Inflectional paradigms have bases too: Arguments from Yiddish*

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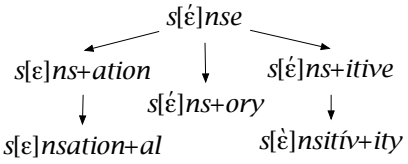
1 Introduction

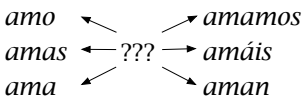
It is well known that the phonological form of a word can depend on its morphological structure. In serial approaches, this follows naturally from the fact that words have derivational histories: morphologically complex words undergo successive levels of phonology as they are constructed, making them eligible for different phonological processes along the way. A crucial distinction is typically made, however, between derivational and inflectional morphology. Whereas derived forms usually have clear "bases of affixation", inflected forms are usually not obviously constructed from one another. For this reason, they are generally not held to have the same formal influence on one another.

(1) Traditional inflectional/derivation distinction

a. Derivational



b. Inflectional



In a fully parallel model such as standard OT (Prince and Smolensky 2002), morphological structure influences phonology not by stages of derivation, but by constraints on relations between forms—for example, via output-output (OO) constraints demanding identity to morphologically related forms (Burzio 1996; Benua 1997; Steriade 2000; Kenstowicz 2002). OO constraints are widely used in the literature, but there is no agreement as to evaluate them. Within derivational paradigms, it is clear that derived forms should be constrained to match their bases (Benua 1997). In inflectional paradigms, however, there have been conflicting approaches. Some have argued that inflectional paradigms may also have privileged bases which the remaining forms must be faithful to (2a) (e.g., Benua 1997; Kenstowicz 1997), while others have assumed the more egalitarian structure in (2b).

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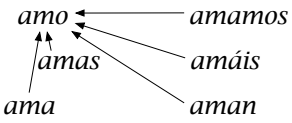
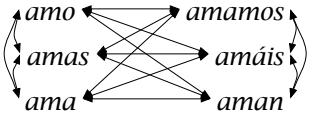
(2) Two approaches to OO correspondence in inflectional paradigms

a. Base Identity



b. Uniform Exponence



McCarthy's recent "Optimal Paradigms" (OP) proposal aims to resolve the issue by codifying the traditional distinction between inflection and derivation: derivational paradigms, which have intuitive bases of affixation, have a hierarchical structure as is traditionally assumed (2a), while inflectional paradigms have the democratic structure in (2b) (McCarthy, to appear, p. 5). McCarthy formulates OO constraints for inflectional paradigms (called OP constraints) such that every member of the paradigm must match every other member. No member of the paradigm is designated as a privileged base form (ibid.).

The OP hypothesis has several apparent advantages: first, it avoids the need to assign privileged bases in inflectional paradigms, where there are often no obvious "derived from" relations. In addition, it leads to strong and novel predictions. In particular, it predicts that if phonology affects one member of the paradigm ($\mathcal{M} \gg \mathcal{F}_{\text{IO}}$), it may potentially spread to the rest of the paradigm through paradigm leveling (overapplication) by means of a high-ranked OP constraint. By contrast, the only way for phonology to underapply (or for marked allomorphs to spread) is by losing the process altogether ($\mathcal{M} \ll\!=\!\gg \mathcal{F}_{\text{IO}}$). McCarthy calls these effects "attraction to the unmarked" and "overapplication only", respectively.

In order to see why these predictions hold, consider the final devoicing example in (3). (Here and elsewhere, I use a final devoicing constraint FINDEVOI as a shorthand for the group of constraints motivating final devoicing—e.g., $\text{IDENT}_{\text{Pre-sonorant}}$(voi) $\gg$ *VOICEDOBSTRUENT (Steriade 1997; Lombardi 1999; Baković 1999; Féry 1999; Padgett 2004).[1] When final devoicing applies without any additional OP effect (FINDEVOI $\gg$ IO-IDENT(voi), OP-IDENT(voi) ranked low), the paradigm with voicing alternations wins. When an OP effect is introduced (OP-IDENT(voi) reranked high), the paradigm with devoicing throughout (candidate (b)) is selected. Thus, the OP constraint causes final devoicing to overapply, and the less marked allomorph prevails (3b). Crucially, the only way for candidate (c) (underapplication) to win is by reranking IO-IDENT $\gg$ FINDEVOI—that is, by allowing voiced obstruents everywhere (blanket loss of final devoicing).

(3) A language with final devoicing:

a. No OP effect

/bund/, /bund-ə/		FINDEVOI	IO-ID(voi)	OP-ID(voi)
☞	a. [bunt], [bundə]		*	* (t∼d)
	b. [bunt], [buntə]		**!	
	c. [bund], [bundə]	*!		

[1] It does not matter for present purposes whether final devoicing is analyzed via positional faithfulness (IDENT-Pre-sonorant(voi) $\gg$ *VOICEDOBST $\gg$ IDENT(voi), positional markedness (*VOICEDOBST-PreSonorant $\gg$ IDENT(voi) $\gg$ *VOICEDOBST), or constraint conjunction (*VOIOBST & *CODA; Ito & Mester 1997, 2003). For concreteness, I adopt the positional faithfulness approach; see Steriade (1997), (Féry 1999) and Wagner (2002) for some additional discussion and arguments.

b. OP effect

/bund/, /bund-ə/		OP-ID(voi)	FINDEVOI	IO-ID(voi)
	a. [bunt], [bundə]	* (t∼d)		*
☞	b. [bunt], [buntə]			**
	c. [bund], [bundə]		*	

The goal of this paper is to show that the overapplication-only prediction, though appealing in its strength, is false. The counterexample comes from a change in the history of Yiddish, involving the "loss of final devoicing". I will show that this change, of the *bunt, bunde* ⇒ *bund, bunde* type, was in fact paradigmatically motivated, and represents an example of underapplication and extension of marked forms. The second aim of this paper is to show that although such a change is unexpected under the OP approach, it follows naturally from a theory in which inflectional paradigms have bases, just like derivational paradigms. In a theory with inflectional bases, the direction of leveling is determined not by markedness or global harmony, but by which form in the paradigm serves as the base (in this case, the inflected plural form). Finally, I will sketch how the choice of base in inflectional paradigms can be determined externally and non-circularly, using a procedure proposed in Albright (2002)—namely, by selecting the *maximally informative* member of the paradigm as the base. I will show that this procedure correctly predicts the use of the plural as the base form in Yiddish.

2 Paradigm leveling in Yiddish nouns: Loss of final devoicing

2.1 Description of the change

Middle High German (MHG), the immediate ancestor of Modern Yiddish, had a regular process of final devoicing (Paul, Wiehl, and Grosse 1989, §62)[2] This can be seen by comparing the forms in (4a), in which stem-final voiced stops surface as voiceless word-finally, against the forms in (4b), which are voiceless throughout.[3]

[2]The MHG contrast between *p,t,k* and *b,d,g* is generally thought to have involved aspiration, and only secondarily voicing; see Paul, Wiehl, and Grosse (1989), §54, or Wright (1950), §33 for discussion. Paul et al. observe that although the alternation was phonologically a fortition (from lenis/sonant to fortis/surd), it was nonetheless motivated by loss of voicing in syllable-final position.

[3]For MHG examples, I will use the standardized orthography of Paul, Wiehl, and Grosse (1989, §§18–20), in which ˆ marks long vowels, *ë* is a short open [e], and *ẓ* is a coronal sibilant fricative, possibly fortis, possibly postalveolar (Paul et al, §151). For Yiddish forms, I will use YIVO transliteration (http://www.yivoinstitute.org/yiddish/alefbeys.htm), with a few minor modifications: I use the IPA symbol, ɔ instead of YIVO *o* for *komets-aleph*, and *-ən* instead of *-en*/*-n* for syllabic [n̩]. In YIVO transcription, *sh* represents [ʃ], *zh* [ʒ], *kh* [x], *ay* [aɪ], and *ey* [eɪ].

(4) Final devoicing in Middle High German

a. Voiced obstruents are devoiced in singular

	Stem	Nom. sg.	Gen. sg.	Nom. pl.	Gloss
/b/	lob-	lop	lobes	lobe	‘praise’
	wîb-	wîp	wîbes	wîber	‘woman’
/d/	rad-	rat	rades	reder	‘wheel’
	held-	helt	heldes	helde	‘hero’
/g/	wëg-	wëc [k]	wëges	wëge	‘way’
	tag-	tac [k]	tages	tage	‘day’
	ding-	dinc [k]	dinges	dinge	‘thing’
	honeg-	honec [k]	honeges	—	‘honey’
/z/	hûs-	hûs [s]	hûses [z]	hiuser [z]	‘house’
/v/	briev-	brief	brieves	brieve	‘letter’

b. Voiceless obstruents throughout the paradigm

	Stem	Nom. sg.	Gen. sg.	Nom. pl.	Gloss
/t/	blat-	blat	blates	bleter	‘leaf’
/k/	roc-	roc	rockes	röcke	‘overcoat’
	druc-	druc	druckes	drucke	‘pressure’
/s/	sloʒ- [s]	sloʒ [s]	sloʒes [s]	sloʒe	‘lock’
/f/	schif-	schif	schiffes [f]	schiffe [f]	‘ship’

In its earliest stages, Yiddish also apparently had final devoicing, as seen in 13th-14th century spellings like *tak* ‘day’ (MHG *tac*), *vip* ‘wife’ (MHG *wîb*), etc., written with Hebrew letters indicating voiceless stops (King 1980, p. 374). In Modern Northeast Yiddish (NEY), however, there is no general process of final devoicing (Sapir 1915, p. 237; Kiparsky 1968, p. 177; Vennemann 1972, pp. 188-189; Sadock 1973; King 1980). Thus, words which showed alternations in MHG (4a) and early Yiddish are now consistently voiced in Modern NEY:

(5) Modern NEY shows no final devoicing

	Stem	Sg.	Pl.	Gloss	cf:	MHG sg.
/b/	loyb-	loyb	loybən	‘praise’		lop
	vayb-	vayb	vayber	’woman’		wîp
/d/	rɔd-	rɔd	reder	‘wheel’		rat
	held-	held	heldən	‘hero’		helt
/g/	veg-	veg	vegən	‘way’		wëc
	tɔg-	tɔg	teg	‘day’		tac
/z/	hoyz-	hoyz	hoyzer	‘house’		hûs
/v/	briv-	briv	briv	‘letter’		brief

As King (1980, p. 383) states, “[g]enerally speaking NEY has restored phonetically a final voiced obstruent wherever MHG had a voiceless obstruent alternating morphophonemically with a voiced obstruent.” Words which were consistently voiceless-final in MHG (4b) remain voiceless in NEY (*blat, rɔk, druk, shlɔs, shif*), as did words with no paradigmatically related forms –e.g., *honik* ‘honey’ (no plural), *avek* ’away’ (etymologically, but not paradigmatically related to *veg* ‘way’).

