OT ACCOUNT OF REGRESSIVE VOICING ASSIMILATION IN MODERN HEBREW AND RUSSIAN

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The topic of this paper is voicing assimilation (VA) in Modern Hebrew and Russian. In obstruent clusters, both in Modern Hebrew and Russian, the voiced labio-dental fricative [v] does not cause regressive VA, yet undergoes it itself. I propose an optimality-theoretical account of RVA in Russian and Hebrew that views RVA as a result of faithfulness and markedness constraints interaction. To account for the idiosyncratic behavior of the labio-dental [v], I adopt Padgett's (2002) view that [v] has a status intermediate between sonorants and obstruents. The evidence for this claim comes from the aerodynamic properties of [v], which is described as a narrow approximant, meaning that it is weakly fricated when voiced and strongly fricated when voiceless. This approach allows to group [v] both with obstruents and sonorants and treat it accordingly in the OT analysis.

INTRODUCTION

The topic of this paper is regressive voicing assimilation in Modern Hebrew and Russian. Voicing assimilation is a wide spread phonological phenomenon that has been the focus of much research (Barkaï & Horvath, 1978; Kiparsky, 1985; Lombardi, 1999; Padgett, 2002). It occurs in a significant number of world languages belonging to different language families (English, Hungarian, Russian, Yiddish, etc.). Voicing assimilation can occur across morpheme and word boundaries and works in both directions: right to left and left to right, hence we distinguish between regressive and progressive voicing assimilation. Assimilation in adjacent obstruents in Yiddish provides an example of regressive voicing assimilation: *bak* 'cheek' – *bagbejn* 'cheekbone' (Lombardi, 1999). Voicing assimilation of the nominal inflections in English is another example of progressive voicing assimilation: *ca[**ts**]* vs. *do[**gz**]*, where the plural suffix assimilates the voicing of the final segment of the stem.

Regressive voicing assimilation is obligatory in fast speech both in Modern Hebrew and Modern Russian. It takes place in a consonant cluster when an obstruent or obstruents assimilate the voice value of the following (rightmost) obstruent in a cluster. Interestingly, it is not always the unmarked value (in this case, unvoiced) that spreads. The following examples illustrate this alternation (the obstruents participating in this alternation are boldfaced):

(1) *Hebrew:*

da**f**ak	*knocked*	ji**t**fok	*will knock*
za**k**an	*beard*	**sk**arim	*beards*
da**k**ar	*stabbed*	ji**tk**or	*will stab*
sa**g**ar	*closed*	ji**zg**or	*will close*
pa**z**al	*squinted*	**bz**ila	*squinting*

(Berman, 1978; Bolozky, 1997)

Russian:*

pros'it'	*to ask*	proz'**b**a	*request*
vo**d**a	*water*	vo**tk**a	*vodka*
pra**v**it'	*to correct, edit*	pra**fk**a	*correction, proofreading*
lo**d**o**k**	*boats* (GEN. PL.)	lo**tk**a	*boat* (NOM. SG.)
goro**d**o**k**	*small town*	goro**tsk**oy	*town, city* (ADJ.)

The rule for regressive voicing assimilation can be represented as follows:

(2) C [-son]→ [α voice] /____ C[-son ; α voice].

The rule reads: an obstruent assimilates the voicing quality of the following obstruent in a cluster. To illustrate, the noun forms *lo**d**ok* vs. *lo**t**ka* exhibit the d~t alternation: [d] [-son; +voice] → [t] [-voice] / ___[k] [-son; -voice], hence, [lo**t**ka].

