesis is not particularly common in NMD, Zduńska identifies only one item (1965: 117), which indicates that the gestures of two adjacent obstruents are rarely fully overlapped in Polish.

(10)	SP	NMD	gloss
	bɨdgɔštš	bɨgdɔštš	Bydgoszcz (a town in Poland)

In line with the directionality predicted in Blevins and Garrett (2004), the process yields a noncoronal-coronal sequence. Smaller degrees of gestural overlap may result in phenomena that are not traditionally classified as metathesis.

3.3.2. Excrescent segments

Ohala (1974) and Browman and Goldstein (1990) argue that variation in gestural timing may yield an excrescent segment. For instance, in English /sæmsən/ 'Samson' is frequently realized as /sæmpsən/. An explanation along the lines of Ohala (1974) makes reference to gestural coordination. Normally, in the /ms/ sequence both gestures of /m/ – labial and velic – are more or less synchronous. However, when the lowering of the velum precedes the release of the labial closure, a short interval of labial closure will be produced, giving rise to excrescent /p/ (Ohala 1974; Browman and Goldstein 1990). Thus, variation in the relative timing of the velic closure and the oral closure leads to the emergence of an excrescent segment. This process is attested in clusters where consonants differ in laryngeal or manner features. The NMD data below match this characterization and predictably display excrescent segments (Zduńska 1965: 118).

(11)		SP	NMD	Gloss
	(a)	hɛnrɨk	hɛndrɨk	first name
	(b)	kɔnrat	kɔndrat	first name
	(c)	tšɛrɛmxa	tsɛrɛmpka	'bird cherry'[7]
	(d)	rusk'ɛ	rustk'ɛ	'Russians' (derogatory)
	(e)	barwɔga	bardwɔga	last name

Items (11a–c) result from the asynchronous execution of velic and oral gestures of the nasal and are parallel to the English case described above. In items (11d–e), the lingual gesture of C_1 is delayed yielding an excrescent coronal stop. Notice that an explanation that makes reference to gestural coordination is fundamentally different from structural accounts. The latter propose segment insertion whose motivation is far from clear. In fact, such an insertion renders the syllable structure more complex and is predicted not to occur. Conversely, the gestural model does not involve any insertion, the articulatory gestures are already present. What is modified is the relative timing of the gestures. The end result is an excrescent segment in perception. To be sure, the process is non-optimizing. In the next section, we turn to cases incompatible with phonetically-based sound change.

[7] Additionally, in this item the fricative /x/ undergoes occlusivization in NMD.

4. Cases of metathesis incompatible with phonetically-based sound change

For the instances discussed in this section, a phonetically-based account is not readily available because metathesis predominantly applies to segments that lack elongated phonetic cues, while the intervening segments are unaffected. The alternative view presented in this section makes use of syllable structure and language processing.

4.1. Syllable structure

The most likely driver for the NMD data below (these items show a high frequency in NMD; cf. Zduńska 1965: 117) seems to be syllable structure.

(12)		SP	NMD	Gloss
	(a)	mi̯ɕl	mi̯lɕ	'thought'
	(b)	katɛxism	katɛxmis	'catechism'

In the NMD items in (12), metathesis seems to be a repair strategy for sonority violations (Polish does not allow syllabic sonorants.). In both SP items in (12) the word-final sonorants appear after an obstruent and thus show a sonority rise in the coda. The transposition of the sonorants in NMD optimizes the syllable structure by placing the sonorants closer to the nucleus.

The item in (12a) is compatible with perceptual metathesis along the lines of Blevins and Garret (2004), as the lateral has elongated phonetic cues. We contend that the phonetically-based and the syllabic accounts converge to produce the structure in (12a). The case in (12b), however, is not equally straightforward for the phonetic account. The transposition of the nasal /m/ in /katexism/ → [katexmis] occurs across an oral obstruent. According to Blevins and Garrett (2004: 140), "[g]iven the articulatory requirements of nasal and oral stops, there is no way for nasality or orality to migrate across a neighboring segment without directly affecting it; in such clusters assimilation is natural, but not metathesis". With this reasoning extended to fricative-nasal sequences, the change in (12b) is problematic to justify. Unless a different analysis involving misperception is proposed, syllable structure seems to offer the most satisfactory solution.

