A Realization Optimality-Theoretic approach to full and partial identity of forms

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1   Introduction

In this paper we present a Realization Optimality-Theoretic account of full and partial identity of forms, i.e., paradigmatic syncretism and cases in which lexemes share the same inflectional formative. Our approach involves both output-to-output correspondence constraints (Benua 1995, McCarthy and Prince 1995, Kenstowicz 1997, Kager 1999) and realization constraints that associate morphosyntactic feature values with morphophonological forms. We show that Realization Optimality Theory (Xu 2007) offers a unified account of these phenomena. Additionally, we argue that Realization Optimality Theory has advantages over several alternative approaches such as feature impoverishment-plus-insertion (Noyer 1998), rules of referral (Zwicky 1985, Stump 1993), and two different models of OT morphology proposed by Müller (2007, 2008).

The organization of this paper is set as follows. In section 2 we discuss Noyer's 1998 approach to syncretism based on a feature impoverishment-plus-insertion theory. We show that divergent bidirectional syncretism (DBS) (Baerman 2004, Baerman, Brown, and Corbett 2005) poses a problem for Noyer's approach and any other theory that derives syncretism based on markedness hierarchies. By comparison, DBS can be captured by both rules of referral and output-to-output correspondence constraints. Additionally, the Old French two-case system poses a similar problem for a markedness account of syncretism. By comparison, it is well captured under Realization Optimality Theory. In section 3 we show that output-to-output correspondence constraints have advantages over rules of referral in that the former can also account for partially identical inflected forms and therefore have a wider scope of application than rules of referral. Additionally, OO correspondence constraints more explicitly spell out the nature of referral, i.e. referral essentially involves a process of copying a base's morphophonological information. In section 4, we compare our Realization Optimality-Theoretic account of directional syncretism with two alternative OT morphological models proposed in Müller 2007, 2008. We argue that Realization OT offers a more reasonable account. We conclude in section 5 and discuss related issues such as the interaction of morphological and phonological components. We suggest that morphology and phonology are basically distinct components of the grammatical architecture; morphology precedes phonology by default while the morphological and phonological components overlap to an extent that varies among languages.

2   Paradigmatic syncretism

Syncretism is a hot topic in inflectional morphology. It refers to a phenomenon in which several paradigmatic slots share the same form. There are two common ways to capture synchronic syncretism under realization models. First, morphophonologically

identical paradigmatic slots can be assumed to share the same morphosyntactic feature value(s) or form a natural class (Stump 1993, Embick and Halle 2005, Wunderlich 2005, among many others). For example, in Hupa, an Athabascan language, the first and second person plural object markers are identical (Golla 1970, Embick and Halle 2005). Consider the paradigm in (1) (from Embick and Halle 2005).

(1) Hupa Subject / Object Markers[1]

	Subject	Object
1sg	*W-*	*Wɨ-*
2sg	*n-*	*nɨ-*
1pl	*dɨ-*	***noh-***
2pl	*oh-*	***noh-***

As we can see, the {1, pl} and {2, pl} object marker *noh-* share the same feature value {pl}. An economical way to capture this syncretism as argued by Embick and Halle 2005 would be to refer to underspecification of feature values and assume that *noh-* only realizes {pl} so that it can occur in both the {1, pl} and {2, pl} slots under the Subset Principle. Notice that in (1) *noh-* is better analyzed as a plural marker than an object one because the singular and plural objects do not share the same marker *noh-*.

    The first approach to syncretism based on underspecification of feature values is employed in various realizational morphological models. We will get back to it in section 4 where we review an alternative approach (Müller 2008) that completely rejects underspecfication of feature values. A second way to capture syncretism is to use a mechanism that builds a connection between two paradigmatic cells. For example, Stump 1993 proposes an approach to Macedonian syncretism based on rules of referral (Zwicky 1985). Consider the Macedonian partial paradigm in (2).

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[1] We use the following abbreviations for features in this paper: 1: first person; 2: second person; ABL/ABL: ablative case; ABS/abs: absolutive case; ACC/ACC/acc: accusative case; DAT/DAT/dat: dative case; GEN/GEN/gen: genitive case; NOM/NOM/nom: nominative case; SG/SG/sg: singular; PL/PL/pl: plural; I, II, III: positional or inflectional class features; MASC/MASC/masc: masculine; FEM/FEM/fem: feminine; n(eut): neuter; GEND: gender; NUM: number; SUBJ/subj: subject; OBJ/obj: object; OBL/obl: oblique; ADV/adv: adverb; gov: governed; def: default; mpn: male personal name; N: noun.

(2) Macedonian partial verbal paradigm (adapted from Stump 1993: 452)

padn- 'fall'		Aorist		
		I	II	III
1sg	*padn*	-*a*	-*v*	
2sg	*padn*	-*a*		
3sg	*padn*	-*a*		
1pl	*padn*	-*a*	-*v*	-*me*
2pl	*padn*	-*a*	-*v*	-*te*
3pl	*padn*	-*a*		-*a*

As we can see, the aorist marker -*v* occurs in the environment of non-third person (either first or second person). The question is why -*v* does not occur in the environment of {2, sg}. Stump posits a rule of referral that requires the second person singular to share the same form with the third person singular in the past tenses.[2] This rule of referral preempts the less specific *v*-suffixation rule. Stump's treatment of the Macedonian syncretism is criticized in Bobaljik 2001, which advocates a feature impoverishment theory (Noyer 1997, 1998) under which the second person feature value is deleted in the environment of the past tense so that the form of {2, sg} syncretizes with the default third person form. Bobaljik remarks that rules of referral are not restrictive about syncretic directions and by contrast, "[t]he impoverishment rule … [assumes] that third person is a default (either in terms of the rules of exponence in Macedonian or universally)" (Bobaljik 2001: 63).

We will first discuss phenomena in which either a rule of referral or feature impoverishment (-plus-insertion) is supposed to apply and then get back to underspecification of feature values. We show that both divergent bidirectional syncretism (DBS) and the Old French two-case system pose a problem for a feature impoverishment-plus-insertion theory (Noyer 1998). Both cases can be captured by either rules of referral or output-to-output correspondence constraints in a Realization OT model (Xu 2007).

2.1 Divergent bidirectional syncretism

Noyer 1998 makes a strong empirical claim that under the impoverishment-plus-insertion theory, systematic syncretisms "will always move from a more marked to a less marked state" (p.282). According to this theory, when two paradigmatic cells are directionally syncretic, it is always the more marked feature value set that is converted into the less marked one.

Divergent bidirectional syncretism (DBS) (Baerman 2004, Baerman, Brown, Corbett 2005) poses a problem for this empirical claim. Baerman (2004: 816) gives the following definition of DBS:

(3) Under divergent bidirectional syncretism, there is a feature value *x* that takes the

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[2] Stump's 1993 original paradigm includes imperfect forms, which are identical with the aorist ones with respect to the occurrence of -*v*.

form associated with feature value *y* in some contexts, while in other contexts *y* takes the form associated with *x*.