However, in obstruent clusters with the voiced labio-dental fricative [v] as a rightmost member of the cluster [v] does not cause regressive voicing assimilation:

(3) *Hebrew:*

	kvar *already*	***gv**ar	
	ti**kv**a *hope*	*ti**gv**a	(Berman, 1978)
Russian:			
	sverx *above*	***zv**erh	
	o**tv**esti *drive away*	*o**dv**esti	

Yet [v] itself as a leftmost member of a cluster undergoes regressive voicing assimilation, as in:

(4) *Hebrew:*

ʃevet	*tribe*	ʃiftu	*tribal*	
ʔahava	*love*	ʔahafti	*I loved*	(Barkaï and Horvath, 1978)

Russian:

koro**v**o**k**	*cow* (GEN.PL. DIM.)	koro**fk**a	*cow* (DIM.)
la**v**o**k**	*bench* (GEN.PL.)	la**fk**a	*bench* (NOM.SG.)

As examples in (3) demonstrate, the voiced labio-dental fricative [v] does not comply with the proposed rule of voicing assimilation by failing to cause regressive voicing assimilation. One of the solutions to this problem is to modify the proposed voicing assimilation rule by adding the exception clause: "the following obstruent in a cluster except [v]." The rule in (2) should, therefore, read: an obstruent assimilates the voicing quality of the following obstruent in a cluster except [v]. But such formulation would result in missing generalizations, for one of the characteristics of a viable phonological rule is its all-inclusiveness; that is, its ability to account for the alternation without having to rely on exceptions to the rule. In other words, the proposed rule for regressive voicing assimilation should be able to apply to *all* obstruents participating in the alternation; however, it does not happen.

Kiparsky (1985) suggests treating Russian [v] as an underlying sonorant /w/, that does not create the environment necessary for regressive voicing assimilation to take place. It is assumed that not only obstruents but also all sonorants undergo assimilation and final devoicing and, therefore, [w] undergoes it as well. Another rule strengthens [w] to [v], and if devoiced, to [f]. In order to account for the fact that sonorants usually do not surface devoiced, a late revoicing rule [+son] → [+voice] applies that 'revoices' the sonorants. Since the w-strengthening rule applies before the revoicing rule, [v] and [f] are not affected. As Padgett (2002) observes, this type of derivation accounts for the fact that [v] fails to trigger assimilation while undergoing it. Yet, as Barkaï & Horvath (1978) point out, this type of analysis lacks parallelism between [v] and other sonorants. In such an analysis it is necessary to specify that only [w] undergoes assimilation. Another piece of important evidence against positing an underlying /w/ comes from language typology. Russian is not the only language where [v] undergoes but fails to trigger assimilation. The labio-dental fricative [v] exhibits a similar pattern in Hebrew and Hungarian. More importantly, some [v]s in Hebrew, as argued by Barkaï and Horvath (1978), cannot be derived from an underlying /w/ but rather an underlying /b/ which undergoes a spirantization rule. This claim is supported with the following examples from Hebrew:

(5) liʒbot *to go on strike*

ʃavtu [ʃaftu] *they struck*

Another solution to the problem posited by the idiosyncratic behavior of [v] is proposed by Barkaï and Horvath (1978, p. 83). They suggest re-analyzing the sonority value for [v] and locating [v] on a sonority scale between sonorants and obstruents:

(6) stops < fricatives< v < nasals < j < r < l

1 2 3 4 5 6 7

They also propose a voicing assimilation rule shown in (6) which demonstrates that only obstruents can be triggers, whereas [v] can be a target.

(7) [*m*sonorant]→ [αvoice] / ____[*n*sonorant, αvoice], where m≤ 3, and n ≤ 2.

That is, segments less than and including 3 on the hierarchy scale are predicted to undergo voicing assimilation before segments that are less or equal 2.