4.2. Language processing

Even more problematic to defend are instances of the transposition of segments with short phonetic cues (underlined; Zduńska 1965: 116–117).

(13)		SP	NMD	Gloss
	(a)	wɔdɨgi	wɔgidɨ	'stem'
	(b)	izdɛpka	izbɛtka	'room' (dim.)
	(c)	prɔtsɛsja	prɔsɛtsja	'procession'
	(d)	pɛrmanɛntnɨ	pɛrnamɛntnɨ	'permanent'
	(e)	pɔrtsɛlana	pɔrtsɨnɛla	'china'
	(f)	kɔwɔvrɔtɛk	kɔrɔvɔtɛk	'spinning wheel'
	(g)	kɔwdra	kɔrdwa	'comforter'
	(h)	rɛgulatɔr	lɛguratɔr	'regulator'

In (13), metathesis applied to oral stops (a–b), sibilants (c), nasal stops (d), sonorants (e–g)[8] and liquids (h). The items are grouped together because they have several features in common. First, they all show long-distance metathesis. Second, the metathesized sounds are perceptually similar.[9] Finally, the process involves two sounds switching places.

Let us determine whether phonetics is the motivating factor for the data in (13). Coarticulatory accounts are inapplicable in long-distance metathesis, as the relevant gestures are not overlapped. Perceptual metathesis is equally unhelpful for (13a–d), as the segments have short phonetic cues and are predicted not to metathesize. In the items in (13e–g), only the rhotic and the lateral are predicted to metathesize, the other sounds, a nasal and a glide, have short cues. The data are incompatible with perceptual metathesis. Only the item in (13h) can in principle be subsumed under perceptual metathesis. However, the perceptual account is not advocated here. As mentioned in Section 3.1, the phonetic cues of /r/ and /l/ show compatible but opposite effects on F3, with /r/ lowering and /l/ raising it. This implies that in a word like [rɛgulatɔr] with both /r/ and /l/ the domains affected by the two sounds never overlap, thus excluding the possibility of one sound migrating into the domain of the other.

Given the inapplicability of phonetically- and syllable-based solutions to the data in (13), I look for a psycholinguistic explanation. The approach advocated here refers to language processing and involves the difficulty of the serial encoding of similar segments.

In visual perception, stimulus detection has been shown to be impaired when the same stimulus is repeated in a brief period of time (repetition blindness; Eriksen and Schutze 1978). Errors of a similar nature have also been reported in repetition of auditory stimuli (Miller and MacKay 1994). Similar sounds are predicted to be difficult to encode in a serial sequence in perception and production (Frisch 2004). The cross-linguistic ubiquity of tongue twisters and speech errors serves to illustrate this point.

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[8] The item in (13g) went through an intermediate stage where both sonorants were transposed (cf. [kɔrɔvwutɛk] Zduńska 1965: 116). In the new environment, /w/ was probably dropped as its labiality was reinterpreted as coarticulatory and ascribed to the flanking /v/ and /ɔ/.

[9] The fact that /w/ historically derives from velarized /ɫ/ makes it plausible to argue that the metathesis occurred when the relevant sounds in (13f–g) were liquids. Later these forms underwent lexicalization.

(14a) She sells sea shells on the sea shore.
(14b) brake fluid → blake fruid

It has been observed that sounds which are problematic for serial encoding share many distinctive features; in (14a) these are coronal sibilants and in (14b) liquids. As evidenced in (14), speech errors occurring in sequences of similar sounds normally result in long-distance transposition. A similar mechanism seems to be involved in the data in (13).

A functional explanation for metathesis and speech errors is rooted in language production and the phonological planning of speech. Psycholinguistic evidence shows that "speakers form connections between similar segments and that similar but different segments pose problems in speech production" (Rose and Walker 2004). Connectionist models that use activation and competition in a neural network of linguistic units have been proposed to handle phenomena that involve similar but not identical segments (Dell 1986). Each segment consists of nodes that are activated when the segment is produced. When two near-identical segments are planned for production, the activation pattern is not identical but there is a great amount of overlap in the activated nodes. Near-identical segments are difficult to produce because, in order to keep them distinct, careful coordination of their few separate properties is necessary. Put in other words, numerous excitations of a single node over a short period of time are predicted to result in errors in serial encoding.