How did words like [vek] come to be pronounced as [veg]? One possibility is that the change was simply caused by a blanket loss of final devoicing—that is, through the demotion of FINDEVOI. Under such an account, words like *veg* came to be pronounced with surface [g] simply because the relevant faithfulness constraint (IO-IDENT(voi)) came to be ranked above FINDEVOI. Words like *druk* and *avek* never had a voiced allomorph in MHG, and thus had underlyingly voiceless final segments (due to the Alternation Condition (Kiparsky 1982), or Lexicon Optimization (Prince and Smolensky 2002)); hence, they remained voiceless even after the change. I will call this the "markedness demotion" account, since it is based on the idea that the change in NEY involved an increased tolerance of final voiced stops.

This can be contrasted with a paradigmatic account, in which the change of *vek* to *veg* was due to leveling of voicing from the plural to the singular, leading only secondarily to the demotion of FINDEVOI. Under this view, words like [vek] imported voicing from the plural and came to be pronounced as [veg]. Words like *druk* were voiceless in the plural, while words like *avek* had no plurals. Therefore, neither group was eligible to become voiced in NEY.

The markedness demotion and paradigmatic accounts seem quite similar, since in both cases, the restoration of final voicing is enabled by the presence of alternations. The difference is the mechanism: in the markedness demotion account, alternations are the evidence for the underlying form, while the mechanism for change is increased tolerance for final voiced obstruents. In the paradigmatic account, learners fail to learn or stop tolerating the alternations, and the markedness consequences are only secondary.

In fact, most treatments of the Yiddish change have pursued a paradigmatic explanation. In the first analytical discussion of the change, Sapir (1915) hypothesized that leveling happened quite early in the history of NEY, and was followed by other changes affecting the shape of noun paradigms, such as final apocope and adding additional plural endings; this account, found also in Sadock (1973), is illustrated in (6). An alternate possibility, shown in (7), is that the the change was precipitated by apocope of final -ə suffixes ([vegə] > [veg]), which rendered final devoicing opaque, and eventually led to leveling. This hypothesis was advanced by Kiparsky (1968, p. 177), and has been pursued by many subsequent authors (King 1968; Stampe 1969, p.453; Vennemann 1972; King 1980).

(6) Early leveling from the plural

Stage 1:	MHG	Sg.	vek	Pl.	vegə
Stage 2:	Leveling of voicing		veg		vegə
Stage 3:	Apocope of final schwa		veg		veg
Stage 4:	Plural marking restored		veg		vegən

(7) Leveling induced by apocope

Stage 1:	MHG	Sg.	vek	Pl.	vegə
Stage 2:	Apocope of final schwa		vek		veg
	***Final devoicing is active, but counterfed by apocope				
Stage 3:	Leveling of voicing		veg		veg
Stage 4:	Plural marking restored		veg		vegən

Either way, the hypothesized leveling leads to underapplication of final devoicing, and creates more marked paradigms—that is, paradigms in which more forms contain voiced stops,

and voiced stops occur even in final position. Thus, if the traditional paradigmatic explanation is correct, the Yiddish change represents a counterexample to the "overapplication only" and "attraction to the unmarked" predictions of the OP hypothesis.

My goal in the following sections is to show that the paradigmatic account is indeed correct, and that the Yiddish change cannot be attributed to a simple loss of final devoicing. In particular, I will show that the "loss of final devoicing" did not introduce voicing contrasts in all positions, as might be expected from simple rule loss or markedness demotion. Even in modern NEY, coda voicing is contrastive only in places where there was paradigmatic pressure from the plural for voicing, while elsewhere, devoicing prevails.

2.2 Persistence of final devoicing in forms outside the paradigm

Discussions of Modern NEY often emphasize that although final voicing was restored to noun paradigms, derivationally related forms continued to obey final devoicing; some examples are shown in the last column of (8).

(8) Persistence of devoicing in derivationally related forms

Gloss	NEY sg.	pl.	Related to
'way	veg	vegən	avek 'away'
'enemy'	faynd	faynd	faynt hɔbən 'hate', faynt krigən 'come to hate'
'love'	libə	libəs	*Dial.* lip hɔbən 'love'[4]
'friend'	fraynd	fraynd	(ge)fraynt 'relatives'

The logic of the argument is that the relation between *veg* and *avek* is transparent enough to set up the UR /a+veg/ (supported also by other pairs, such as *heym* 'home' ∼ *aheym* 'homewards', *ponim* 'face' ∼ *aponim* 'apparently', etc.), but since 'away' is not part of the inflectional paradigm of 'way', it is protected from leveling and continues to undergo final devoicing. If this is right, then it would constitute strong evidence that the change from [vek] to [veg] is not purely phonotactic, but is due to paradigmatic pressure from the plural.

An important caveat, however, is that the argument from words like *avek* rests crucially on the assumption they had not been relexicalized (e.g., /avek/) by the time of the change. If *avek* was no longer derived synchronically from /veg/, then there is no reason why changes in the paradigm of /veg/ would have affected *avek*, and persistence of [k] in this form would be irrelevant to the issue at hand. Thus, an argument based on derivationally related words must be treated cautiously; I include it here for completeness, since it has frequently been cited in the literature as evidence for a paradigmatic effect. Fortunately, there are many other arguments that the loss of final devoicing was paradigmatically restricted, which do not rest on assumptions about the underlying form of words like *avek*.

2.3 Persistence of final devoicing in affixes

A related argument comes from the fact that although voicing contrasts were reintroduced at the ends of lexical roots, affixes generally went in the opposite direction, leveling to the *voiceless* variant. The MHG adjectival suffix *-ic*, *-ige* (with [k] ∼ [g]) alternations) yielded NEY *-ik*, *-ike*, with

[k] throughout—for example, the inflected forms of *lebedik* 'lively' include *lebedike*, *lebedikən*, and *lebediker*. Similarly, the MHG preposition/prefix *abe*/*ab*/*ap* yielded NEY *ɔp* in all positions (e.g., *ɔpesn* 'eat up'), rather than restoring the voiced [b]. This is unexpected under the markedness demotion account, since these affixes had alternations, and for this reason must have had underlying voiced obstruents (/-ig/, /ab-/); a general loss of final devoicing should have allowed them to surface faithfully.

More generally, a survey of Katz (1987) reveals that although Yiddish has a fair number of affixes ending in consonants, none of these end in final voiced obstruents.[5]

(9) Inventory of Yiddish affixes
   a. Inflectional suffixes
      - Verbal: ∅, *-st*, *-t*, *-ən*, *-ən*, *-əndik*
      - Nominal: ∅, *-ən*, *-s*, *-s*, *-ɪm*, *-ər*, *-əkh*
      - Adjectival: ∅, *-ər*, *-ə*, *-ən*, *-əm*, *-s*, *ər*, *ət*
   b. Inflectional prefixes
      - Verbal: *ge-*
   c. Derivational suffixes
      - Verbal: *-kə-*, *-əvə-*
      - Nominal: *-hayt*, *-kayt*, *-ung* [uŋ], *-ur*, *-ik*, *-enish*, *-ents*, *-ek*, *-eray*, *-shaft*, *-s*, *-tum*, *-əl*(ə), *-ələkh*, *-ke*, *-əkhts*, *-ɪm*, *-izm*, *-ist*, *-er*, *-or*, *-nik*/*-nitsə*, *-ent*, *-ets*, *-uk*, *-yak*, *-tshik*, *-in*, *-tə*, *təl*/*stəl*
      - Adjectival/adverbial: *-ərheyt*, *-ləkh*
   d. Derivational prefixes
      - Verbal: *ant-*, *ba-*, *der-*, *far-*, *tse-*, *oys-*, *uf-*, *um-*, *unter-*, *iber-*, *ayn-*, *on-*, *op-*, *bay-*, *for-*, *tsu-*, *adurkh-*, *ahin-*, *aher-*, *avek-*, *mit-*, *antkegən-*, *anider-*, *arop-*, *aroys-*, *aruf-*, *arum-*, *arayn-*, *arunter-*, *ariber-*, *nokh-*, *farbay-*, *faroys-*, *funander-*, *tsuzamen-*, *tsunoyf-*
      - Adverbial: *a-*, *am-*

