Nothing is a phonological fact

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1 Introduction

(1) Phonology can interfere with morphological processes. When the expected morphological operation yields a phonologically ill-formed word, the form cannot surface with its expected shape.

(2) In some cases, the ill-formed structures undergo repair. In other cases, a form from elsewhere in the paradigm might be used. But there is also a third option, and that is to abandon the attempt for a synthetic expression of the relevant morphological categories, leaving periphrasis or circumlocution as the only options. This last situation leads to gaps in paradigms, a situation sometimes dubbed *absolute ungrammaticality* or even *ineffability*.

(3) Our working hypothesis is that gaps are 'produced', i.e. a synchronic process of word formation can be thwarted by the phonology and result in no output. In this light, we claim that a model of synchronic grammatical knowledge must include a strategy for representing phonologically grounded crashes in the morphology.

2 Examples of gaps

(4) References wherein one finds discussion of gaps in the context of OT include Albright (2003); Fanselow and Féry (2002); Hansson (1999); Klein (2005); McCarthy and Wolf (2005); Nevins and Vaux (2003); Orgun and Sprouse (1999); Raffelsiefen (2004); Rice (2003, 2005); Törkenczy (2002), and references cited in those works.

(5) *Norwegian imperatives* (Rice 2003, 2005)

- a. Well-formed imperatives
  - (i) å spise – spis! '(to) eat'
  - (ii) å snakke – snakk! '(to) talk'
  - (iii) å løfte – løft! '(to) lift'
- b. Ill-formed imperatives
  - (i) å åpne – *åpn! 'open'
  - (ii) å padle – *padl! 'paddle'
  - (iii) å sykle – *sykl! 'bike'

(6) *Gaps in schm- reduplication* (Nevins and Vaux 2003)

- a. Well-formed schmeduplications
  - (i) Holiday: holiday–schmoliday
  - (ii) Nevins: Nevins-schmevins
- b. Gaps-schmaps
  - (i) Schmidt: *Schmidt-Schmidt
  - (ii) Schmooze: *schmooze-schmooze

(iii) Schmuck: *schmuck-schmuck

3 Strategies for optimizing gaps

(7) The architecture of OT is such that every input must be mapped onto some output. The data involving gaps seem—at least informally—to be situations in which there is an input which maps onto no output. How can the architecture of OT model gaps? How can some input be mapped onto nothing?

(8) *Null Parse* (Prince and Smolensky 1993)
The *null parse* is a candidate which is in some crucial sense incomplete, e.g. it lacks a morphological category, and therefore violates the constraint MPARSE. Depending on the constraint ranking in EVAL, this candidate may nonetheless be optimal. When it is, its ill-formedness makes it "uniquely unsuited to life in the outside world" (Prince and Smolensky 1993: 51).

(9) *Control* (Orgun and Sprouse 1999)
CONTROL is posited as a component of the grammar with 'hard' constraints. The candidate which wins in EVAL is then submitted to the control component. If that candidate violates the hard constraint(s), there is no output for the given input.

(10) *Null output* (McCarthy 2002)
A slight revision on the *null parse*, the *null output* is described as having "no structure whatsoever" (McCarthy 2002: 197). This candidate "always and only" violates MPARSE. Since the usual definition of MAX would lead to an awarded violation for $\odot$, the restriction to "only" violating MPARSE is a stipulation.

(11) *String-based correspondence theory* (McCarthy and Wolf 2005)
This development is partially motivated to develop a conception of the null output which actually does not violate MAX, which which does violate "always and only" MPARSE, but without stipulation.

a. A distinction is drawn between a candidate output suffering from pervasived deletion, represented as ϕ, and the null output, $\odot$.
b. Deletion is represented as a mapping from an input segment to an output '#', which is an empty string in a concatenative decomposition.
c. MAX is redefined as an input-output correspondence relation, which is *not* violated by mapping to #.
d. MPARSE punishes the failure to have a 'total bijective function' mapping the input onto the output. When the output is empty (as opposed to being filled with #s), there can be no such function. Hence, there is no correspondence, and no violation of the usual faithfulness constraints.
e. MPARSE is relativized to individual morphological categories.

(12) *Optimal gaps* (Rice 2005)

a. This approach analyzes gaps within the optimal paradigms framework (McCarthy 2005). One of the central components of that theory is that candidates are paradigms.
b. The *optimal gaps* strategy explores the consequences of candidates which are

incomplete paradigms.

c. In typical OT-fashion, tension is created between phonological markedness constraints and constraints requiring the expression of a morphological category, MAX{CAT}.

d. The tableau in (12e) illustrates the basic strategy. With this input, we consider candidates which consist of paradigms expressing the infinitive and the imperative. Candidate (a) has a morphologically well-formed imperative which violates the phonological markedness constraint. Candidate (c) improves on markedness by devoicing the sonorant in the imperative, and the cost of having different expressions of the root in the two members of the paradigm. Candidate (d) devoices both sonorants. Candidate (b) fails to express the imperative. Given the grammar below, the incomplete paradigm is optimal. The relatively highly ranked constraint MAX{INF.} is not included in the tableau for typographical reasons.