Baerman illustrates DBS with cases from the Latin second declension, Classical Arabic declension, and Diyari declension.[3]

    Consider the Latin second declension. The suffix *-us* is the exponent of the nominative singular and marks the nom sg of both default masculine nouns and a group of neuter nouns including *vulgus* 'crowd', *vi:rus* 'poison', and *pelagus* 'sea'. By contrast, *-um* is the exponent of the accusative singular and marks the acc sg of both default neuter and default masculine nouns. See (4).

(4) The Latin second declension (adapted from Baerman 2004: 816)

	DEFAULT NEUTER 'war'	DEFAULT MASCULINE 'slave'	NOM & ACC in *-us* 'crowd'
NOM SG	***bell-um***	*serv-us*	*vulg-us*
ACC SG	*bell-um*	*serv-um*	***vulg-us***
GEN SG	*bell-ī*	*serv-ī*	*vulg-ī*
DAT SG	*bell-ō*	*serv-ō*	*vulg-ō*
ABL SG	*bell-ō*	*serv-ō*	*vulg-ō*

The acc sg of nouns such as *vulgus* 'crowd' syncretizes with the nom sg by taking *-us* as its exponent. An analysis based on impoverishment-plus-insertion will delete the acc feature value and add the nom feature value so that the vocabulary item *-us* ↔ nom sg can be inserted, as in (5).[4] This analysis conforms to the tenet of feature impoverishment-plus-insertion that the form of a less marked feature value always prevails.

(5) a. acc sg → sg → nom sg (in the environment of nouns like *vulgus*)
    b. *-us* ↔ nom sg

    The syncretism of the nom sg and acc sg of default neuter nouns, however, contradicts the tenet of impoverishment-plus-insertion. The nom sg of the second declension default neuter nouns takes on the form of the acc sg. Given that nom is universally less marked than acc (see e.g., Comrie 1975, 1976, Woolford 2001),

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[3] See also Carstairs-McCarthy 1998, Baerman, Brown, and Corbett 2005 for criticisms of the impoverishment theory from a different perspective, i.e., if we reasonably manipulate the morphosyntactic feature values of vocabulary items, impoverishment will make different predictions about syncretic directions.
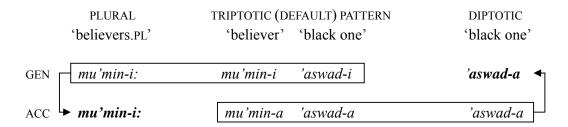
[4] Third declension neuter nouns like *tempus* 'time' pattern similarly to *vulgus*, in that the form of both the nom and acc resembles the masculine and feminine nominative (e.g., *dens* 'tooth', *miles* 'soldier').

impoverishment-plus-insertion unexpectedly moves from a less marked to a more marked state:

(6) a. nom sg → sg → acc sg (in the environment of default neuter nouns)
    b. *-um* ↔ acc sg

Another case of DBS comes from Classical Arabic declension. According to Baerman, "(i)n the so-called sound plurals (formed by suffixation), genitive and accusative are syncretic, marked by the ending *-i:*, which corresponds to the distinct genitive of the default type. Diptotic nouns (certain adjectival stems, some broken plurals, and some personal names) likewise have a syncretic genitive/accusative, but the ending is *-a*, corresponding to the distinct accusative of the default type" (p.817). As we can see from (7), the genitive of diptotic nouns takes on the form of the acc. By contrast, the acc of sound plurals takes on the form of the gen.
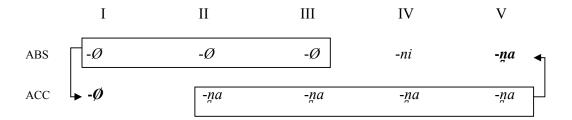
(7) Classical Arabic declension (adapted from Fischer 1997: 196 and Baerman 2004: 817)

	PLURAL 'believers.PL'	TRIPTOTIC (DEFAULT) PATTERN		DIPTOTIC 'black one'
		'believer'	'black one'	
GEN	*mu'min-i:*	*mu'min-i*	*'aswad-i*	**'aswad-a**
ACC	**mu'min-i:**	*mu'min-a*	*'aswad-a*	*'aswad-a*

According to Comrie (1975, 1976), acc is universally less marked than gen. (See the Case Hierarchy in (8).) Therefore, it is against the tenet of impoverishment-plus-insertion that the acc of sound plurals takes the form of the gen, a more marked feature value.

(8) The Case Hierarchy (Comrie 1975, 1976)
    subject > direct object > indirect object > oblique
    (nom)   (acc)   (dat)   (gen)

The third instance of DBS comes from Diyari declension. In Diyari, the absolute case has a zero exponent and the suffix *-ṇa* is the exponent of the acc. As we can see from (9), the abs of Type V nouns (male personal names) takes on the marker of the acc, i.e., a less marked feature value takes on the form of a more marked one, given that Diyari is an ergative language. This again violates the tenet of impoverishment-plus-insertion.

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(9) Diyari declension (adapted from Austin 1981: 47-50, 61, Baerman 2004: 818)

	I	II	III	IV	V
ABS	-Ø	-Ø	-Ø	-ni	**-n̪a**
ACC	-Ø	-n̪a	-n̪a	-n̪a	-n̪a

I = singular nouns
II = non-singular nouns, non-singular 3rd person pronouns, singular pronouns
III = non-singular 1st and 2nd person pronouns
IV = female personal names, singular pronouns
V = male personal names

In effect, as long as there is a markedness difference between the two feature values *x* and *y* in a case of DBS, it will pose a potential problem for the empirical claim that syncretism obeys markedness.

One may try to save this empirical claim by assuming that the form of a marked feature value acts as a default marker. For example, in Latin, *-um* may be treated as an "elsewhere" marker. To account for the syncretism of the nom sg and acc sg of default neuter nouns, impoverishment-plus-insertion will delete the nom feature value so that the default marker *-um* can be inserted:

(10) a. nom → Ø / default neuter
    b. *-um* ↔ Elsewhere

The same analysis applies to the syncretism of the gen and acc of sound plurals in Classical Arabic. That is, the gen exponent *-i* is treated as a default. The acc feature value is deleted in the environment of sound plurals so that *-i* can be be inserted (ignoring the vowel lengthening of the plural marker for the moment). The syncretism of the abs and acc in Diyari can be analyzed in the same way. The acc exponent *-n̪a* is a default marker. The abs feature value is deleted in the environment of male personal names so that *-n̪a* can be inserted.

It is, however, unmotivated to assume that the form of a marked feature value acts as a default in the cases of DBS in question. Bobaljik 2001 argues in favor of the impoverishment theory in Noyer (1997, 1998) and suggests that the form of a universally less marked feature value tends to be a default. Therefore, *-us* ↔ nom sg should be a more suitable candidate for a default than *-um* ↔ acc sg in the Latin second declension; *-a* ↔ acc should be more suitable for a default than *-i* ↔ gen in Classical Arabic; and *-Ø* ↔ abs should be more suitable for a default than *-n̪a* ↔ acc in Diyari, because the former feature values are universally less marked than the latter ones, respectively. Additionally, within these languages it is not clear why we should

choose the forms of the latter feature values as defaults rather than those of the former ones, given that the forms of both marked and less marked syncretic feature values occupy equal numbers of paradigmatic cells as we can see in (4),[5] (7), and (9).