Overall, this rule allows to account for the particular behavior of [v]. It demonstrates that [v] participates in the alternation as only a target but does not have a status on the ranking scale high enough to create the environment necessary to trigger assimilation of its [voice] value. However, as Padgett (2002) argues, the rule based on this scale does not capture the behavior of [v] in an explanatory way. The rule misses the explanation why [v] undergoes assimilation but does not trigger it. Instead, he suggests the view that Russian [v] has a status intermediate between sonorants and obstruents. The evidence for this claim comes from the aerodynamic properties of [v], which is described as a narrow approximant, meaning that it is weakly fricated when voiced and strongly fricated when voiceless. Padgett suggests calling this kind of a sound a *narrow approximant*. He further claims that vowels, glides, and some liquids are [+wide], while obstruents and narrow approximants are [-wide]. He also proposes that Russian [v] is [+son], which explains why it patterns with sonorants. The specifications [-wide] and [+son] account for the fact [v] behaves as a sonorant by failing to cause voicing assimilation, and as an obstruent by undergoing assimilation.

VOICING ASSIMILATION IN MODERN HEBREW AND RUSSIAN

I propose an optimality-theoretical account of regressive voicing assimilation in Russian and Hebrew that views this phenomenon as a result of faithfulness and markedness constraint interaction. To account for the idiosyncratic behavior of the labio-dental [v], I adopt Padgett's (2002) view of the properties of Russian [v] and extend it to Hebrew. Ascribing the [-wide; +son] specifications to [v] allows to group [v] both with obstruents and sonorants and treat it accordingly in the optimality theoretical analysis.

The first principle to be considered is Richness of the Base, which states: no constraints hold at the level of underlying forms (Prince and Smolensky, 1993). In other words, underlying representations can contain any kind of phonological contrast. Whether this contrast is preserved in the output forms or not, depends upon the interaction between the faithfulness and markedness constraints. Richness of the Base implies that voiced and voiceless obstruents contrast in their underlying representations; yet this contrast can be neutralized in the output forms due to the higher ranking of markedness constraints with respect to faithfulness constraints. The first faithfulness constraint proposed is IDENT-IO (ObsVce), which belongs to the family of faithfulness constraints originally proposed by McCarthy and Prince (1995).

IDENT-IO (ObsVce) – correspondent obstruents are identical in their specification for voice (Kager, 1999).

Cross-linguistically voiced obstruents are marked compared to voiceless obstruents. Another relevant constraint that accounts for the fact that

voiced obstruents are disfavored in comparison to their voiceless counterparts is VOP (voiced obstruent prohibition):

VOP – no obstruents must be voiced (Itô & Mester, 1998, cited in Kager, 1999).

This constraint is violated both in Modern Hebrew and Russian, for in both languages underlying voiced obstruents surface in certain positions. Although this constraint is notcrucial to the present analysis of voicing assimilation, is should be nevertheless included in the constraint ranking hierarchy, since it is responsible for word final devoicing in Russian (as demonstrated in (8)) and a number of other languages.

(8) *Russian:*

sle**d**a	*track* (GEN.SG.)	sle**t**	*track*	(NOM.SG.)
gu**b**a	*lip* (NOM.SG.)	gu**p**	*lip*	(GEN.PL.)

To explain the ban on the occurrence of adjacent obstruents differing in the value [voice], the constraint AGREE is used:

AGREE - obstruent clusters should agree in voicing (Lombardi, 1999).

AGREE dominates the proposed constraint IDENT-IO (ObsVce), since the latter is violated in Modern Hebrew and Russian and, therefore, is the lowest ranking constraint in hierarchy. The constraint AGREE, however, does not refer to or implies the directionality of voicing assimilation. Leftward direction of voicing assimilation is the result of the interaction of positional faithfulness and markedness constraints. Due to positional faithfulness constraint, underlying contrast in specific psychologically and perceptually prominent positions is maintained (Beckman, 1997). By prominent position Beckman means initial syllables, stressed syllables, syllable onsets, and root syllables. Positional faithfulness constraints preserve underlying contrast in prominent positions and militate against such a contrast in other positions. Following Beckman (1997), Lombardi (1999) proposes an **IDentOnset** (Laryngeal) (IDOnsLar) constraint which militates against the change of underlying [voice] specifications in the onset position. AGREE can be satisfied if onsets stay the same and codas assimilate to them. The direction of voicing assimilation is thus dependent on the ranking of AGREE and IDOnsLar constraints with respect to each other. The dominance of IDOnsLar over AGREE will result in regressive voicing assimilation; while progressive assimilation is still possible, as argued by Lombardi (1995, 1999), but only if higher ranked constraints override the effects of IDOnsLar. The ranking hierarchy for regressive voicing assimilation is then:

IDOnsLar >>AGREE >> VOP, IDENT-IO (ObsVce)**

The interaction of these constraints is illustrated for Hebrew in tableau I.