We are faced, then, with a Richness of the Base problem (Smolensky 1996); in principle, ranking IDENT-IO(voi) ≫ FINDEVOI should allow the possibility of a voicing contrast *anywhere*, including in affixes. If final voicing was restored by such a reranking, then affixes like *-ig* and *ab-* should have yielded [-ig] and [ɔb-], and more generally, voiced-final affixes should have become possible. Even while acknowledging the fact that languages do not create or acquire new affixes all that often (and furthermore, that the primary source languages for Yiddish have had final devoicing during much of the contact period), we must contend with the fact that in the two affixes

[5] An ambiguous case is the element *varg* 'equipment, gear, ...ware', found in words such as *esənvarg* 'food' ('food-ware'), or *zisvarg* 'candy' (lit. 'sweet-ware'). It seems likely that *varg* is related to English and German *ware* (cf. German *Süßwaren* 'candy'), but I am unable to determine the source of the final [g] in Yiddish. (The expected MHG form, *warc* ∼ *warges*, does exist, but means 'savage, criminally-minded man'—this is most likely not the origin of Yiddish *-varg*. Some uses of *varg* are also incompatible with the meaning of *-ware*, such as *kleynvarg* 'youngsters' ('small-ware'?).) Whatever its origin, if *varg* is a suffix, then the [g] would be an exception to the claim that affixes never end in voiced obstruents. I would argue, however, that words like *zisvarg* and *kleynvarg* are more like compounds than suffixed forms, confirmed by the fact that they have two stresses (*zísvàrg*). Thus, *varg* acts as a (bound) stem, and need not be counted as an exception.

where NEY should have inherited final voiced stops, we find devoicing ([-ik], [op-]). It appears that the restoration of final voicing was blocked in both of the affixes where it is expected, leaving a language with no voiced-final affixes.

Distinctions between the phonotactics of roots and affixes are not uncommon, and in particular, it has frequently been noted that roots may allow a greater range of marked structures than affixes. A common recipe for handling such cases within OT is to posit special faithfulness constraints that apply only to roots (or lexical categories): IDENT-IO$_{\text{LexCat}}$(voi) (Casali 1997; Beckman 1998; Alderete 2001; Alderete 2003). A description of the Yiddish change, therefore, would involve reranking FINDEVOI with respect to IDENT-IO$_{\text{LexCat}}$(voi), but not with respect to the more general IDENT-IO(voi) constraint:

(10) Reranking to allow final voiced obstruents within roots:

Stage 1: FINDEVOI $\gg$ IDENT-IO(voi), IDENT-IO$_{\text{LexCat}}$(voi)

Stage 2: IDENT-IO$_{\text{LexCat}}$(voi) $\gg$ FINDEVOI $\gg$ IDENT-IO(voi)

The "loss of final devoicing" was thus subject to a curious restriction: why was voicing restored only in roots? The older stage of the language provided no evidence for the relative ranking of IDENT-IO$_{\text{LexCat}}$(voi) and IDENT-IO(voi), so we might have expected that demoting the ban on voiced codas should have placed it below both constraints. The actual change was a more subtle, morphologically restricted one.

2.4 Persistence of devoicing in word-final obstruent clusters

Another respect in which devoicing persists in NEY is in determining the direction of assimilation in obstruent clusters. This can be seen, for example, in the paradigm of the verb 'to love' (Katz 1987, p. 29), which shows that although a single voiced obstruent is allowed to surface faithfully (1sg *lib*), when the suffixes *-st* and *-t* are added, the voicing disagreement is resolved by devoicing:

(11) Devoicing in 2sg, 3sg, and 2pl

1sg	li**b**	1pl	li**b**ən
2sg	li**p**st	2pl	li**p**t
3sg	li**p**t	3pl	li**b**ən

How should this pattern be captured? It is instructive to compare Yiddish with two similar but crucially different languages: English and German. In English, there is no general process of final devoicing, meaning that faithfulness for voicing must outrank the ban on voiced obstruents: IDENT(voi) $\gg$ *VOICEDOBSTRUENT. Furthermore, when a suffix consisting of a single obstruent is added, the root controls the voicing of the suffix: *swapped* [swap-t] vs. *swabbed* [swab-d]. This pattern can be handled by a constraint against disagreeing sequences like *[bt], *[pd] (AGREE; Lombardi 1999), combined with greater faithfulness to roots than to affixes (IDENT-IO$_{\text{LexCat}}$(voi) $\gg$ IDENT-IO(voi)).

(12) IDENT$_{\text{LexCat}}$(voi) and AGREE force suffix to assimilate in English

a. Simple voiced codas surface faithfully

/swab/	AGREE	$\text{ID}_{\text{LexCat}}$(voi)	ID(voi)	*VOIOBST
☞ a. [swab]				*
b. [swap]		*!	*	

b. Voiced + voiced sequences surface faithfully

/swab-d/	AGREE	$\text{ID}_{\text{LexCat}}$(voi)	ID(voi)	*VOIOBST
☞ a. [swabd]				**
b. [swapt]		*!	**	

c. Voiced + voiceless sequences assimilate to root (voiced + voiced)

/swap-d/	AGREE	$\text{ID}_{\text{LexCat}}$(voi)	ID(voi)	*VOIOBST
a. [swapd]	*!			*
b. [swabd]		*!	*	**
☞ c. [swapt]			*	

In German, by contrast, the opposite pattern holds: there is a general process of final devoicing, so final voiced obstruents surface as voiceless (/li:b/ → [li:p] 'dear').Furthermore, the 3sg suffix is voiceless (*-t*), and root-final obstruents devoice to agree with the suffix (*klappt* [klapt] 'knock-3sg' vs. *liebt* [li:pt] 'love-3sg'). Superficially, it appears that the choice of [li:pt] over *[li:bd] displays an unnatural preference to maintain suffix faithfulness over root faithfulness, contrary to the usual preference to preserve roots ($\text{IDENT-IO}_{\text{LexCat}}$(voi) ≫ IDENT-IO(voi)). One approach might be to introduce an parallel suffix-faithfulness constraint ($\text{IDENT-IO}_{\text{Affix}}$(voi)), which in this case would need to be ranked higher than the corresponding root-faithfulness constraint ($\text{IDENT-IO}_{\text{LexCat}}$(voi)). A simpler and more appealing account, however, would be to attribute the choice of [li:pt] to the general process of final devoicing, which independently rules out *[li:bd].

The constraints in (13) show that the only difference between English and German is the high ranking of FINDEVOI (= $\text{IDENT}_{\text{Pre-Son}}$(voi) ≫ *VOIOBST), which rules out both simplex *[li:b] and derived *[li:bd]:

(13) FINDEVOI (= $\text{IDENT}_{\text{Pre-Son}}$(voi) ≫ *VOIOBST) forces final devoicing in German

a. Simple voiced codas are devoiced

/li:b/	$\text{ID}_{\text{Pre-Son}}$(voi)	*VOIOBST	AGREE	$\text{ID}_{\text{LexCat}}$(voi)	ID(voi)
a. [li:b]		*!			
☞ b. [li:p]				*	*

b. Voiceless + voiceless sequences surface faithfully

/klap-t/	$\text{ID}_{\text{Pre-Son}}$(voi)	*VOIOBST	AGREE	$\text{ID}_{\text{LexCat}}$(voi)	ID(voi)
☞ a. [klapt]					
b. [klabd]		*!*		*	**

c. Voiced + voiceless sequences assimilate to voiceless, by final devoicing

/li:b-t/			ID$_{\text{Pre-Son}}$(voi)	*VOIOBST	AGREE	ID$_{\text{LexCat}}$(voi)	ID(voi)
	a.	[li:bt]		**!	*		
	b.	[li:bd]		**!*			*
☞	c.	[li:pt]		*		*	*

Returning to the Yiddish pattern in (11), we see that NEY is like English in lacking final devoicing (e.g., [lib] 'dear'), but is like German in repairing AGREE violations by regressive devoicing. Since there is no final devoicing (*zɔg, vayb, held, veg* surface faithfully), we infer that some version of faithfulness for voicing (IDENT$_{\text{LexCat}}$(voi), IDENT(voi)) must outrank the ban on voiced obstruents (*VOIOBST). This is compatible with the ranking argued for in the previous section, of IDENT$_{\text{LexCat}}$(voi) ≫ *VOIOBST ≫ IDENT(voi). This ranking allows simple voiced codas to surface faithfully:

(14) Simple voiced codas surface faithfully in Yiddish

/lib/			ID$_{\text{Pre-Son}}$(voi)	ID$_{\text{LexCat}}$(voi)	*VOIOBST	ID(voi)
☞	a.	[lib]			**	
	b.	[lip]		*!	*	*

Turning next to forms with complex codas, we find that adding AGREE to this ranking produces an incorrect prediction for inputs like /lɔb-t/ 'love-3sg', since IDENT$_{\text{LexCat}}$(voi) eliminates the desired winner [lipt] (indicated by ☠), favoring instead the output [libd]:

(15) Ranking incorrectly predicts English-like assimilation for disagreeing complex clusters

/lib-t/			ID$_{\text{Pre-Son}}$(voi)	AGREE	ID$_{\text{LexCat}}$(voi)	*VOIOBST	ID(voi)
	a.	[libt]		*!		**	
☞	b.	[libd]				***	*
☠	c.	[lipt]			*!	*	*

Previous analyses of Yiddish (Lombardi 1999, p. 294; Baković 1999, p. 2) have sidestepped this problem, because they did not differentiate faithfulness violations in roots vs. affixes. If only a single IDENT(voi) constraint is employed, then both [libd] and [lipt] incur a single faithfulness violation; the decision then falls to *VOIOBST, which prefers the less marked output [lipt]. The data from the previous section show that this is too simplistic, however, and that IDENT(voi) must be ranked too low to eliminate (15b) [libd]. More generally, preserving the /b/ of the stem should be favored over the /t/ on all relevant faithfulness dimensions: it is adjacent to a vowel (phonetic context), it is part of the root (syntagmatic context), and it even stands in an output-output relation to forms where it is voiced (paradigmatic context).