e. Optimizing a defective paradigm

	sykl/inf./imp.	SONSEQ	IO-ID(VOI)	OP-ID(VOI)	MAX{IMP.}
a)	sykle$_{inf.}$, sykl$_{imp.}$	*!			
b)	sykle$_{inf.}$, sykl̥$_{imp.}$		*!	**	
c)	sykl̥e$_{inf.}$, sykl̥$_{imp.}$		*!*		
☞ d)	sykle$_{inf.}$,				*

4 Same problem; different solutions

(13) The *optimal gaps* approach posits a constraint for each morphological category, requiring its expression. As recently noted by Rebrus and Törkenczy (2005), this opens the door to the same (phonological) problem receiving different solutions in different (morphological) contexts. Related discussion appears in McCarthy and Wolf (2005).

(14) Can we identify situations in which different word formation processes encounter the same phonological difficulty, and find the different word formation processes show different solutions?

4.1 Norwegian verbal and nominal roots

(15) Both nouns and verbs can be formed on some roots. Without any affixation, these roots can become the (nominal) singular or the (verbal) imperative.

a. *skriv!* 'write!'; *(et) skriv* '(a) document'
b. *kost!* 'sweep!'; *(en) kost* '(a) broom'
c. *dans!* 'dance!'; *(en) dans* '(a) dance'
d. *kast!* 'throw!'; *(en) kast* '(a) throw'

(16) Some roots end in clusters with rising sonority.

a. /sykl/ ‘bike’
b. /adl/ ‘nobility’
c. /hindr/ ‘hinder’
d. /ordn/ ‘arrange’

(17) What is the fate of these stems when singular nouns are to be formed?
—They show epenthesis: *sykkel*, *adel*, *hinder*, *orden*. (For discussion of Norwegian quantity, including the gemination on *sykkel* cf. Rice (to appear).) Note that the stem can appear, e.g. in other forms of the noun *sykler* ‘bikes’; *syklist* ‘cyclist’;

(18) What is the fate of these stems when imperatives are to be formed?
—They crash.

(19) The same phonological problem—syllabification of a final cluster with rising sonority—is dealt with in different ways in different morphological contexts. In the singular form of the noun, the phonological problem is repaired. In the imperative, it is not.

(20) In the *optimal gaps* approach, this can be understood as a situation in which the requirements to express the categories have different relationships with the phonological constraint(s) prohibiting various repair strategies.

(21) Repair and a gap in the same paradigm

	sykl/sg./pl./inf./imp.	SonSeq	Max{sg.}	Dep	Max{imp.}
a)	sykl$_{sg.}$, sykler$_{pl.}$ sykle$_{inf.}$, sykl$_{imp.}$	*!*			
b)	sykkel$_{sg.}$, sykler$_{pl.}$ sykle$_{inf.}$, sykl$_{imp.}$	*!		*	
c)	sykkel$_{sg.}$, sykler$_{pl.}$ sykle$_{inf.}$, sykkel$_{imp.}$			**!	
d)	sykler$_{pl.}$, sykle$_{inf.}$,		*!		*
☞ e)	sykkel$_{sg.}$, sykler$_{pl.}$, sykle$_{inf.}$,			*	*

(22) Considering the possibility of epenthesis, the requirement to express the singular is more important then the prohibition on epenthesis, while the prohibition on epenthesis is more important that the requirement to express the imperative. Because there is no ‘null output’ in optimal gaps theory, we must consider candidate paradigms. For pedagogical reasons, (21) illustrates a paradigm consisting of the singular and plural forms of the noun and the imperative and infinitive of the verb.

a. The singular and the imperative are identical to the root. When the root has a cluster with rising sonority, these will each incur a violation of SonSeq, as in candidate (a).

b. If we repair just the singular with epenthesis, as in candidate (b), a single violation of SonSeq remains, eliminating the candidate paradigm.
c. Repairing both of the offenders eliminates SonSeq violations, but gives two Dep violations, as in candidate (c).
d. A paradigm which has expresses only two of the four morphemes incurs a violation of each of the Max{cat} constraints, as in candidate (d).
e. Given the ranking, the best situation is the nonexpression of just one of the categories, and a single Dep violation. In this way, one of the SonSeq violators is repaired (sing.) and one leads to a gap (imp.).

4.2 Swedish neuter adjectives and participles

(23) *Adjectives, masculine and neuter* (Eliasson 1975; Iverson 1981)

a. Well-formed neuter marking in Swedish
   (i) en rysk pojke (masc.) 'a Russian boy'
   (ii) ett rysk-t barn (neut.) 'a Russian child'
b. Ill-formed neuter marking in Swedish
   (i) en rädd pojke (masc.) 'a scared boy'
   (ii) *ett rädd-t barn (neut.) 'a scared child'
c. A word cannot end with the sequence /ddt/. Final /dd/ or /tt/ is possible. In this particular situation, however, no repair is implemented and the paradigm has a gap, i.e. the language has no neuter form of this adjective.