Tableau I

/pzila/ *squinted*	IDOnsLar	AGREE	VOP	IDENT –IO (ObsVce)
a. pzila		*!	*	
b. psila	*!			*
☞c. bzila			**	*

The faithful candidate in (a) looses due to the violation of the high ranked constraint AGREE, since the obstruent cluster does not agree in voicing. Candidates (b) and (c) each incurs one violation of IDENT-IO(ObsVce). Although candidate (b) with progressive assimilation in the cluster satisfies AGREE, it does it at the expense of violating the dominating IDOnsLar and looses to the optimal candidate (c) *bzila*.

The same constraint ranking is illustrated for the Russian data in tableau II.

Tableau II

/pros'ba/ *request*	IDOnsLar	AGREE	VOP	IDENT –IO (ObsVce)
a.pros'ba		*!	*	
b. pros'pa	*!			*
☞c. proz'ba			**	*

In tableau II loosing candidates (a) and (b) each violates constraints AGREE and IDOnsLar respectively and loose to optimal candidate (c) *proz'ba*. Candidate (c) satisfies both high ranking constraints IDOnsLar and AGREE by being unfaithful to lower ranked VOP and IDENT-IO (ObsVce). However, these constraints are not enough to rule out other possible candidates, such as **zila* or **pizila* for Hebrew and **proba* and **prosiba* for Russian. The constraints MAX-IO and DEP-IO, belonging to the family of faithfulness constraints, are included to rule out these candidates:

MAX-IO – input segments must have output correspondents
DEP-IO – output segments must have input correspondents (Prince and Smolensky, 1993).

The following tableau illustrates the interaction of the proposed faithfulness constraints.

Tableau III

/pzila/ *squinting*	MAX IO	DEP IO	IDENT IO (ObsVce)
a. zila	*!		
b. pizila		*!	
☞c. bzila			*
/pros'ba/ *request*			
d. proba	*!		
e. prosiba		*!	
☞f. proz'ba			*

MAX-IO and DEP-IO dominate the low ranking constraint IDENT-IO (ObsVce). But MAX-IO and DEP-IO are not crucially ranked with respect to each other or with respect to AGREE (ObsVce), since all of these three constraints are responsible for ruling out less optimal candidates, leaving *bzila* and *proz'ba* as winning candidates. The ranking hierarchy is, therefore, as follows:

IDOnsLar >>AGREE, MAX-IO, DEP-IO >> IDENT-IO(ObsVce).

The crucial ranking of IDOnsLar, AGREE and IDENT-IO (ObsVce) is tested with respect to Russian [v] in tableaux IV and V. The input forms in tableaux IV and V are assumed as *lavka* and *otvesti*. Underlying voicing of segments is posited for the input segments based on Padgett's (2002) assumption that the underlying voicing of consonants is apparent from their voicing before sonorants. Therefore, in tableau IV [v] is hypothesized as an underlying input segment, given the form lavok (PL. GEN.), and in tableau V [v] in *otvesti* is posited as an input segment, given that it is already in a pre-sonorant position.

Tableau IV

/lavka/ *bench*	IDOnsLar	AGREE	VOP	IDENT-IO (ObsVce)
a. lavka		*!	*	
☞b. lafka				*
c. lavga	*!		**	*

In tableau IV candidate (a) violates the AGREE constraint and looses to (b). Candidate (c) violates high ranking IDOnsLar and is ruled out. Candidate (b) *lafka* satisfies the high ranking constraints at the expense of violating the low ranking constraints VOP and IDENT-IO (ObsVce) and wins.