To briefly summarize, the above cases of DBS pose a problem for the strong claim of an impoverishment-plus-insertion theory that the form of a less marked feature value always prevails. To account for cases of DBS, impoverishment-plus-insertion needs to introduce the form of a less marked feature value in some cases and the form of a more marked feature value in others, or it sometimes needs to assume an unmotivated default marker. In fact, DBS poses a problem for any type of account of directional syncretism based on markedness feature hierarchies as those in Comrie 1975, 1976, Aissen 1999, Woolford 2001.[6]

2.2 Old French two-case system

Additionally, the Old French two-case system poses a similar problem for an account based on markedness hierarchies of features. Old French had a system of two cases: nominative and accusative[7]. The nominative singular and accusative plural of regular masculine nouns were marked by the suffix -s, which also marked the plural of regular feminine nouns. The masculine nominative plural did not have an overt marker. See the tables in (11).

(11) a. Regular masculine nouns like *murs* "wall"

	SG	PL
NOM	*murs*	*mur*
ACC	*mur*	*murs*

b. Regular feminine nouns like *porte* "door"

	SG	PL
NOM	*porte*	*portes*
ACC	*porte*	*portes*

If we assume that the default substantive plural marker in Old French is the suffix -s, which occupies more plural cells than -Ø, the nominative singular of a masculine noun syncretizes with the default plural, i.e. the former takes the marker of the latter. This case of syncretism again violates the prediction of directional syncretism based on markedness hierarchies of features, assuming that singular is universally less marked than plural.[8,9]

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[5] In (4) the dative marker -ō seems to be the most suitable candidate for a default since it occupies the largest number of paradigmatic slots.

[6] Wunderlich (2000, 2005) describes syncretism on the basis of impoverishment and underspecification. Baerman (2004) criticizes Wunderlich's (2005) treatment of syncretism and remarks that underspecification is incapable of accounting for DBS.

[7] Some works (e.g. Detges 2009) term the Old French accusative "oblique case."

[8] See Matthews 1991 for relevant reasoning that singular is less marked than plural.

2.3 A Realization Optimality-Theoretic account of paradigmatic syncretism

In this section we present a Realization Optimality-Theoretic account of the above-mentioned cases of directional syncretism. Realization Optimality Theory is an inferential-realizational model of morphology (Matthews 1972, Zwicky 1985, Anderson 1992, Aronoff 1994, Stump 1993, 2001) within the framework of Optimality Theory. Following Russell 1995, Kager 1996, Yip 1998, MacBride 2004, we assume that the phonological information of inflectional affixes is introduced through realization constraints that associate abstract morphosyntactic feature values with phonological forms. For example, the constraint {plural}: -*z* requires the feature value {plural} to be realized by the suffix -*z*. We assume that the input to realization consists of stems and unrealized morphosyntactic feature values. Following Grimshaw 1997, we assume that morphosyntactic feature values remain identical in both the input and output. We propose the constraint ranking schema in (12) to account for directional syncretism.

(12) output-to-output correspondence constraints >> realization constraints

Output-to-output (OO) correspondence constraints (Benua 1995, McCarthy & Prince 1995, Kenstowicz 1997, Kager 1999) make a new form identical to a base form. These constraints are "asymmetrical" because there is a direction between a base and a copier. It is always a base that determines the phonological shape of a copier and not vice versa. Since these constraints reflect a directional copying process, they are well applicable to cases of DBS in which there is a clear syncretic direction.

We propose two relevant OO correspondence constraints[10] and two realization constraints in (13) to account for the syncretism of the nom sg and acc sg of both default neuters and neuter nouns like *vulgus* in the Latin second declension.

(13) a. IDENT (acc sg (base), nom sg / def(ault) n(euter)) (F): Corresponding
        segments of the forms of both the base acc sg and the nom sg in the
        context of a default neuter have identical values for any phonological
        feature. (IDENT AN)[11]

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[9] The loss of Old French -*s* is highly complicated and controversial. This paper will not tackle this issue. See Detges 2009 for a review of various approaches to it.

[10] Apart from the feature identity constraints in (13), there are other OO correspondence constraints such as MAX-OO which bans the deletion of a segment of a base and DEP-OO which bans the occurrence of a segment in the output that does not have a correspondent in the base. For simplicity of presentation we sometimes omit the discussion of some OO correspondence constraints which are not crucial to our results.

[11] This constraint can also be formulated as follows. Corresponding segments of the forms of both the base acc sg and the nom sg plus a diacritic feature <default neuter> have identical values for any phonological feature.

b. IDENT (nom sg (base), acc sg / nouns like VULG) (F): Corresponding segments of the forms of both the base nom sg and the acc sg in the context of nouns like VULG have identical values for any phonological feature. (IDENT NA)

c. {nom, sg}: -*us*: Nominative singular is marked by the suffix -*us* in the output.

d. {acc, sg}: -*um*: Accusative singular is marked by the suffix -*um* in the output.

Additionally, we refer to the markedness constraint *FEATURE SPLIT (Xu 2007) in (14) to rule out extended morphological exponence (**um-us*).

(14) *FEATURE SPLIT: A morphosyntactic feature value should not be realized by more than one exponent. (*FS)

In conventional OT literature constraints are assumed to have universal status but realization constraints are necessarily language-specific in that they realize arbitrary Saussurean signs. It is important to emphasize that the target of conventional OT is phonology while our model mainly deals with morphology, which, since at least Ferdinand de Saussure, has emphasized arbitrary associations of meaning and form. In other words, morphological realization is necessarily language-particular, in any framework. Our paper is concerned with morphological realization, not with phonology and language-particular realization constraints are crucial in dealing with morphological phenomena, by definition. Whether language-particular constraints are necessary for purely phonological aspects of language is, thus, completely outside the scope of our work. As Wunderlich 2006 remarks, it remains a question whether all constraints must belong to a universal set, or whether there can be language- or even construction-specific constraints. The effects of the OCP constraint, for example, are universally observed while each instantiation of this constraint is language-particular (cf. Yip 1998, Mohanan and Mohanan 2003). Mohanan and Mohanan (2003) propose a model in which a universal constraint matrix generates language-particular constraints. Similarly, we assume that each specific realization constraint is a language-particular instantiation of a universal constraint that associates meaning with form.