(24) *Participles, masculine and neuter*

a. Parse: Verb root + participle /d/ + neuter marking /t/
b. Well-formed paradigm in Swedish
   (i) *(forbe)reda* 'prepare'
   (ii) *måltiden är (forbe)redd* 'the meal is prepared'
   (iii) *talet är (forbe)rett* 'the speech is prepared'
c. Here again, a word with a final /dd/ gets the neuter suffix attached to it. However, here a repair is implemented, reducing the string /ddt/ to /tt/, i.e. the language does have a neuter participle for this verb.

(25) The Swedish case differs from the Norwegian one in having an overt suffix. This suffix can be applied in two different morphological contexts. Examples can be constructed which are phonologically identical in the relevant way.

(26) The same phonological problem is met in two different morphological categories. The suffix is the same in each case—the neuter /t/—but in one case the problem leads to a gap, while in the other it is repaired and yields a well-formed output.

(27) The first tableau here illustrates an analysis for the adjectives. We follow McCarthy and Wolf (2005) by assuming that the relevant markedness constraint is an OCP constraint prohibiting a sequence of coronals. The suffixation of the neuter *–t* creates a violation of this constraint—as in candidate (a)—which can be avoided by 'fusion', including voicing assimilation—as in candidate (b). In this particular situation, however, the best solution is to avoid the OCP violation by eliminating from the paradigm the offending member.

	rädd/Adj-masc/Adj-neut	OCP(COR)	IDENTIO(VOI)	MAX{ADJ-N}
a)	$\underline{\text{rädd}}_{adj-m}$, $\underline{\text{räddt}}_{adj-n}$	*!		
b)	$\underline{\text{rädd}}_{adj-m}$, $\underline{\text{rätt}}_{adj-n}$		*!	
☞ c)	$\underline{\text{rädd}}_{adj-m}$			*

(28) Now we illustrate the situation for the participle, where the relevant MAX{CAT} constraint dominates the constraint punishing assimilation. Now the repair of the OCP violation—as in candidate (b)—is less costly than elimination of the offending paradigm member, such that candidate (b) is optimal.

	re:d/Part-masc/Part-neut	OCP(COR)	MAX{PART-N}	ID-IO(VOI)
a)	$\underline{\text{redd}}_{part-m}$, $\underline{\text{reddt}}_{part-n}$	*!		
☞ b)	$\underline{\text{redd}}_{part-m}$, $\underline{\text{rett}}_{part-n}$			*
c)	$\underline{\text{redd}}_{part-m}$		*!	

(29) The neuter suffix *–t* can be attached to adjectives and to participles. If the stem adjective and stem participle have the same shape, then affixation of the neuter suffix will create the same phonological problem in two different morphological contexts. In one case, this leads to a gap in the paradigm, and in another, it leads to a repair. This is modeled here by ranking the constraint prohibiting repair below the requirement to express one morpheme and above the requirement to express the other.

5 Discussion and conclusion

(30) A gap in a paradigm can result synchronically when a morphological process yields a phonologically infelicitous form which does not get repaired. The gaps in schm-reduplication, for example, show that even in 'language games', there can be failed attempts to apply the process.

(31) If we accept the claim that gaps can be a synchronic result, then the theory of grammar must provide some way of modeling this specific type of grammatical knowledge. Because gaps arise in a morphological context, and lead to the non-realization of a 'cell' in a paradigm, they suggest a tension between the completeness of a paradigm and a phonological restriction.

(32) Within the context of optimality theory, the optimal paradigms approach is one formalism for considering this kind of phenomenon, if it is augmented to represent the noted type of tension. However, the use of constraints requiring the realization of particular morphological categories raises the possibility that different categories can

have different relationships to the phonological restriction. In particular, it raises the possibility that the same phonological problem might be encountered in two different morphological contexts, and might be resolved differently in each of those contexts.

(33) Two cases with this property have been analyzed, bearing out the claim implicit in the approach. In Norwegian, a syllabification problem faced by a root when it gets no suffix results in a gap in the verbs and epenthesis in the nouns. In Swedish, a syllabification problem which develops when adding a coronal suffix to a stem with a final coronal geminate cannot be repaired as an adjective, but can be repaired as a participle.

(34) McCarthy and Wolf (2005) claim that their formalism also facilitates an analysis of the examples given here. However, the cost of doing that is perhaps too nihilistic. The theory requires $\odot$, ϕ and #, all as null items with different properties.

(35) The strategy advocated here for modeling gaps has to its merit that it treats them as such. In this way, the *null parse* or *null output* can be eliminated from the theory as a candidate. I.e. we don't have to analyze gaps by finding some way in which nothing is treated as something. Instead, a gap in a paradigm is analyzed as an incomplete paradigm, which is punished for its incompleteness, but rewarded for its well-formedness. With this strategy, one might claim that nothing is left out of the picture.

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