The candidate [libd] can, however, be ruled out on general phonotactic grounds. As both Lombardi and Baković correctly point out, Yiddish words never end in sequences of voiced obstruents, no matter whether they are monomorphemic or suffixed. Thus, I will assume that [libd] is eliminated by a high-ranking constraint banning word-final voiced obstruent clusters (*DD#). Adding this constraint allows the Yiddish pattern to be derived correctly, as shown in (16).

(16) Final voiced+voiced sequences are blocked

a. In monomorphemic words

/tabd/		$\text{ID}_{\text{Pre-Son}}$ (voi)	*DD#	AGREE	$\text{ID}_{\text{LexCat}}$ (voi)	*VOIOBST	ID(voi)
	a. [tabt]			*!	*	*	*
	b. [tabd]		*!			**	
☞	c. [tapt]				**		**

b. Or derived by suffixation

/lib-t/		$\text{ID}_{\text{Pre-Son}}$ (voi)	*DD#	AGREE	$\text{ID}_{\text{LexCat}}$ (voi)	*VOIOBST	ID(voi)
	a. [libt]			*!		**	
	b. [libd]		*!			***	*
☞	c. [lipt]				*	*	*

The tableau in (16) provides further demonstration of what we saw in the previous section: the "loss of final devoicing" yielded a pattern that is more complicated than either English (with consistent lack of final devoicing) or German (with consistent devoicing). Yet again, we see that the change was far from a simple demotion of the ban on voiced codas. Rather, what we observe is a complex re-ranking of contextual faithfulness and specific markedness constraints, all to achieve the effect of allowing single voiced obstruents at the ends of roots.

2.5 Resistance to voicing in word-internal clusters

Further evidence that voiced obstruents are not freely allowed in codas in NEY comes from the way that voicing disagreements are resolved in clusters. According to the standard description, obstruent clusters are subject to regressive voicing assimilation, both within words and (to a lesser extent) across word boundaries (Katz 1987, pp. 29-30; Lombardi 1999, p. 279; Baković 1999):

(17) Regressive devoicing

a.	/vɔg + shɔl/	→	[vɔkshɔl]	'weight-scale'
b.	/briv + treger/	→	[briftreger]	'letter carrier'
c.	/ayz + kastən/	→	[ayskastən]	'ice box'

(18) Regressive voicing

a.	/bak + beyn/	→	[bagbeyn]	'cheek-bone'
b.	/kɔp + veytik/	→	[kɔbveytik]	'head-ache'
c.	/zis + varg/	→	[zizvarg]	'sweet-ware' (candy)

Recent OT discussions of regressive voicing and devoicing in Yiddish (e.g., Lombardi 1999) have treated them as fully parallel, providing a unified analysis of both processes. In point of fact, regressive voicing is weaker and less frequent than regressive devoicing. Katz states: "Voiced consonants *usually* undergo devoicing," but "Voiceless consonants *may* undergo voicing" (emphasis mine). He elaborates further: "Voicing assimilation [i.e., regressive voicing] is less consistent than devoicing assimilation, but it is frequently heard in natural speech."

The most direct test of this claimed asymmetry would be a corpus study of spoken Yiddish, measuring the rate and degree of assimilatory voicing and devoicing across word boundaries under various syntactic conditions. Although such a corpus does not exist, Yiddish does provide another valuable source of information about the propensity to assimilate, in the form of large numbers of loanwords with disagreeing obstruent clusters in the source languages. Thus, in order to get a quantitative estimate of the asymmetry between voicing and devoicing, I performed a study of Hebrew loans in Yiddish.

Hebrew loans are a good test case for the productivity of assimilation, since Hebrew permits a large assortment of disagreeing word-internal clusters. (In fact, since clusters in Hebrew generally arise through templatic morphology—e.g., *kadosh* 'holy' ∼ *mikdash* 'sanctuary'—they are probably more common than they would be in a non-templatic language that allows such clusters.) Furthermore, Hebrew loanwords into Yiddish are unusual among cases of loanword adaptation, in that they were borrowed exclusively through texts rather than through living speakers, and are thus relatively free from effects of bilingualism or the influence of native L1 phonology. As a result, to the extent that such words undergo assimilation in Yiddish, we can be certain that this is a result of Yiddish phonology, and not, say, the way that Hebrew voiced stops are perceived by Yiddish speakers.[6]

There is one other fact about Hebrew loans into Yiddish which facilitates the study of assimilation, and that is the fact that the two languages differ in how they represent vowels (Yiddish uses separate letters, while Hebrew, for the most part, does not). For this reason, if unfamiliar loans are written in Hebrew orthography, Yiddish speakers are often uncertain about how to pronounce them (in particular, where the vowels go, and what they should be). Weinreich's (1968) dictionary solves this problem by including romanized transcriptions of Hebrew loanwords, with the purpose of revealing the vowels, but with the side effect of marking assimilation as well.[7] For example, a word written <bdkenen> in Hebrew letters is transcribed as [BATKENEN]'inspect (slaughter)' (with assimilation), whereas the morphologically related word <bdikh> is transcribed as [BDIKE] (no context for assimilation).

I compiled a database of all Hebrew words in Weinreich (1990) containing disagreeing obstruent clusters, along with their transcriptions. In some cases, the root occurred in multiple words—e.g., S,G,L in *hisgales* 'revelation' and *nisgale* 'revealed', or SH,G,KH in *mazhgiekh* 'custodian' and *hazhgokhe* 'supervision'. In such cases, only one instance was counted, to avoid the risk of inflated counts due to a lexicalized allomorph. In addition, clusters involving [x] were removed, since the standard romanization includes no symbol for [ɣ], leaving no way to indicate voicing in such cases.

[6] An issue which I am not able to address here is the question of the relative recency of different loans, and how this might affect their degree of nativization. Differences between various portions of the lexicon have been a major focus of studies on loanwords (see, e.g., Ito and Mester 2002), and it seems plausible that more recent (or, less frequent or familiar) loans would be relatively more protected from assimilation. This is an important question, and it is difficult to give it the treatment it deserves without an etymological dictionary (including dates of attestation) and a frequency dictionary for the language. There is, moreover, the mitigating fact that Hebrew source forms have been consistently available throughout history—so in a sense they have been constantly reborrowed, and there has always been some pressure to produce faithful (unassimilated) forms. In any event, the question here is simply whether there is a difference between voiced+voiceless inputs and voiceless+voiced ones. It seems unlikely that one set was borrowed systematically before the other.

[7] These transcriptions reflect, of course, the educated speech of Weinreich and his editors/assistants.

Table 1: Obstruent clusters with and without assimilation

C1	C2	Pattern	Example		
[+voi]	[−voi]	Assim.	/plu**gt**e/	[plu**kt**e]	‘dispute’
		No assim.	/ko**ds**he/	[ko**ds**he]	‘Holy of’
[−voi]	[+voi]	Assim.	/he**kd**esh/	[he**gd**esh]	‘poorhouse’
		No assim.	/ma**kd**im/	[ma**kd**im]	‘ahead’

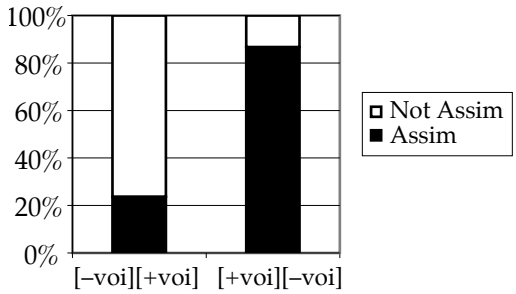


Figure 1: Relative occurrence of regressive voicing and devoicing

Among the remaining cases, we see in Table 1 that assimilation is not absolute in either voiceless+voiced or voiced+voiceless combinations. (That is, there are both assimilating and unassimilating examples of both input sequences.) However, as the graph in Figure 1 shows, devoicing (on the right) is far more common than voicing (87% vs. 24%). Although it is not a categorical effect, we see that even in Modern NEY, voiced obstruents are strongly dispreferred in coda (really, not pre-sonorant) position.

This effect can be seen even more strongly in onset clusters, where voiced+voiceless sequences generally assimilate, but voiceless+voiced clusters never do ((19)):

(19) Assimilation in word-initial obstruent clusters

a. Voiced+voiceless sequences generally assimilate

a.	/bsule/	[psule]	‘maiden’
b.	/bxor/	[pxor]	‘first-born son’
c.	/dkhak/	[tkhak]	‘dire need’
d.	/zkeynim/	[skeynim]	‘old men’

but compare:

e.	/bshas/	[b(ə)shas]	‘during’

b. Voiceless+voiced sequences do not assimilate

a.	/kdushe/	[kdushe]	'sanctity'
b.	/pgam/	[pgam]	'dent, blemish'
c.	/shvue/	[shvue]	'oath'

It must be reiterated that when obstruent clusters agree in the input, they are always pronounced faithfully (/hagbe/ → [hagbe], /bdike/ → [bdike] 'ritual inspection'). In other words, there is no general process eliminating voiced+voiced sequences—there is merely a reluctance to create them through voicing assimilation.