Rose and Walker (2004) provide a formal analysis, couched within Optimality Theory (Prince and Smolensky 2004), which can be adapted to the data in (13). Although Rose and Walker focus on consonant harmony systems, similar relations likely hold in consonant dissimilation, speech errors and metathesis. The crux of their proposal is the family of constraints which establish correspondence relations between similar segments.

(15) Corr-C↔C: Let S be an output string of segments and let C_i, C_j be segments that share a specified set of features F. If C_i, $C_j \in S$, then C_i is in a relation with C_j; that is C_i and C_j are correspondents of one another.

In accordance with the formulation in (15), segments that stand in correspondence must share a specified set of features. For instance, if the two segments that are designated as correspondents are stops they must share the features [−sonorant, −continuant]. In the same vein, the shared features for nasals are [+consonantal, +sonorant, +nasal]. The individual Corr constraints are universally ranked with respect to one another, in that the constraints that describe the relations between more similar segments are ranked higher than those that target segments that show less similarity. Concretely, a constraint that encompasses sonorants [+consonantal, +sonorant] is ranked lower than a constraint that

targets nasals [+consonantal, +sonorant, +nasal].[10] In this way, more similar segments enter stronger correspondence relations than less similar segments. Another important aspect of the Corr constraints is that they are insensitive to segments that intervene between correspondents. The intervening segments are invisible to the Corr constraints.

It is proposed that segments that are correspondents via a high-ranked Corr constraint are subject to variable pressures, which may result in metathesis. In this way, the observation that only the most similar segments are difficult to encode serially receives a formal explanation.[11] To be sure, this extension of Rose and Walker's analysis to metathesis is tentative and needs refinement. Consonant harmony and metathesis differ in one important point. While the output of consonant harmony can be predicted and formalized, long-distance metathesis is non-deterministic in the sense that it may or may not apply in a given word. What is important for the present purposes is the common source of consonant harmony, speech errors and long-distance metathesis exemplified in (13). These processes are driven by similarity and intervening segments are often unaffected.

5. Conclusion

Phonetically-based sound change provides an accurate model for many processes subsumed under metathesis in dialectal Polish. In line with the predictions that processes involving a perceptual reinterpretation should apply to segments with elongated phonetic cues, we have found cases comprising the transposition of /r/ across an adjacent vowel. Phonetic motivation was also established for an interesting case involving copying of a consonant across /r/. It has been argued that coarticualtion and varying degrees of gestural overlap are responsible for several documented instances of excrescent segments and metathesis. A type of long-distance metathesis that affects similar segments calls for a psycholinguistic account incorporating the difficulty of the processing of similar sounds. The formal mechanism, which draws on Rose and Walker's (2004) agreement by correspondence, still needs refinement. In several cases, syllable structure (sonority) seems to play a role in predicting the locus of metathesis.

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[10] To account for consonant harmony, Walker proposes a set of Ident constraints that directly refer to segments designated by the Corr constraints. These constraints enforce consonant identity and are irrelevant for the present purposes.

[11] Because of the assumption of strict domination of constraints, variation is not easily modeled within classical Optimality Theory (Prince and Smolensky 2004). Stochastic Optimality Theory (Boersma 1998) is an extension that proposes continuous ranking of constraints. Concretely, for two constraints that are sufficiently "close" to each other on this continuous ranking scale stochastic candidate evaluation may result in an effective constraint reversal yielding a different output. Thus, variation is analysed as an instance of constraint reversal. A formal account of the metathesis in (13) couched within Stochastic Optimality Theory is beyond the scope of this paper.

An analysis that exclusively employs syllable structure in motivating metathesis runs into problems. For instance, recourse to the syllable predicts the existence of local metathesis of obstruents, when the process seems to be restricted to liquids (sonorants). Syllabic approaches seem incompatible with other cases of metathesis as well. Concretely, the word-initial copying of a stop across a rhotic does nothing to optimize structure. While the discussed data do not warrant a categorical statement about teleology, it seems plausible to argue that structural optimization is not necessarily an outcome of every instance of sound change. On a similar note, the role of synchronic pressures may not be as important in shaping language change as hitherto assumed. Finally, this paper has also shown that metathesis is a cover-term for diverse language processes conditioned by phonetics, phonology and psycholinguistics. Future attempts to explain metathesis should be capable of making these distinctions. Although this analysis seems to point in the right direction, more research is necessary to substantiate the main claims.

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