Tableau V

/otvesti/ *drive away*	IDOnsLar	AGREE	VOP	IDENT-IO (ObsVce)
a. otvesti		*!	*	
b. otfesti	*!			*
☜c.odvesti			**	*

The current ranking hierarchy IDOnsLar >>AGREE >> IDENT-IO(ObsVce) wrongly predicts **odvesti* in I as an optimal candidate, since it satisfies both IDOnsLar and AGREE. Candidate (b) is ruled out by IDOnsLar. The actual surface form (a) *otvesti*, although satisfying IDOnsLar, is shown to violate the AGREE constraint, since the
*–tv-*cluster does not agree in voicing.

Similarly, the syllable- based interpretation fails to account for lack of voicing assimilation in Hebrew as well, as shown in tableau VI. The actual optimal candidate *tikva* is predicted to be ruled out, since it does not satisfy AGREE, and candidate I that does not surface in Modern Hebrew is chosen as a winning candidate based on the current ranking hierarchy.

Tableau VI

/tikva/ *hope*	IDOnsLar	AGREE	VOP	IDENT-IO (ObsVce)
a. tikva		*!	*	
b.tikfa	*!			*
☜c.tigva			**	*

As it is apparent from the tableaux, the current IDOnsLar based on the syllable position, fails to correctly rule out the less optimal candidate, and, therefore, should be revised and modified. It has been argued that rather than drawing upon the prosodic positions, specific references should be made to more phonetic detail in order to capture the true patterns of voicing

assimilation (Steriade, 1997, cited in Padgett, 2002). Padgett (2002) points out that in Russian it is not the onset position that is perceptually privileged but rather the position before sonorants, and crucially, neutralization of the voicing contrast takes place in the position before an obstruent. He thus proposes IDENT-IOPS (Vce) constraint that captures this distinction.

IDENT-IOPS (Vce) – correspondent pre-sonorant obstruents are identical in their specification for voice (Padgett, 2002).

In order to resolve the conflict of candidates in tableaux V and VI, I incorporate the proposed faithfulness constraint IDENT-IOPS (Vce) that militates against changing the input voice specification in obstruents in the pre-sonorant positions.

It is necessary to remember that [+son] specification refers to both vowels and sonorant consonants. Therefore, given the assumption that [v] is [+sonorant], any segment positioned before it, must preserve its underlying [voice] value. The revised ranking hierarchy is:

IDENT-IO PS (Vce) >>AGREE, MAX-IO, DEP-IO >> IDENT-IO (ObsVce), which is demonstrated in tableau VI. The candidates violating MAX-IO and DEP-IO constraints are not included.

Tableau VII

/otvesti/ *drive away*	IDENT-IO PS (Vce)	AGREE	VOP	IDENT-IO (ObsVce)
☞a. otvesti		*	*	
b. otfesti	*!			*
c. odvesti	*!		**	*

The high ranking faithfulness constraint IDENT-IO PS (Vce) correctly rules out candidates (b) and (c). In (b) underlying [v] changes its voicing in the position before the vowel, and in (c) the input segment [t] changes its voicing before [v] thus violating IDENT-IO PS (Vce). Candidate (a) *otvesti*, although violating the lower ranked AGREE, wins by satisfying the highest ranked constraint IDENT-IO PS (Vce).

The same ranking of IDENT-IO PS (Vce), AGREE and IDENT-IO (ObsVce) is tested for the Hebrew data in tableau VII, where faithful candidate (a) *kvar* wins by keeping its underlying voicing in the pre-sonorant position.