Such "grandfathering" effects have been discussed by Łubowicz (2002), who proposes to handle them with constraint conjunction—e.g., *VOIOBST & IDENT(voi) (don't be both a voiced obstruent and an IDENT violation) (see also Baković (1999), and Ito and Mester (2003)). This constraint allows voiced obstruents (*VOIOBST violation), and devoicing (IDENT(voi) violation), but not voicing (both violations simultaneously). If the effect were absolute and categorical, then adding this constraint above AGREE would capture the difference between /abta/ (regressive devoicing applies) and /apda/ (no regressive voicing):

(20) a. Regressive devoicing in /abta/

/abta/		$\text{ID}_{\text{Pre-Son}}$ (voi)	ID(voi) & *VOIOBST	AGREE	$\text{ID}_{\text{LexCat}}$ (voi)	*VOIOBST	ID(voi)
a.	[abta]			*!		*	
b.	[abda]	*!			*	**	*
☞ c.	[apta]				*		*

b. No regressive voicing in /apda/

/apda/		$\text{ID}_{\text{Pre-Son}}$ (voi)	ID(voi) & *VOIOBST	AGREE	$\text{ID}_{\text{LexCat}}$ (voi)	*VOIOBST	ID(voi)
☞ a.	[apda]			*		*	
b.	[abda]		*!		*	**	*
c.	[apta]	*!			*		*

In actuality, the effect is not all-or-nothing, but is rather a statistical tendency (devoice 87% of the time, voice 24%). The probabilistic nature of the pattern can be captured using stochastic constraint ranking procedure, such as the Gradual Learning Algorithm (GLA; Boersma 1997; Boersma and Hayes 2001). In the GLA approach, constraints do not receive absolute rankings, but rather ranges of possible ranking values. When the grammar is invoked to derive an output, each constraint is probabilistically assigned a specific ranking value. This means that if two constraints (C1, C2) have overlapping ranges, their relative ranking may differ from utterance to utterance, with the probability that C1 $\gg$ C2 depending on the degree of overlap. (See Boersma (1997) for further details.) In the case of Yiddish, what is required is for AGREE to be ranked in such a way that it usually (but not always) dominates $\text{IDENT}_{\text{LexCat}}$(voi), producing regressive devoicing most of the time. At the same time, IDENT(voi) & *VOIOBST must usually outrank AGREE, blocking regressive devoicing on a majority of occasions. A ranking that achieves these relative proportions is shown in Figure 2.

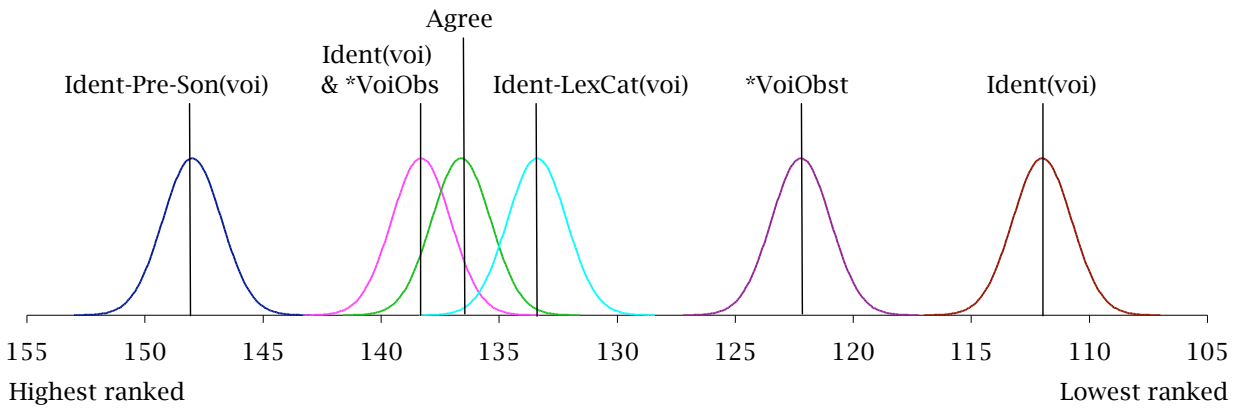


Figure 2: Stochastic constraint ranking for regressive voicing assimilation

When applied to Hebrew input forms with disagreeing sequences, the constraint ranking in Figure 2 will produce assimilation at the rates shown in Fig. 1. A fact that this cannot account for, however, is the stability of individual lexical items amidst global gradience. Although many of the words listed in Weinreich (1990) show variation (occurring both with and without assimilation), some tend to occur more often in their assimilated form, while others rarely or never do. A full analysis of the pattern would therefore require two components: a constraint ranking that produces assimilation at the expected rates, and knowledge about the behavior of individual lexical items. For a proposal regarding how learners acquire both types of knowledge simultaneously and deploy them in a grammar of stochastically ranked constraints, see Zuraw (2000). For present purposes, it is enough to observe that the grammar that is needed to capture the gradient assimilation pattern is a complex one, which includes a strong tendency to avoid creating voiced codas.

There is one final observation that is relevant to the analysis of assimilation in Yiddish. King (1980, p. 387), in his discussion of final devoicing, notes that regressive voicing assimilation across word boundaries may not be fully neutralizing: "My own impression is that a sound like the *t* in *halt zi* [dz] is not identical with the [d] in *vald* 'forest'; rather, it is a semivoiced (or even voiceless) lenis." Similar effects have been observed in other languages, such as Taiwanese (Hsu 1997, cited in Steriade (1997)) and Dutch (Ernestus (2000), Jansen (2004)), and have been taken as evidence that assimilation involves deleting the voicing specification, rather than copying the neighboring specification: /[−voice][+voice]/ → [∅voice][+voice]. Under such an analysis, the first consonant loses contrastive voicing, but may still receive coarticulatory/passive voicing from the preceding vowel. This would be fully in line with King's observation of partial voicing. A prediction of this underspecification account, however, is that neutralized segments should be receive passive voicing from the preceding vowel regardless of the voicing of the following consonant—and indeed, this is what Jansen (2004) observes for Dutch. Impressionistically, what one finds in Yiddish, however, is that C1 has intermediate voicing only in underlying voiceless+voiced sequences; in voiced+voiceless sequences, it is fully devoiced. Clearly, careful phonetic studies are needed to determine whether assimilation across word boundaries in Yiddish is amenable to an underspecification analysis. An additional complication is that assimilation *within* words appears to yield fully voiced or voiceless outcomes (though this too requires

investigation). Further data may change the precise formulation of the analysis, but what is important here is that the rate (and possibly degree) of assimilation differs depending on whether one must voice or devoice to satisfy AGREE.

In sum, this section presents yet another suspicious restriction: if the loss of final devoicing was accomplished by demoting the ban on voiced codas, why is there a reluctance to create voiced codas root-internally through regressive assimilation?

2.6 Capturing this distribution with gradient constraint ranking

The previous sections have shown that voiced obstruents do not occur freely in codas, even in Modern NEY; rather, they are avoided in affixes, in final clusters, and, to a certain extent, in medial clusters as well. In this section, I sketch an analysis of these facts, using the Gradual Learning Algorithm (GLA; Boersma 1997; Boersma and Hayes 2001) to capture the gradient nature of assimilation observed above.

As seen in the previous sections, the analysis of Modern NEY requires a variety of contextual constraints to capture the distribution of voiced obstruents. These reflect the fact that voicing contrasts are maintained more consistently before sonorants and within lexical roots than before obstruents and outside of roots. In addition, the assimilation pattern requires a constraint that bans voicing underlyingly voiceless codas, such as *VOIOBST & IDENT(voi). The full set of constraints employed thus far are summarized in (21):

(21) Constraints needed for the analysis of Modern NEY

a. Faithfulness constraints

IDENT(voi)	Preserve underlying voicing value
$\text{IDENT}_{\text{Pre-sonorant}}$(voi)	Preserve voicing in pre-sonorant position
$\text{IDENT}_{\text{LexCat}}$(voi)	Preserve voicing within roots of lexical categories

b. Markedness constraints

*VOIOBST	No voiced obstruents
*DD#	No word-final sequences of voiced obstruents
AGREE	Consecutive obstruents may not have conflicting [voice] specifications

c. Conjoined markedness and faithfulness

*VOIOBST & IDENT(voi)	No derived (unfaithful) voiced obstruents

By combining the rankings given in (10), (16), and Fig. 2, it appears that it would be possible to yield a single ranking which yields all of the Yiddish data. A small complication arises, however, from the fact that regressive devoicing is not absolute word-internally (87%), while it does occur consistently at the ends of words (/lib-t/ → [lipt]). The stochastic ranking in Fig. 2 predicts that AGREE may be violated a certain proportion of the time, favoring outcomes that are more faithful to the underlying voicing of the root. Thus, a ranking that yields word-internal variation also predicts a small but unacceptable amount of variation word-finally ([libt]). There is no ranking of the given constraints which can produce [abta] 13% of the time, while never producing *[libt].

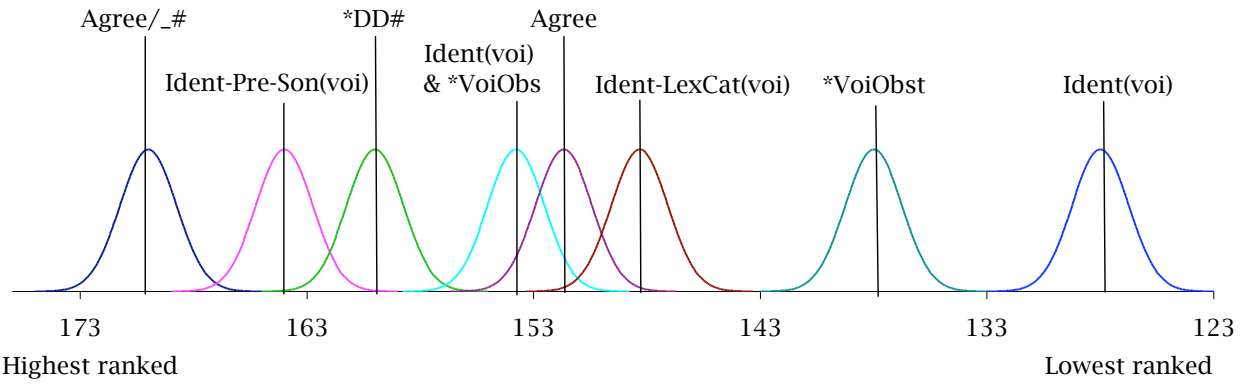


Figure 3: Overall ranking of constraints

In order to solve this problem, I added one more constraint, designed to enforce voicing agreement specifically at the ends of words: *AGREE/___ #.[8] This special AGREE constraint is never violated in Yiddish, and can thus be ranked on top, stamping out any [libt]-type errors that would otherwise be produced by the gradient ranking of regular AGREE.