Let us first consider the syncretism of the nom and acc of default neuters. We assume that an input contains both a lexical stem and inherent features of a lexeme, and abstract morphosyntactic feature values that remain constant. The function *Gen* generates an infinite list of morphophonological forms which spell out the lexeme and the abstract morphosyntactic feature values.[12] We assume that, for example, an input

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[12] See McCarthy 2009, to appear for a different interpretation of the function *Gen*. Under this interpretation, *Gen* is a powerful part of the grammar that participates in the selection of output forms apart from constraint rankings. *Gen* rules out all the logical output possibilities that are not minimally different from the input so that they cannot stand in correspondence to the input.

contains both the lexeme BELL whose lexical stem is *bell* and the morphosyntactic feature values nom sg; we assume that *-um* {acc, sg} is a base whose morphophonological form is to be copied.[13] Consider the tableau in (15). The word *bell-um* is the winning candidate although it violates the lower ranked constraint {nom, sg}: *-us*. The candidate **bell-us* fatally violates the OO correspondence constraint IDENT AN because /s/ of *-us* does not correspond to /m/ of *-um* in the base with respect to a phonological feature (e.g., voicing, nasality). The form **bell-um-us* {nom, sg} is ruled out by *FEATURE SPLIT, which bans extended exponence.

(15) BELL (Latin)

BELL (def n), nom, sg │ *bell* Base: acc sg: *-um*	IDENT AN	IDENT NA	*FS	{nom, sg}: *-us*	{acc, sg}: *-um*
☞ a. BELL (def n) nom sg │ ∨ *bell* *-um*				*	
b. BELL (def n) nom sg │ ∨ *bell* *-us*	*!				
c. BELL (def n) nom sg │ ⋈ *bell* *-um* *-us*			*!*		

The same grammar can account for the syncretism of the nom sg and acc sg of nouns like VULG in the Latin second declension. We assume that the input comprises the lexeme VULG and its lexical stem *vulg* and the morphosyntactic feature values acc sg. We also assume that the relevant base is *-us* {nom, sg}. The output candidate **vulg-um* {acc, sg} fatally violates the constraint IDENT NA because /m/ of *-um* does not correspond to /s/ of *-us* in the base with respect to phonological features such as voicing, nasality. The form *vulg-us* {acc, sg} is the winning candidate despite its violation of the lower-ranked constraint {acc, sg}: *-um*. See (16).

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[13] The notion of a base in this chapter is a morphophonological form which is to be copied. By contrast, Kager (1999) gives a different definition of a base and proposes that a base should be a free-standing word and contains a subset of the grammatical features of the derived form.

(16) VULG (Latin)

VULG, acc, sg | vulg Base: nom sg: -us	IDENT AN	IDENT NA	*FS	{nom, sg}: -us	{acc, sg}: -um
☞ a. VULG acc sg | ∨ vulg -us					*
b. VULG acc sg | ∨ vulg -um		*!			
c. VULG acc sg | ⋈ vulg -um -us			*!*		

To account for the syncretism of the gen and acc of sound plurals in Classical Arabic, we propose three crucial constraints in (17).

(17) a. IDENT (gen (base), acc / plural) (vowel height): Corresponding segments of the forms of both the base gen and the acc in the context of a plural have identical values for vowel height. (IDENT GA (VH))

  b. {pl}: long vowel: Plurals are marked by long vowels. ({pl}: LV)

  c. {acc}: -a: The accusative is marked by the suffix -a in the output.

Consider the tableau in (18). We assume that an input, for example, comprises the lexeme MU'MIN whose lexical stem is mu'min and the feature value set {acc, pl}. We also assume that the relevant base is -i {gen}. The word mu'min-i: is the winning candidate although it violates the lower-ranked constraint {acc}: -a. The illicit candidate *mu'min-i is ruled out by the grammar because it fatally violates the constraint {pl}: LV which requires the plural to be marked by a long vowel. The illicit candidate *mu'min-a is also ruled out because it fatally violates both the constraints IDENT GA (VH) and {pl}: LV in that /a/ is a short vowel and does not correspond to /i/ of the genitive base.

(18) MU'MIN (Classical Arabic)

MU'MIN, acc, pl *mu'min* Base: gen: *-i*	IDENT GA (VH)	{pl}: LV	{acc}: *-a*
☞ a. MU'MIN acc pl *mu'min* *-i:*			*
b. MU'MIN acc pl *mu'min* *-i*		*!	*
c. MU'MIN acc pl *mu'min* *-a*	*!	*	

    To account for the syncretism of the absolutive and accusative of both male personal names (Type V nouns) and singular nouns (Type I nouns) in Diyari declension, we propose two crucial OO correspondence constraints and two realization constraints in (19).

(19) a. MAX (acc (base), abs / male personal name): Every segment in the base accusative form has a correspondent in the form of the absolutive in the environment of a male personal name (mpn). (MAX (acc, abs))

   b. DEP (abs (base), acc / singular noun): Every segment in the form of the accusative has a correspondent in the base absolutive form in the environment of a singular noun. (DEP (abs, acc))

   c. {abs}: -Ø: The absolutive is marked by a zero suffix in the output.

   d. {acc}: -*ṉa*: The accusative is marked by the suffix -*ṉa* in the output.

    Let us first consider the syncretism of the accusative and absolutive of male personal names. Assume the input comprises a male personal name and the absolutive feature value and the relevant base is -*ṉa* {acc}. Consider the tableau in (20). The affix -*ṉa* is the winning candidate although it violates the lower-ranked constraint {abs}: -Ø. The output candidate *-Ø fatally violates the OO correspondence constraint MAX (acc, abs) because the base form has no correspondent in the output.

(20) Male personal name (Diyari)

abs / mpn Base: acc: -ṇa	MAX (acc, abs)	DEP (abs, acc)	{abs}: -Ø	{acc}: -ṇa
☞ a. abs / mpn | -ṇa			*	
b. abs / mpn | -Ø	ṇ!a			

The same grammar can account for the syncretism of the accusative and absolutive of singular nouns. Assume the input contains a singular noun and the accusative feature value and the relevant base is -Ø {abs}. The output candidate *-ṇa fatally violates the OO correspondence constraint DEP (abs, acc) because the output has no correspondent in the base. See the tableau in (21).

(21) Singular noun (Diyari)

acc / singular Base: abs: -Ø	MAX (acc, abs)	DEP (abs, acc)	{abs}: -Ø	{acc}: -ṇa
☞ a. acc / singular | -Ø				*
b. acc / singular | -ṇa		ṇ!a		

To account for the syncretism in the Old French two-case system (11), we propose the relevant realization and OO correspondence constraints in (22).

(22) a. MAX ({pl} (base), {masc, nom, sg}): Every segment in the base plural form has a correspondent in the form of nominative masculine singular.

b. DEP ({sg} (base), {masc, nom, pl}): Every segment in the form of nominative masculine singular has a correspondent in the base singular form.

c. {pl}: -s: The plural is marked by the suffix -s in the output.

d. {sg}: -Ø: The singular is marked by a zero suffix in the output.