Tableau VIII

/kvar/ *already*	Ident-IO PS (Vce)	AGREE	VOP	IDENT IO (ObsVce)
☞a. kvar		*	*	
b. kfar	*!			*
c. gvar	*!		**	*

The final ranking for regressive voicing assimilation is:
IDENT-IO PS (Vce) >> AGREE, MAX IO, DEP IO >> VOP, IDENT IO (ObsVce).

To summarize, in order to account for regressive voicing assimilation in Modern Hebrew and Russian, a set of markedness and faithfulness constraints is proposed. The constraint AGREE responsible for the uniformity in voicing specifications in obstruent clusters, is implemented. To account for the directionality of voicing assimilation, I also employ the constraint Ident-IO PS (Vce) which assumes the pre-sonorant position as the most privileged and perceptually prominent position in which the contrast is preserved. I have also adopted Padgett's (2002) view of [v] as having a status intermediate between sonorants and obstruents and applied it to the 'problematic' data from Modern Hebrew.

CONCLUSION

In the present paper an attempt has been made to analyze regressive voicing assimilation in Modern Hebrew and Russian within the optimality theoretical framework. Obstruent regressive voicing assimilation in these and a number of other languages appears to draw the investigators' attention due to the fact that not all obstruents participating in the alternation behave according to their specifications; namely, the labio-dental fricative [v] does not cause regressive voicing assimilation, as expected, while undergoing it. The analysis of regressive voicing assimilation should, therefore, address this issue and embrace both differences and similarities in behavior of segments participating in the alternation. It has been demonstrated that in order to account for the pattern of voicing assimilation exhibited by [v] within the rule-based framework one has to modify the rule for obstruent voicing assimilation by saying that it applies to all obstruents except the voiced labio-dental fricative [v]. The shortcoming of such a rule lies in the fact that it is not capable of providing the explanation *why* such a behavior should be the case. Another solution to this problem is to resort to abstract accounts assuming an underlying /w/. However, as Padgett (2002) points out, since /w/ never surfaces in Russian, there are no related surface forms that can prove the

existence of the underlying /w/ in Russian. Overall, none of the reviewed rule-based analyses has been extremely successful in accounting for the discrepancies in the behavior of [v]. And none of these approaches has been able to offer a redundancy-free derivational account that could explain the pattern exhibited by [v] that could be extended to similar cases in other languages.

The proposed optimality-theoretical analysis of regressive voicing assimilation allows accounting for the alternation in terms of universal constraints rather than language-specific rules. More importantly, re-ranking of the proposed constraint hierarchy is capable of explaining language specific alternations, which can be viewed as a result of conflicts between faithfulness and markedness constraints. These conflicts are resolved in different manners in languages due to different constraint ranking. The proposed ranking is also capable of accounting not only for the directionality of voicing assimilation, but also different patterns of voicing assimilation, i.e., syllable-final neutralization in German; voicing assimilation in obstruent clusters with word-final neutralization in Russian, Polish, and Dutch; voicing assimilation in obstruents clusters with word-final contrast in Yiddish, Romanian, and Serbo-Croatian (Lombardi, 1999).

Padgett's (2002) suggestion to treat Russian [v] as a narrow approximant explains the behavior of [v]. It allows to account for the fact why [v] behaves as a sonorant under certain circumstances and as an obstruent under others, yet neither a sonorant nor an obstruent per se. This approach avoids collapsing [v] and sonorants in the same category, as some approaches are guilty of, thus falsely predicting that [v] and sonorants will pattern alike with respect to voicing assimilation. As a consequence, this approach explains why [v] undergoes assimilation but fails to trigger it. The same patterns of voicing assimilation hold in a number of languages and, thus, the important upshot of Padgett's analysis is that it can be extended to other languages, as it has been done in this paper.

NOTES

* All the data come from the author, who is the native speaker of the language.

** I keep the original names of constraints as formulated by the authors. Thus the feature specified for IDOns is Laryngeal, as worded by Lombardi (1999), but IDENT-IO (Voice) as formulated in Kager (1999).

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