I submitted these constraints to the GLA using the OTSoft software package (Hayes, Tesar, and Zuraw 2003). The input forms included: (1) monomorphemic pseudowords ending in voiced and voiceless obstruents, which always surface faithfully ([tak], [tag], [dak], [dag]), (2) suffixed pseudoword showing absolute regressive assimilation (/zok-t/, /zog-t/ → [zokt]), and (3) monomorphemic pseudowords with disagreeing obstruent clusters, showing assimilation in the observed ratios (/abta/ → [apta] or [abta], /apda/ → [apda] or [abda]). Since the main goal of the analysis was to show that all of the data could be captured by a single consistent constraint ranking, the model was provided with the clear, categorical rankings ahead of time; its task was to discover the correct stochastic ranking of AGREE relative to IDENT(voi) & *VOIOBST and $\text{IDENT}_{\text{LexCat}}$(voi). Training was run for 10000000 trials, using an initial plasticity of 2 and a final plasticity of .002. The resulting grammar was then tested on all of the input forms, along with hypothetical monomorphemic inputs like /tagd/ and /tagt/ (which never occur in the training data, but should nonetheless be repaired by the grammar).

A ranking that can produce all of the Yiddish forms in the correct proportion is shown in Figure 3. (The difference in absolute values between Figures 2 and 3 are meaningless; it is only the degree of overlap between the constraints that matters.) This ranking not only produces assimilation to the same degree that it is observed in the lexicon (variably word-internally, invariably word-finally), but it also generalizes correctly to hypothetical inputs with final /DD/ or /DT/ sequences (fixing them by devoicing)

There are two things to observe here. The first is that the distribution of voicing in Modern NEY is considerably more complex than has been assumed in recent literature. In fact, although it is true that Yiddish does differ from German in allowing voiced obstruents in coda position, the

[8] It would be more in keeping with the general thrust of the analysis to capture the word-final effect using positional faithfulness. It turns out, however, that this is difficult or impossible. The reason is that the context for consistent devoicing (/V___ C#) seems to be the same or even better than the environments for variable devoicing (/V___ CV, /#___ CV)) in terms of ability to support voicing cues. For expediency, I state the condition as a contextual AGREE constraint instead.

"loss of final devoicing" did *not* yield a language that freely allows them in all positions. In fact, even in the modern language, there are only two places where voiced obstruents freely occur: (1) before sonorants, where they have always been possible, and (2) in root-final position, where there were paradigmatic alternations (and even then, not in clusters with other obstruents). The ranking in (3) is hardly a phonological simplification; the only thing that got simpler about Yiddish is that noun paradigms lack alternations, with modern forms preserving the voicing values previously seen only in the plural.

2.7 The fate of *-nd* and *-ld* clusters

One additional complication that does not seem to play a role in the synchronic grammar of NEY, but does provide further support for the paradigmatic account, concerns the fate of MHG stems ending in *nd* or *ld*. In many such cases, [d] was restored as expected, as seen in (22):

(22) Restoration of [d] in /nd/, /ld/ clusters

	MHG sg., pl.	Yiddish sg.	Yiddish pl.
'picture'	bilt, bilder	bild	bilder
'land'	lant, lender	land	lender
'ribbon'	band, bender	band	bender
'cattle'	rint, rinder	rind	rinder
'child'	kint, kinder	kind[9]	kinder
'forest'	walt, welde/welder	vald	velder
'field'	vëlt, vëlde(r?)	felt/feld	felder
'blind' (adj.)	blint, blinde	blind	blinde
'wild' (adj.)	wilt, wilde	vild	vilde

In some words, however, the voiceless [t] was generalized completely. In many cases, the change from /d/ to /t/ was probably already underway in MHG—for example, NEY *gelt* 'money' derives from MHG *gelt* ∼ *geldes* ∼ *geltes*.[10] In other cases, such as NEY *hunt* 'dog', MHG always shows a [d] in suffixed forms.

[10]This may have been part of a more general [t]/[d] confusion (cf: MHG *tâht* 'wick' ⇒ NHG *Docht*, MHG *dûsent* 'thousand' ⇒ NHG *tausend*, and so on), but the effect was especially strong for [nd] and [ld]. See Paul, Wiehl, and Grosse (1989, §104) for discussion.

(23) Generalization of [t] from MHG [t] ∼ [d]

	MHG sg., pl.	Yiddish sg.	Yiddish pl.	Compare
'money'	gelt, geldes/geltes	gelt	gelter/gelten (??)	
'attire'	gewant, gewandes (/gewantes)	gevant	gevantən	
'healthy'	gesunt, gesuntes/gesundes	gezunt	gezunte	
'dead'	tot, totes/todes	toyt	toyte	
'dog'	hunt, hunde	hunt	hint	hintel 'doggie'
'hand'	hant, hende	hant	hent	hantik 'handy'
'wall'	want, wende	vant	vent	ventel (dimin.)
'region'	gegent, gegende	gegnt	gegntn	gegntik 'regional'
'screw thread'	(NHG Gewinde)	gevint		

In a few words, [t] was generalized within the inflectional paradigm, with traces of [d] remaining elsewhere:

(24) Leveling to [t] within the inflectional paradigm

	MHG sg., pl.	Yiddish sg.	Yiddish pl.	Compare
'wind'	wint, winde	vint	vintən	vintik ∼ vindik 'windy'
'wolf'	wolf, wolve	volf	velf	velfəl ∼ velvəl 'wolfie'

In yet other words, devoicing remains optionally or dialectally:

(25) Variability in [t] ∼ [d]

	MHG sg., pl.	Yiddish sg.	Yiddish pl.	Compare
'base'	grunt, gründe	grunt/grund[11]	grundən (/gruntən?)	
'friend'	vriunt, vriunt/vriunde	fraynd/fraynt[12]	fraynd/fraynt	
'force'	gewalt, gewelde/gewelte	gvalt/gvald	—	gvaldik 'forceful'

At one time, all of these words had [t] in the singular, and [d] in the plural and related forms—so why are there different outcomes in Modern NEY? Two facts seem to be relevant here. The first, noted by King (1980, p. 409), is that [d] tended to be preserved in nouns when the plural ending was [-ər], but [t] was generalized when the plural was [-ə] or null. The devoicing among [-ə] plurals is suggestive, since [-ə] subsequently underwent apocope (*hendə* > *hend*), putting the *d* in final position. This alone could not explain the difference, however, since apocated words did not usually get devoiced (cf. *tagə* > *tag*); in fact, apocope is generally thought to be the source of final voiced obstruents that led to the loss of final devoicing.

The second relevant fact is that during the same period, late MHG/early NHG was gradually eliminating N+voiced stop sequences. For *mb* and *ŋg*, this was solved by deletion: earlier *lember* > modern *Lämmer* 'lambs', earlier *juŋge* > *Juŋe* 'youth', etc. For *nd*, however, the solution was often, for some reason, devoicing: *hinder* > *hinter* 'behind', *munder* > *munter* 'lively'. This process was not exceptionless in German (*ander* remains *ander* 'other'), and in particular, it never affected plurals in *-er*: (*lender* > *Länder*, *kinder* > *Kinder*, etc. (See also Sadock (1973) on devoicing of *-nd*.)

Putting these two facts together, we arrive at the following conjecture: at around the same time as apocope, expected [-ə] plurals like *hend* and *vind* often devoiced to *hent*, *vint*, due not to final devoicing, but rather to a special **nd* ban. (Since devoicing of [nd] > [nt] occurred both intervocalically and word-finally, the exact timing relative to apocope is not crucial). Owing to the sporadic nature of [nd] > [nt], some exceptions remained, at least optionally (*grund*, *fraynd*). Since plurals in *-er* were never affected by [nd] > [nt], they consistently maintained [nd]. Modern Yiddish retains whatever form of the noun was found in the plural (usually [nt] in the former case, always [nd] in the latter).

2.8 Further evidence for leveling from the plural to the singular

There is one last source of evidence that the restoration of voicing was due to paradigmatic pressure from the plural, and not merely a blanket markedness demotion: in addition to final voicing, vowel length was also imported from plural to singular.

In late MHG, a sound change lengthened vowels in open syllables, creating paradigmatic alternations (Paul, Wiehl, and Grosse 1989, §23):[13].