Every paradigmatic cell in (11) can be accounted for by the ranking schema under which *FEATURE SPLIT and the more specific OO correspondence constraints (22a-b) outrank the less specific realization constraints (22c-d). Let us see how our grammar derives the illustrative Old French paradigmatic cells, i.e. {masc, nom, sg}, {masc,

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nom, pl}, and {fem, nom, pl}. Consider first the tableau in (23). Candidate (a) wins even if it violates the lower ranked constraint that requires the singular to be realized by a zero suffix. Candidate (b) is ruled out because the base plural suffix -*s* is not spelled out in the output. Candidate (c) is ruled out by *FEATURE SPLIT because the singular is doubly realized by both -*s* and -Ø.

(23) Nominative masculine singular (Old French)

MUR "wall" masc, nom, sg | *mur* Base: {pl}: -*s*	*FS	MAX ({pl}, {masc, nom, sg})	DEP ({sg}, {masc, nom, pl})	{pl}: -*s*	{sg}: -Ø
☞a. MUR "wall" masc, nom, sg | ⌄ *mur* -*s*					*
b. MUR "wall" masc, nom, sg | ↓ *mur* -Ø		*!			
c. MUR "wall" masc, nom, sg | ⌄ | *mur* -*s* -Ø	*!				

Similarly, in (24) Candidate (a) wins though it violates the constraint {pl}: -*s*. Candidate (b) is ruled out because it violates DEP ({sg} (base), {masc, nom, pl}), which requires the nominative masculine plural to copy a zero suffix. Candidate (c) is ruled out by *FEATURE SPLIT because the plural is doubly realized by both -Ø and -*s*.[14]

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[14] The markedness constraint *FEATURE SPLIT should outrank OO constraints in Old French so that in some irregular nominative masculine singular forms a suppletive stem that marks masculine, nominative, and singular blocks the suffix -*s*, which syncretizes with the plural and marks {nom, masc, sg} in regular forms (11). In the following paradigm, the suppletive form *lerre* 'robber, thief' marks {nom, masc, sg} without taking the suffix -*s*.

Two-case declension of OF masculine class III nouns (*lerre* 'robber, thief')

	Nominative	Accusative
Singular	*lerre*	*larron*
Plural	*larron*	*larron-s*

(24) Nominative masculine plural (Old French)

MUR "wall" masc, nom, pl | *mur* Base: {sg}: -Ø	*FS	MAX ({pl}, {masc, nom, sg})	DEP ({sg}, {masc, nom, pl})	{pl}: -*s*	{sg}: -Ø
☞a. MUR "wall" masc, nom, pl | ↘↓↙ *mur* -Ø				*	
b. MUR "wall" masc, nom, pl | | *mur* -*s*			*!		
c. MUR "wall" masc, nom, pl | ↘↓↙ | *mur* -Ø -*s*	*!				

In (25) the nominative feminine plural form *portes* satisfies all the constraints and becomes the winning candidate.

(25) Nominative feminine plural (Old French)

PORTE "door" fem, nom, pl | *porte*	*FS	MAX ({pl}, {masc, nom, sg})	DEP ({sg}, {masc, nom, pl})	{pl}: -*s*	{sg}: -Ø
☞a. PORTE "door" fem, nom, pl | | *porte* -*s*					
b. PORTE "door" fem, nom, pl | | *porte* -Ø				*!	

Our Realization OT grammar in which OO correspondence constraints outrank realization constraints performs as well as rules of referral (Zwicky 1985, Stump 1993) in accounting for directional syncretism of fully identical forms. Take the syncretism of the nom sg and acc sg of default neuters in the Latin second declension as an example. Consider the rules in (26) (Baerman 2004: 816). The rule of referral in (26a) states that in the environment of a default neuter, the nom sg refers to the phonological form of the acc sg. This rule of referral feeds the rule of exponence in (26b) which spells out the acc sg. Unlike the impoverishment-plus-insertion theory that makes an excessively restrictive prediction about directions of syncretism, the constraint-based grammar and rules of both referral and exponence have no problem accounting for directional syncretism of fully identical forms.

(26) a. nom sg in default neuter = acc sg

b. acc sg = stem + *-um*

Compared to rules of referral, a grammar with OO correspondence and realization constraints more explicitly shows that cases of syncretism in which a direction has to be specified involve a *copying process*. The proposed constraint-based grammar also captures the two functions of a rule of exponence, i.e., a rule of exponence not only spells out morphosyntactic feature values but also sometimes provides a base which is to be copied by a distinct set of morphosyntactic feature values in a rule of referral.

A related question arises. What can act as a base which is to be copied when we need to specify the direction of syncretism? There are several possibilities, which by no means form an exhaustive list. First, the phonological form realizing a feature value which occupies more paradigmatic cells of this feature value may act as a base (e.g., in the Latin second declension, *-um*, which marks accusative singular, acts as a base for the nominative singular of a default neuter to copy because *-um* occupies more accusative cells than nominative ones). Second, the phonological form which realizes a universally less marked feature value tends to be a base (Noyer 1998, Bobaljik 2001). Additionally, Albright 2008 argues that the plural form in early Yiddish was a base on which morphological leveling took place although the plural is a marked feature value. He remarks 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."

3   Partial Identity of Forms

In this section we show that output-to-output correspondence constraints are more fine-grained mechanisms than rules of referral although both can capture directional syncretism. OO correspondence constraints can also capture forms which are partially identical while by contrast rules of referral connect two fully identical forms.

3.1 Pinker 1998

Pinker 1998 observes that English words such as *workman* and *snowman* have the irregular inflection *X-men* while *Walkman* 'a personal stereo' doesn't. Based on the Right-hand Head Rule (Williams 1981), Pinker argues that the plural form of *Walkman* is *Walkmans* instead of **Walkmen* because something (let's say "X") prevents *Walkman* from inheriting its manner of inflection from its rightmost morpheme *-man*. Pinker assumes the structure for *Walkman* is [N [V *Walk*] [X [N *man*]]]. Pinker's account leaves two questions unaddressed: (i) It is not clear what this "something" or X refers to. (ii) It is not clear why this X stands in between the nominal categories in cases like *Walkman*.

3.2 A Realization Optimality-Theoretic account of partial identity of forms

We show that the ranking schema under which OO correspondence constraints outrank realization constraints can account for the distinction between *snowmen* and

Walkmans. We organize nouns including *workman* and *snowman* with both the morpheme -*man* (/mæn/) and the sense of "human appearance" into one inflectional class (Aronoff 1994) in that they decline in the same way to realize the plural feature value. Let us call this class "*man*-class." We propose a relevant OO correspondence constraint and a realization constraint in (27).

(27) a. IDENT (pl / MAN), (pl / {N, *man*-class}) (F): Corresponding segments of both the plural exponent of MAN and a *man*-class noun have identical values for any phonological feature. (IDENT (pl / MAN), (pl / *man*-class))

   b. {pl}: -*s*: Plural is realized by the suffix -*s* in the output.