(26) MHG lengthening

a. "Classical" MHG

	Sg.	Pl.
Nom.	tak	tagə
Acc.	tak	tagə
Gen.	tagəs	tagə
Dat.	tagə	tagən

b. Late MHG:

	Sg.	Pl.
Nom.	tak	ta:gə
Acc.	tak	ta:gə
Gen.	ta:gəs	ta:gə
Dat.	ta:gə	ta:gən

In the development from MHG to NEY, short [a] remained [a] (seen in *makhən* 'make', *haltən* 'hold', *vartən* 'wait'), while long [a:] became [ɔ] (*fɔrən* 'travel', *tsɔlən* 'count', *shlɔgən* 'strike', all corresponding to [a:] in NHG). If MHG [tak] had survived into NEY with only the voicing restored, we would expect [tag]; in fact, the NEY form is [tɔg], with the reflex of a long [a:]. As Sapir (1915, p. 238) points out, the most plausible source for length in such words is by leveling from the plural.

Thus, we see that final obstruent voicing was not the only feature to be imported from the plural to the singular. If we attribute the loss of final devoicing to a voicing-specific markedness demotion, we have no account for the leveling of vowel length.

[13] This is not the only possible formulation of lengthening in MHG; see Reis (1974) for an overview and critique of Paul's original analysis.

2.9 Summary of loss of final devoicing

We have seen so far that the outcome of nouns and adjectives in Modern NEY depended on the properties of their plural form. When there was a plural with a root-final voiced obstruent, this was "restored" to the singular (final devoicing *underapplied*)—e.g., sg. *veg* 'way' instead of expected *vek*. In the relatively rare event that the plural devoiced, either because of a ∅ suffix, or the tendency to devoice [nd] > [nt], then voicing was eliminated throughout the paradigm (final devoicing *overapplied*). When the plural had a long vowel, that too was imported to the singular. When there was no paradigmatic pressure, the effects of final devoicing can still be seen in various ways through the ban on voiced codas obstruents outside roots, and the reluctance to create voiceless codas within roots.

This provides support for the traditional view that the Yiddish change was, at its core, motivated by paradigm leveling. The result, however, was overall more marked paradigms, precisely of the type that OP predicts should never be favored:[14]

(27) Leveling to a more marked paradigm:

/bund/, /bund-ə/		OP-IDENT(voi)	FINDEVOI	IO-IDENT(voi)
a.	[bunt], [bundə]	* (t∼d)		*
☠ b.	[bund], [bundə]		*	
☞ c.	[bunt], [buntə]			**

This is not the only case in which paradigms have apparently leveled to a particular slot in the paradigm, regardless of markedness; see, for example, Kraska-Szlenk (1995) on over- and underapplication of *jer* deletion in Polish diminutives, Sturgeon (2003) on over- and underapplication of depalatalization in Czech nouns, and Albright (2002) on leveling of vowel alternations in Yiddish verb paradigms. These cases pose a challenge to the OP architecture, and argue in favor of privileged bases within inflectional paradigms.

3 Analysis of the change using plural as the inflectional base

The problem with the OP approach is that the singular and plural get equal say in determining the outcome of the paradigm. This would be easily solved if, instead of an OP constraint, we used faithfulness to a pre-selected plural base form (either by transderivational correspondence (Benua 1997) or Base-Identity (Kenstowicz 1997)), or a more direct form-to-form mapping as proposed by Bochner (1993), Barr (1994), Albright (to appear), and many others. For concreteness, an analysis using Base-Identity to the plural is shown in (28)

[14] It is worth noting that the word *bund* itself does exist in Yiddish, and is one of the 'variable outcome' *-nd* nouns discussed in section 2.7: Weinreich glosses *bund* as 'tie, bond, alliance, league', and *bunt* as both 'rebellion' and 'bundle'.

(28) Plural form has no devoicing:

/bund-ə/ (pl.)	BASE-ID$_{pl.}$	FINDEVOI	IO-ID(voi)
☞ a. [bundə]			
b. [bunte]			*!

Singular form constrained to match plural:

/bund/ (sg.)	BASE-ID$_{pl.}$	FINDEVOI	IO-ID(voi)
☞ a. [bund]		*	
b. [bunt]	*!		*

In actuality, the change was somewhat more complex than this, because of the opaque interaction of final devoicing and apocope. I have argued elsewhere that such levelings are not necessarily the result of OO constraints at all, but rather the result of how learners learn to project alternations, and how they assess the productivity of alternating and non-alternating patterns (Albright pear). For present purposes, the exact mechanism of leveling is not critical; all that matters is that it must refer to the plural as a privileged base form.

This analysis rests, then, on the assumption that the plural may serve as the base of noun paradigms. Such an assumption seems unappealing, since in this case the plural is suffixed, and can in no way be seen as the "base of affixation" for the singular. This raises numerous questions: can any form in the paradigm be designated as the base? If so, is there any rhyme or reason to which form serves as the base? In the next section, I show briefly how the use of the plural as a base form in Yiddish represents a principled choice, and is correctly predicted by the base selection algorithm proposed in Albright (2002).

4 Base forms as a language-particular choice

The use of the plural as a base form in Yiddish may be unusual, but it seems to serve a purpose. As Vennemann (1972, p. 189) notes: "...no contrasts are lost in the process ...: *k*/*k* : *g*/*g* is a better resolution of *k*/*k* : *k*/*g* than *k*/*k* : *k*/*k* would have been. This seems to be true in general: Sound change neutralizes contrasts, analogy emphasizes contrasts by generalizing them." The intuition is that in this case, the plural is the form that most clearly exhibits lexical contrasts, and extending the plural variant does the least violence to recoverability.

This idea is developed in detail in Albright (2002), in which it is proposed that bases are selected by language learners as part of a strategy that enables them to learn paradigms on the basis of incomplete information. The premise of this proposal is that learners must ideally be able to understand and produce whole paradigms of inflected forms, and in order to do this, they need to learn the morphological and phonological properties of each word. Not every part of the paradigm is equally informative, however, and learners do not have complete paradigms available to them. The hypothesis, then, is that learners identify the part of the paradigm with the most information, and focus on that form to learn the properties of words. (See Albright (2002) for details and algorithmic implementation.)

As applied to a stage of Yiddish prior to leveling, we can see that the plural most clearly displayed lexical contrasts. Consider the task of a language learner, faced with paradigms like those found in MHG:

(29) A few of the many types of MHG noun paradigms

	Singular				Plural			
	Nom.	Gen.	Dat.	Acc.	Nom.	Gen.	Dat.	Acc.
'day'	tac	tages	tage	tac	tage	tage	tagen	tage
'sack'	sac	sackes	sacke	sac	secke	secke	secken	secke
'gift'	gëbe	gëbe	gëbe	gëbe	gëbe	gëben	gëben	gëbe
'word'	wort	wortes	worte	wort	wort	worte	worten	wort
'land'	lant	landes	lande	lant	lender	lender	lendern	lender
'guest'	gast	gastes	gaste	gast	geste	geste	gesten	geste
'tongue'	zunge	zungen	zungen	zungen	zungen	zungen	zungen	zungen

The learner must learn phonological properties of words, such as the underlying voicing value of stem-final consonants (obscured in the nom./acc. sg. by final devoicing), as well as the identity of the root vowel (which is sometimes altered in the plural). In addition, there are unpredictable morphological properties to contend with, such as how the noun pluralizes (*-e*, *-en*, *-er*, ∅; with or without umlaut) and other subtleties of morphological class.

Even without going into all the details of MHG noun classes, it is clear that some forms would be better than others for purposes of inferring these properties. The nominative/accusative singular neutralize most morphological classes (∅ suffix), undergo final devoicing (losing contrastive voicing information).[15]. The genitive singular and dative plural reveal stem-final voicing, but also neutralize most morphological classes. The nominative plural neutralizes some morphological classes, but reveals more distinctions than any other part of the paradigm; in addition, it has the virtue of preserving stem-final voicing.

Early Yiddish had a smaller range of possible paradigm members to choose from: nominative and possessive, in the singular and plural. Among these, the singular forms would have suffered from devoicing of the stem-final consonant, and would also have been uninformative regarding the plural suffix that the noun should take. The nominative plural, on the other hand, would have continued to reveal both stem-final voicing and morphological class. Hence, the nominative plural was *maximally informative*: even if it did not unambiguously reveal every property of every word, it would have done better than any other form in the paradigm. Although a complete computational simulation confirming this result is beyond the scope of this paper, it is clear that the principles laid out in Albright (2002) would favor the plural as the base form in early Yiddish. Furthermore, once this form is selected as the base form, paradigm leveling is predicted to extend whatever properties are found there, regardless of their markedness.

To summarize, the Yiddish loss of final devoicing follows straightforwardly from a theory in which inflectional paradigms have privileged base forms, just like derivational paradigms. Crucially, however, the base must be allowed to vary from language to language, so that the nominative plural could act as the base of Early Yiddish noun paradigms. The attractiveness of such a theory depends on the extent to which the choice of base can be predicted on a language by language basis; I have shown here that the base selection procedure described in Albright

[15]We will never know whether final devoicing in early Yiddish was completely neutralizing, or whether the contrast was partly preserved through secondary cues, as has been argued for languages like Modern German (Fourakis 1984; Port and O'Dell 1986) or Catalan (Dinnsen and Charles-Luce 1984)). In MHG and early Yiddish, devoicing was represented orthographically, raising the possibility that these languages were more like Modern Turkish, in which the neutralization is argued to be complete (Kopkalli 1993). No matter whether the neutralization was complete or partial, however, it is undeniable that the singular afforded less evidence about stem final voicing than the plural did.

(2002) makes the right predictions, and rests on principles that constitute a sensible learning strategy.

5 Conclusion

The goal of this paper has been to provide evidence that inflectional paradigms have bases, just like derivational paradigms. To this end, I have presented several new arguments that the change known as the "loss of final devoicing" in early Yiddish was paradigmatically motivated, as traditional accounts have assumed. This change constitutes a counterexample to some key predictions of the Optimal Paradigms approach—namely, that leveling should always favor overapplication, and extension of less marked allomorphs. This is not a negative result, however. Such cases show that inflectional paradigms have more complex structure than is often supposed, and in particular, that they have privileged base forms, just like derivational paradigms. Furthermore, I have argued that the base form can be identified by independent procedures. Thus, the proposed model actually represents a simplification, not a complication, in how relations between surface forms are computed in phonology.