Let us first consider *snowmen*. We assume that the input comprises the lexeme SNOWMAN and its stem *snowman* and the plural feature value. The relevant base is *men*, which realizes both MAN and the plural feature value. Consider the tableau in (28). The word *snowmen* is the winning candidate although it violates the lower-ranked constraint {pl}: -*s*. The word *snowmen* satisfies IDENT (pl / MAN), (pl / *man*-class) because corresponding segments of both *men* and *snowmen* have identical phonological feature values.[15] The illicit form *snowmans fatally violates the OO correspondence constraint because the plural exponent *men* in the base does not correspond to the plural exponent -*s* in the output with respect to phonological features. The illicit form *snowmens violates *FEATURE SPLIT because the plural feature value is realized twice.

(28) SNOWMAN

[SNOWMAN, *man*-class], pl *snowman* Base: [MAN, *man*-class], pl *Men*	IDENT (pl / MAN), (pl / *man*-class)	*FEATURE SPLIT	{pl}: -*s*
☞ a. [SNOWMAN, *man*-class], pl *Snowmen*			*
b. [SNOWMAN, *man*-class], pl *snowman* -*s*	*!		
c. [SNOWMAN, *man*-class], pl *snowmen* -*s*		*!	

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[15] The word *snowmen* violates the constraint DEP-OO which requires no occurrence of additional segment compared to the base *men*. DEP-OO should therefore rank lower than MAX-IO which requires no deletion of the input segments of *snowman*. The output candidate *men fatally violates MAX-IO and is therefore ruled out.

Next, let us consider *Walkmans*. We assume that the input comprises the lexeme WALKMAN and its stem *Walkman* and the plural feature value. The base is *men*, which realizes both MAN and the plural feature value.[16] The constraint IDENT (pl / MAN), (pl / *man*-class) does not apply to *Walkmen* or *Walkmans*, because WALKMAN is not a *man*-class noun since WALKMAN does not denote the sense of "human appearance." *Walkmen* is ruled out by the constraint {pl}: -*s*. *Walkmans* is the winning candidate, which satisfies both the constraints IDENT (pl / MAN), (pl / *man*-class) and {pl}: -*s*. See the following tableau.

(29) WALKMAN

WALKMAN, pl *Walkman* Base: [MAN, *man*-class], pl *men*	IDENT (pl / MAN), (pl / *man*-class)	{pl}: -*s*
☞ a. WALKMAN, pl *Walkman* -*s*		
b. WALKMAN, pl *Walkmen*		*!

This analysis captures the observation that the plural form of MAN is unpredictable[17] while there is a productive process in which the plural forms of *man*-class nouns copy the plural form of MAN. Similar analyses apply to other inflectional classes in English such as the *go*-class including *go, forgo, undergo*, etc. and the *stand*-class including *stand, understand, withstand*, etc.[18]

Additionally, this approach circumvents the problems for Pinker's (1998) analysis of *Walkmans*. It straightforwardly shows that the plural form of WALKMAN does not

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[16] It is possible that there is no base for WALKMAN to copy given that by contrast all *man*-class nouns are free-standing words and have the semantic structure "something that looks like a man." This assumption, however, encounters a problem when we account for, for example, the past tense forms of UNDERGO, FORGO, etc. which have *went* as their base. Verbs like UNDERGO, FORGO are semantically unrelated to GO.

[17] If we follow Pinker (1998), we can assume that the irregular form *men* is listed in the lexicon. By contrast, Distributed Morphology (Halle and Marantz 1993) would assume that -Ø marks the plural of the Root √MAN, which is followed by a readjustment rule triggering a Root-internal vowel change.

[18] Kiparsky 1982b discusses a case where the past tense form of the verb *grandstand* is *grandstanded* instead of **grandstood*. Following Kiparsky 1982b, we assume *stand* in *grandstand* is a noun and therefore exclude *grandstand* from the *stand*-class in which no member contains the noun *stand*.

copy *men* because the meaning of the whole lexeme prevents WALKMAN from joining the *man*-class.

3.3 Rules of Referral

OO correspondence constraints have a wider scope of application than rules of referral (Zwicky 1985, Stump 1993) which would encounter problems to account for partial identity of forms. In the spirit of Zwicky (1985), who uses rules of exponence to realize German suppletive determiners,[19] we can propose a rule of exponence in (30) to realize the plural of the lexeme MAN.

(30) {MAN, pl} = *men*

We cannot, however, use a rule of referral like (31) to realize the plural form of the lexeme SNOWMAN because otherwise the plural form of SNOWMAN would be *men* instead of *snowmen*.[20] Rule (31) says that the plural form of SNOWMAN is identical to the plural form of MAN which is *men*.

(31) {SNOWMAN, pl} = {MAN, pl}

4   Müller 2007, 2008

In this section we discuss two alternative OT morphological approaches to syncretism in Müller 2007, 2008 and continue to argue for the superiority of Realization OT.

Müller 2007 proposes a "radically non-morphemic" approach to syncretism, which rejects directional approaches to syncretism such as referral and dispenses with Saussurean associations of meaning and form. He uses negatively defined constraints to rule out all other logically possible combinations of meaning and form in order to derive a single correct output. For example, to derive the nominative singular exponent of a neuter noun in Latin second declension, i.e. -*um*, he will have to use negatively defined constraints to forbid other logically possible morphs to realize the morphosyntactic feature values (e.g. *-*us* {nom, sg, neuter}, *ō {nom, sg, neuter}, …)[21]

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[19] Zwicky's rule of exponence is formalized as follows, for example. "[INDEX: 15, CASE: nom, GEND: neut, NUM: sg] is realized as /das/" (Zwicky 1985: 383).

[20] The Head Application Principle (Stump 2001) accounts for the plural form of SNOWMAN, though it is not clear how it accounts for the plural form of WALKMAN.

[21] We simplify Müller's 2007 notations. He uses binary morphosyntactic features, e.g. {nom} = {[+subject], [-object], [-oblique], [-adverb]}. He orders morphs along a sonority scale and assigns either a phonological feature (e.g. [+continuant]) or an arbitrarily defined feature of sonority range to a group of morphs. It is not clear to us why and how morphs are ordered along a sonority scale. Additionally, his ordering can be arbitrary: sometimes it is a vowel that determines the sonority level of a morph that also contains consonants; sometimes it is a consonant that determines the sonority

One of the problems with this type of approach lies in language acquisition, as Müller 2007 admits. A child will have to learn an immense list of negatively defined restrictions before he acquires one exponent. Notice that morphs that are not inflectional exponents can also participate in competing for a specific paradigmatic slot given that his approach is radically non-morphemic in that a morph is not associated with any meaning.

Müller (2008) abandons this radical approach and advocates a different version of OT morphology. He assumes that all syncretisms are directional and posits the notion "leading form", which is similar to "base" in Realization OT. He rejects underspecification of feature values, which is widely used to account for non-directional syncretism.

Let us illustrate Müller's 2008 framework with the Latin paradigm in (4), repeated in (32). Müller would assume that there are four leading forms in (32): {-*us*, -*um*, -*ī*, -*ō*}. Each of them is arbitrarily associated with a fully specified morphosyntactic feature set. For example, the suffix -*ī* can be arbitrarily associated with the feature value set {Declension class: II, genitive, singular, masculine}.[22] Subsequently, the morphophonological information of -*ī* spreads to other paradigmatic slots. We present in (33) the whole picture of how Müller's 2008 mechanism works. Notice that all the leading slots are arbitrarily chosen.

(32) The Latin second declension (adapted from Baerman 2004: 816)

	DEFAULT NEUTER 'war'	DEFAULT MASCULINE 'slave'	NOM & ACC in -*us* 'crowd'
NOM SG	*bell-um*	*serv-us*	*vulg-us*
ACC SG	*bell-um*	*serv-um*	*vulg-us*
GEN SG	*bell-ī*	*serv-ī*	*vulg-ī*
DAT SG	*bell-ō*	*serv-ō*	*vulg-ō*
ABL SG	*bell-ō*	*serv-ō*	*vulg-ō*

level of a morph that also contains a vowel. For example, it is not clear which morph is more sonorant, [e] or [ip] because the former contains a mid vowel but no coda while the latter contains both a high vowel and a coda. He does not consider duration or perception of a segment, which can play a significant role in determining sonority.
[22] We simplify the notations of Müller 2008, which uses binary features. But such simplification won't affect our current demonstration.

(33) The Latin second declension analyzed with leading forms

	DEFAULT NEUTER 'war'	DEFAULT MASCULINE 'slave'	NOM & ACC in *-us* 'crowd'

NOM SG .... *-us*

ACC SG *-um* ....

GEN SG *-ī*

DAT SG *-ō*

ABL SG

Like Realization Optimality Theory, Müller 2008 assumes that an input contains abstract morphosyntactic feature values that remain identical in both the input and output. He posits an exponent category (EXP) that consists of leading forms, e.g. {*-us*, *-um*, *-ī*, *-ō*}$_{EXP}$ in (33). He proposes the undominated constraint MATCH that maps into an output all the information of a leading form, i.e. both its morphosyntactic and morphophonological information and the association of the two pieces of information. A group of faithfulness constraints will select the winning candidate. He decomposes feature values into smaller components. A table of case decomposition is show in (34).[23,24] A table of gender decomposition is shown in (35).

(34) Table of case decomposition (adapted from Müller 2007: 51)

	subject	object	oblique	adverb
NOM	+	-	-	-
ACC	-	+	-	-
GEN	+	+	-	-
DAT	-	+	+	-
ABL	-	+	-	+

(35) Table of gender decomposition (adapted from Müller 2008: 84 citing Bierwisch 1967, Wiese 1999)

	masculine	feminine
MASC	+	-
FEM	-	+
NEUTER	+	+

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[23] Readers are also referred to Bierwisch 1967, Wiese 1999, 2003a, b for details on feature decomposition.

[24] The notations of feature values in Müller 2007 differ somewhat from those in Müller 2008. For example, in Müller 2008 {nom} is decomposed into [-governed] and [-oblique]. Since Müller 2008 does not discuss the ablative case while Müller 2007 does, we refer to the notations in Müller 2007, but such notational differences won't affect our demonstration.

A tableau of illustrating the derivation of the form *bell-ī* {gen, sg, neuter, Declension class: II} is shown in (36). The four output candidates are the leading forms in (33). The IDENT-constraints in (36) require the morphosyntactic information of each output candidate to match that of the input. The candidate *bell-ī* {gen, sg, masc, Declension: II} wins because all the other leading forms more seriously violate the constraints in the grammar. (We leave our readers a task of deriving other paradigmatic slots in (33) and making adjustments of the grammar in (36).)

(36) Latin paradigmatic effects

bell, +subj, +obj, -obl, -adv, +sg, +masc, +fem, II EXP	M A T C H	IDENT CLASS	IDENT MASC	IDENT ADV	IDENT SG	IDENT SUBJ	IDENT OBJ	IDENT OBL	IDENT FEM
☞ *bell-ī*, +subj, +obj, -obl, -adv, +sg, +masc, -fem, II									*
bell-us, +subj, -obj, -obl, -adv, +sg, +masc, +fem, [*vulg*-class], II		*!					*		
bell-um, -subj, +obj, -obl, -adv, +sg, +masc, +fem, II						*!			
bell-ō, -subj, +obj, +obl, -adv, +sg, +masc, -fem, II						*!		*	*

Müller's 2008 approach is interesting, but it causes several problems that are avoided in Realization OT. Above all, as Müller admits, the selection of a leading form can often be arbitrary in his framework, technically speaking. By contrast, Realization OT does not posit a base unless necessary.

Second, Müller's framework causes a huge burden on language acquisition while Realization OT does not. Müller assumes that paradigms are epiphenomena, which in our understanding do not participate in the derivation of output forms. But his framework crucially relies on leading forms whose content is mapped to outputs. Additionally, he needs to place these leading forms in an exponent category or paradigm. All these show that paradigms are not epiphenomena in his framework, which contradicts his basic assumption. Moreover, the constraint MATCH is essentially an OO correspondence constraint. Notice that the grammar in (36), for example, is basically a morphosyntactic grammar and the morphosyntactic information of a leading form that is mapped to an output via MATCH basically differs from that of an input. If the constraint MATCH is not restrictively defined, then every listed item that is not necessarily an inflectional exponent should be able to occur in the output. In

other words, in order to realize a single paradigmatic slot, a learner has to learn not only a huge number of listed items but also the grouping of them.[25] By contrast, Realization OT reduces the burden of acquisition to the minimum. It does not posit OO correspondence constraints unless necessary and these constraints are always restrictively defined. If the MATCH constraint in Müller 2008 is restrictively defined to reduce the burden of acquiring the Latin paradigm in (4) (=(32)) to the minimum while at the same time incorporate the necessary direction of syncretism, the new constraints that replace MATCH will be identical with those OO correspondence constraints in Realization OT.

Last but not least, the OO correspondence constraints in Realization OT constitute a simpler mechanism compared to Müller's 2008 approach. Müller's grammar may arguably be more "principled" than Realization OT. However, given that feature decomposition varies among frameworks and languages[26] and Müller's OT grammar allows powerful mechanisms such as constraint reranking, indexed faithfulness constraints or contextually defined constraints, constraint conjunction, sympathy theory, etc., it is not clear at all how principled his mechanism is or what predictions his grammar makes. If his grammar makes no more predictions than Realization OT, we will naturally prefer simpler OO correspondence constraints to the more complicated system in Müller 2008.

5　Conclusions

We have shown that Realization OT is superior to several alternative approaches to syncretism. Our Realization OT approach based on both realization and OO correspondence constraints can account for both directional syncretism and cases in which partially identical lexemes share the same inflectional formative. Divergent bidirectional syncretism, which brings about both marked and unmarked forms, poses a problem for the tenet of impoverishment-plus-insertion that the form of a less marked feature value always prevails. The Old French two-case system poses a similar problem. By contrast, Realization OT shows that directional syncretism involves a process of copying a base's morphophonological form. An approach based on the Right-hand Head Rule has problems accounting for nouns like WALKMAN and SNOWMAN which contain the same root but do not undergo the same inflectional

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[25] Such an "immense paradigmatic effect" should also be observed in works such as Wolf 2008 and McCarthy to appear, which do not posit realization constraints or recognize an autonomous morphological component.