References

Albright, A. (2002). *The Identification of Bases in Morphological Paradigms*. Ph. D. thesis, UCLA.

Albright, A. (To appear). The morphological basis of paradigm leveling. In L. Downing, T. A. Hall, and R. Raffelsiefen (Eds.), *Paradigms in Phonological Theory*.

Alderete, J. D. (2001). *Morphologically Governed Accent in Optimality Theory*. New York: Routledge.

Alderete, J. D. (2003). Structural disparities in Navajo word domains: A case for LEXCAT-FAITHFULNESS. *The Linguistic Review 20*, 111157.

Bakovic, E. (1999). Assimilation to the unmarked. In J. Alexander, N.-R. Han, and M. M. Fox (Eds.), *University of Pennsylvania Working Papers in Linguistics 6.1*, pp. 1–16.

Barr, R. (1994). *A lexical model of morphological change*. Ph. D. thesis, Harvard.

Beckman, J. (1998). *Positional Faithfulness*. Ph. D. thesis, UMass.

Benua, L. (1997). *Transderivational Identity: Phonological Relations Between Words*. Ph. D. thesis, University of Massachusetts, Amherst.

Bochner, H. (1993). *Simplicity in Generative Morphology*. Berlin: Mouton de Gruyter.

Boersma, P. (1997). How we learn variation, optionality, and probability. *21*, 43–58. http://fon.hum.uva.nl/paul/.

Boersma, P. and B. Hayes (2001). Empirical tests of the Gradual Learning Algorithm. *Linguistic Inquiry 32*(1), 45–86.

Burzio, L. (1996). Surface constraints versus Underlying Representation. In J. Durand and B. Laks (Eds.), *Current trends in phonology: Models and methods*, pp. 97–122. CNRS, Paris, and University of Salford: University of Salford Publications.

Casali, R. F. (1997). Vowel elision in hiatus contexts: Which vowel goes? *Language 73*, 493–533.

Dinnsen, D. and J. Charles-Luce (1984). Phonological neutralization, phonetic implementation and individual differences. *Journal of Phonetics 12*(1), 49–60.

Ernestus, M. (2000). *Voice assimilation and segment reduction in casual Dutch*. Ph. D. thesis, Free University of Amsterdam/Holland Institute of Generative Linguistics.

Féry, C. (1999). Final devoicing and the stratification of the lexicon in german. In *Proceedings of HILP 4*, Leiden.

Fourakis, M. (1984). Should neutralization be redefined? *Journal of Phonetics 12*(4), 291–296.

Hayes, B., B. Tesar, and K. Zuraw (2003). Otsoft 2.1 software package. http://www.linguistics.ucla.edu/people/hayes/otsoft/.

Herzog, M. I. (1965). *The Yiddish Language in Northern Poland: Its Geography and History*. Bloomington, IN: Indiana University.

Hsu, C.-S. (1997). Voicing underspecification in Taiwanese word-final consonants. In M. K. Gordon (Ed.), *UCLA Working Papers in Linguistics, Number 2: Papers in Phonology 3*, pp. 1–24.

Ito, J. and A. Mester (1997). Sympathy theory and German truncations. In V. Miglio and B. Mor'en (Eds.), *University of Maryland Working Papers in Linguistics 5, selected phonology papers from Hopkins Optimality Theory Workshop 1997/University of Maryland Mayfest 1997*, pp. 117–139.

Ito, J. and A. Mester (2002). The phonological lexicon. In N. Tsujimura (Ed.), *A Handbook of Japanese Linguistics*. Oxford: Blackwell.

Ito, J. and A. Mester (2003). On the sources of opacity in OT: coda processes in German. In C. Féry and R. van de Vijver (Eds.), *The Syllable in Optimality Theory*, pp. 271–303. Cambridge University Press.

Jansen, W. (2004). *Laryneal Constrast and Phonetic Voicing: A Laboratory Phonology Approach to English, Hungarian, and Dutch*. Ph. D. thesis, Rijksuniversiteit Groningen.

Katz, D. (1987). *Grammar of the Yiddish Language*. London: Duckworth.

Kenstowicz, M. (1997). Base identity and uniform exponence: alternatives to cyclicity. In J. Durand and B. Laks (Eds.), *Current Trends in Phonology: Models and Methods*, pp. 363–394. Salford: University of Salford.

Kenstowicz, M. (2002). Paradigmatic uniformity and contrast. In A. Csirmaz, Z. Li, A. Nevins, O. Vaysman, and M. Wagner (Eds.), *MIT Working Papers in Linguistics #42: Phonological Answers (and their Corresponding Questions)*.

King, R. D. (1980). The history of final devoicing in Yiddish. In M. I. Herzog, B. Kirshenblatt-Gimblett, D. Miron, and R. Wisse (Eds.), *The Field of Yiddish: Studies in Language, Folklore, and Literature, Fourth Collection*, pp. 371–430. Philadelphia: Institute for the Study of Human Issues.

Kiparsky, P. (1968). Linguistic universals and linguistic change. In E. Bach and R. T. Harms (Eds.), *Universals in Linguistic Theory*. New York: Holt, Rinehart, and Winston.

Kiparsky, P. (1982). Lexical morphology and phonology. In T. L. S. of Korea (Ed.), *Linguistics in the Morning Calm: Selected Papers from SICOL-1981*. Seoul, Korea: Hanshin Publishing Company.

Kopkalli, H. (1993). *A phonetic and phonological analysis of final devoicing in Turkish*. Ph. D. thesis, University of Michigan.

Kraska-Szlenk, I. (1995). *The Phonology of Stress in Polish*. Ph. D. thesis, University of Illinois at Urbana-Champaign.

Lombardi, L. (1999). Positional faithfulness and voicing assimilation in Optimality Theory. *Natural Language and Linguistic Theory 17*, 267–302.

McCarthy, J. (to appear). Optimal paradigms. In L. Downing, T. A. Hall, and R. Raffelsiefen (Eds.), *Paradigms in Phonological Theory*. Oxford: Oxford University Press. Available from the Rutgers Optimality Archive, ROA-485.

Padgett, J. (to appear). Russian voicing assimilation, final devoicing, and the problem of [v]. *Natural Language and Linguistic Theory*.

Paul, H., P. Wiehl, and S. Grosse (1989). *Mittelhochdeutsche Grammatik* (23rd ed.). Max Niemeyer Verlag Tübingen.

Port, R. and M. O'Dell (1986). Neutralization of syllable-final voicing in German. *Journal of Phonetics 13*, 455–471.

Prince, A. and P. Smolensky (1993/2002). Optimality Theory: Constraint Interaction in Generative Grammar. Technical report, Rutgers RuCCS-TR-2/University of Colorado, Boulder CU-CS-696-93. ROA 537, 8/2002 version.

Reis, M. (1974). *Lauttheorie und Lautegeschichte; Untersuchungen am Beispiel der Dehnungs- und Kurzungsvorgange im Deutschen*. Munich: W. Fink.

Sadock, J. M. (1973). Word-final devoicing in the development of Yiddish. In B. B. Kachru, R. B. Lees, Y. Malkiel, A. Pietrangeli, and S. Saporta (Eds.), *Issues in Linguistics: Papers in Honor of Henry and Renée Kahane*, pp. 790–797. Urbana, IL: University of Illinois Press.

Sapir, E. (1915). Notes on Judeo-German Phonology. *The Jewish Quarterly Review 6*, 231–266.

Smolensky, P. (1996). The initial state and 'richness of the base' in Optimality Theory. Technical report, Johns Hopkins University.

Stampe, D. (1969). The acquisition of phonetic representa tion. *Papers from the fifth regional meeting of the Chicago Linguistic Society*, 443–454.

Steriade, D. (1997). Phonetics in phonology: The case of laryngeal neutralization. UCLA ms.

Steriade, D. (2000). Paradigm uniformity and the phonetics/phonology boundary. In J. Pierrehumbert and M. Broe (Eds.), *Papers in Laboratory Phonology, vol. 6*. Cambridge University Press.

Sturgeon, A. (2003). Paradigm uniformity: Evidence for inflectional bases. In G. Garding and M. Tsujimura (Eds.), *WCCFL 22 Proceedings*, Somerville, MA, pp. 464–476. Cascadilla Press.

Vennemann, T. (1972). Phonetic analogy and conceptual analogy. In T. Vennemann and T. H. Wilbur (Eds.), *Schuchhardt, the Neogrammarians, and the transformational theory of phonological change: Four essays by Hugo Schuchhardt, Theo Vennemann, Terence H. Wilbur*, Number 26 in Linguistische Forschungen, pp. 115–179. Frankfurt am Main: Athenäum.

Wagner, M. (2002). The role of prosody in laryngeal neutralization. In A. Csirmaz, Z. Li, A. Nevins, O. Vaysman, and M. Wagner (Eds.), *MIT Working Papers in Linguistics #42: Phonological Answers (and their Corresponding Questions)*, pp. 373–392.

Weinreich, U. (1990). *Modern English-Yiddish, Yiddish-English Dictionary*. New York: Yivo Institute for Jewish Research.

Wright, J. (1950). *A Middle High German primer* (4th ed. revised by M. OC. Walshe ed.). Oxford: Clarendon Press.

Zuraw, K. (2000). *Patterned Exceptions in Phonology*. Ph. D. thesis, UCLA.