[26] For example, nom and acc form a natural class in Müller 2008 because they share the feature value [-obl] while they do not form a natural class in Wunderlich 2004, which assumes that acc bears the feature values [+higher role] and [verb] but by contrast nom is unspecified with respect to any feature. Additionally, German acc (+gov, -obl) and gen (-gov, +obl) do not form a natural class in Müller 2008 but they form a natural class in Müller 2007, which assumes that acc and gen share the feature values [+obj], [-obl], and [-adv]. Moreover, Müller 2008 assumes that acc and gen form a natural class in Russian but not in German.

process because it is not clear what prevents WALKMAN from being inflected in the same way as SNOWMAN. OO correspondence constraints are more fine-grained mechanisms and have a wider scope of application than rules of referral in that the former are able to account for both full and partial identity of forms while rules of referral connect two fully identical forms.

There always remain issues for further exploration, which shows that Realization OT is a promising framework. For example, one reviewer asks whether there is an essential difference between rules of referral, impoverishment (-plus-insertion), and OO correspondence constraints in Realization Optimality Theory. Actually, it is not clear to us whether the way Zwicky 1985 presents a rule of referral (e.g. nom = acc) indicates a change of morphosyntactic feature value (e.g. feature impoverishment-plus-insertion) or a process of copying a base's morphophonological form (e.g. OO correspondence). Both impoverishment-plus-insertion and OO correspondence tackle morphology-syntax mismatches. As far as we can see, markedness hierarchies of features are mechanisms external to both impoverishment-plus-insertion and OO correspondence constraints, so the difference between impoverishment-plus-insertion and OO correspondence lies somewhere else. Technically speaking, impoverishment (-plus-insertion) creates intermediate stages or linkers (e.g. nom → Ø → acc → realization). Unless we can make cognitive or linguistic significance out of such linkers, we will naturally prefer a simpler mechanism without spelling out these intermediate stages.

Our paper argues for an autonomous morphological component of the grammatical architecture. All the cases in question are independent of any phonological approach to syncretism. A natural question arises how morphology interacts with phonology, which is studied in many works. To summarize a few findings, Wolf 2008 and McCarthy to appear argue that phonology and morphology are not separate components and morphology operates within the phonological component. Their arguments are based on evidence from phonologically conditioned morphological processes such as allomorphy. Yu (2003, 2007) presents a model in which morphological constraints outrank phonological ones, but see Paster's (to appear) criticisms of such a model. Kiparsky (1982a, b, 2001) presents a cyclic model of morphology-phonology interaction in which morphology precedes phonology. Paster (2009, to appear) concludes that phonologically conditioned allomorphy is not a universal phenomenon and there are cases in which morphology determines allomorphy. She basically adopts Kiparsky's model and suggests that morphology and phonology are separate components and morphology strictly precedes phonology. In cases of phonologically conditioned allomorphy, the morphological component generates outputs for phonology to process. (See also Xu 2007 for relevant discussion.)

Given the numerous discoveries made by "blind people trying to figure out an

elephant's shape by touching its different parts"[27], we suggest a hybrid model of the morphology-phonology interface by adopting the Confucian ideology that we should always stand in between two extremes. That is, morphology and phonology are basically distinct components of the grammatical architecture; morphology precedes phonology by default while the two components overlap to an extent that varies among languages.

Many questions can be raised on this hybrid model. For example, what do morphological and phonological components consist of? Realization OT attempts to address part of this question, i.e. what does an autonomous morphological component consist of? Our current paper and other research show that such an autonomous morphological component does exist. It includes realization and OO correspondence constraints, markedness constraints favoring simple exponence (e.g. Xu 2007), the scope constraint that maps semantic scope to morphological structures (e.g. Xu 2007, Aronoff and Xu to appear), etc.

We assume that morphology precedes phonology by default given the works of lexical morphology and phonology. The default situation is that phonology takes effects after a stem or word is built up. In the overlapping area of morphology and phonology we may observe both phonologically conditioned morphological processes such as allomorphy and morphologically conditioned phonological processes that involve sound changes sensitive to morphosyntactic information (see Inkelas to appear for criteria to distinguish realizational morphology from morphologically conditioned phonological processes). Morphologically conditioned phonological processes are assumed to involve morphological effects (effects of Saussurean signs) in the phonological component.

We believe that phonologically conditioned allomorphy, for example, is a case in which phonological effects show up in the morphological component. If morphology strictly precedes phonology, then morphology should determine every case of allomorphy, given that allomorphs compete to realize a feature set and therefore mutually exclude because of the blocking principle that dates back at least to Pāṇini's time and is assumed in every morphological framework. Only a model that recognizes a simultaneous interplay of phonological and morphological effects can account for such phonologically conditioned morphological processes because otherwise by the time allomorphs are introduced via realizational morphology into either the input (e.g. conventional OT) or the output (Wolf 2008, McCarthy to appear), only one allomorph

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[27] This expression comes from a Buddhist story. Once upon a time, four blind people wanted to know how an elephant looked like, but they could not see it. One fat blind man touched an elephant's ivory and claimed that the elephant looked like a carrot; one tall blind man grasped its ear and stated that the elephant should resemble a fan; one short blind man felt its leg and said that the elephant was like a column; one old blind man disagreed with them and concluded that the elephant looked like a rope because he held its tail. This story implies that the complicated nature of the interface of morphology and phonology may be beyond any predictions of a uniform theoretical model.

will survive because of morphological blocking, which will leave no choice to phonology. Realization OT is such a theory, which recognizes an autonomous morphological domain while at the same time allows phonological effects to show up in this domain.

One subsequent question is what kind of phonological effects can show up in the morphological domain. For example, the constraint ONSET often shows its effects in morphology to determine allomorphy perhaps because it is a very general phonological requirement given that every human language has words with an onset. By contrast, the spreading of nasality feature is seldom observed to condition morphological processes perhaps because it is not very general and only occurs in a few languages.

Given that languages have both morphologically and phonologically conditioned allomorphy, it seems that the morphological and phonological components overlap to an extent that varies among languages. That is, in languages whose morphological component does not overlap with the phonological one, we may observe morphologically conditioned allomorphy if we assume morphology precedes phonology by default. On the other hand, in languages whose morphological component overlaps with the phonological one, we may observe phonologically conditioned allomorphy, i.e. phonological effects showing up in the morphological component.

All of the above-mentioned issues deserve further exploration so that the morphology-phonology interface will become less mysterious and more fine-grained theoretical models will be proposed to account for it. For the time being, we aim to provide linguists with a useful and promising model for doing morphology, i.e. Realization Optimality Theory.

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