Gradient activity results in gradient markedness: A representational account of phonological exceptions

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The assumption of Gradient Symbolic Representations that phonological elements can have different degrees of activation allows a unified explanation for the typology of phonological exceptions. The crucial theoretical mechanism for exceptional behaviour are gradient constraint violations: The activation of a phonological element in an underlying morpheme representation determines 1) how much the element is preserved by faithfulness constraints and 2) how much it is penalized by markedness constraints. I argue that this simple mechanism predicts the attested typology of phonological exceptions. Two cases studies from Molinos Mixtec and Finnish show why such an account should be preferred over alternative analyses of exceptionality.

The typology of exceptions One common classification of exceptional morphemes which seemingly do not follow the regular phonology of a language is the distinction into 1) exceptional triggers for a process that is otherwise not regular (1C), 2) exceptional non-triggers for a general phonological process (1D), 3) exceptional undergoers of a process that is otherwise not regular (1E), and 4) exceptional non-undergoers of a general phonological process (1F). Those different types are illustrated in (1) with a toy language employing backness harmony that is parasitic on vowel height where all exceptional morphemes are underlined. Many examples for all these exceptionality types are attested; a representative example for each pattern is cited in (1).

(1) Toy language with backness vowel harmony (=VH), parasitic on height

A. Regular: VH if same height
/pon -ek/ → ponok

B. Regular: No VH if diff. height
/put -ek/ → putek

C. *Exc. trigger*: VH & diff. height
/kun -ek/ → kunok
e.g. V-deletion in Yine (Pater, 2010)

D. *Exc. non-trigger*: No VH & same height
/kol -ek/ → kolek
e.g. tone in Molinos Mixtec (Hunter and Pike, 1969)

E. *Exc. undergoer*: VH & diff. height
/put -em/ → putom
e.g. V-harmony in Y. Mayan (Krämer, 2003)

F. *Exc. non-undergoer*: No VH & same height
/pon -el/ → ponel
e.g. tones in V.A.Y. Zapotec (Hyman, 2010)

GSRO and exceptions Under the assumption of Gradient Symbolic Representations, phonological elements can have different degrees of presence in underlying representations, expressed as numerical activities (Smolensky and Goldrick, 2016; Rosen, 2016; Zimmermann, 2018, 2019). These activities result in gradient constraint violations: Elements with an activity higher than the default activity 1 are preserved more by faithfulness and penalized more by markedness constraints. Conversely, elements with an activity lower than the default activity 1 are preserved less by faithfulness and penalized less by markedness constraints. This system is termed 'Gradient Symbolic Representations in the Output' (=GSRO). How this simple mechanism of gradient constraint violations in a system based on Harmonic Grammar (Legendre et al., 1990) predicts the four exceptionality types is illustrated in (2) with tableaux for our toy language. SH(ARE) demanding that vowels should share the same backness feature has a lower weight than MAX_F demanding preservation of backness features and no VH surfaces (2B). Only if a feature change can avoid a violation of SH and $\text{SH}_{\pm\text{HI}}$ demanding that vowels with the same height specification should share the same backness feature is vowel harmony predicted (2A). If, however, an exceptional morpheme has an exceptionally high activation for its vowel, harmony applies even if the two vowels have different heights, simply because SH is now violated to a greater degree* (2C). Conversely, if an exceptional morpheme contains only a weakly active vowel, harmony does not apply even if both vowels share the same height since SH and $\text{SH}_{\pm\text{HI}}$ are violated by a lesser degree which is not enough to override the faithfulness violations (2D). The account for excep-

tional (non)undergoers (1E+F) is absolutely parallel and simply assumes weaker (=exceptional non-undergoer) and stronger (=exceptional undergoer) activity for certain suffix vowels.

(2) GSRO account: Different activation = different phonological behaviour

		MAX_F 15	$\text{SH}_{\pm\text{HI}}$ 10	SH 10	
A. Regular: VH if same height					
1a.	$p_1o_1n_1e_1k_1$		-1	-1	-20
☞ 1b.	$p_1o_1n_1o_1k_1$	-1			-15
B. Regular: No VH if diff. heights					
☞ 2a.	$p_1u_1t_1e_1k_1$			-1	-10
2b.	$p_1u_1t_1o_1k_1$	-1			-15

		MAX_F 15	$\text{SH}_{\pm\text{HI}}$ 10	SH 10	
C. Exceptional trigger: Diff. heights					
3a.	$k_1u_3n_1e_1k_1$			-2	-20
☞ 3b.	$k_1u_3n_1o_1k_1$	-1			-15
D. Exceptional non-trigger: Same heights					
☞ 4a.	$k_1o_{0.4}l_1e_1k_1$		-0.7	-0.7	-14
4b.	$k_1o_{0.4}l_1o_1k_1$	-1			-15

(*Markedness constraints are violated by the 'mean activity' of all elements that create the marked structure; i.e. SH for two vowels $*u_3 \ldots e_1$: $(3 + 1) \div 2 = 2$)

Arguments for GSRO The assumption that morpheme-specific phonological behaviour within one language arises from gradient differences in the activity of phonological elements makes at least four prediction that set the account apart from alternative approaches to exceptionality based on autosegmental defectivity (=ASD; e.g. Lieber, 1987; Tranel, 1996; Zoll, 1996) or lexically indexed constraints (=LIC; e.g. Pater, 2006; Flack, 2007; Mahanta, 2012). *First*, it offers a symmetric account for the four types of exceptionality in (1). In contrast, an account based on LIC cannot predict the existence of exceptional non-triggers (Smith, 2017) that have indeed be argued to be non-existent (e.g. Finley (2010) for vowel harmony). In contrast, I will strengthen the arguments for the existence of exceptional non-triggers (Smith, 2017; Hout, 2017) and discuss a new pattern in the tonal phonology of Molinos Mixtec where certain tones fail to trigger an otherwise regular tone spreading (Hunter and Pike, 1969). *Second*, a GSRO account predicts that exceptional elements can be exceptional for multiple processes. Such an instance can also be found in Molinos Mixtec: The tones that are exceptional non-triggers for a spreading process are also exceptional non-undergoers of an otherwise regular tone association process. A representational account where the gradient activity of the tones is the explanation for exceptional behaviour predicts exactly such an accumulation of exceptional behaviour. *Third*, a GSRO account predicts different degrees of exceptionality. This point is illustrated with a case study of Finnish where an exceptional repair for heteromorphemic /ai/ sequences can be observed (Anttila, 2002; Pater, 2006). Certain /i/-initial suffixes are exceptional triggers for a repair process but the type of repair (assimilation /pala-i/→[paloi], deletion /otta-i/→[otti], or variation between both /taitta-i/→[taittoi]∼[taitti]) depends on the nature of the preceding /a/-final morpheme. The assumption of four different activity levels for segments in Finnish straightforwardly explains the regular and the different exceptional classes. These underlying representations (=ur) are given in (2). Only morphemes with an exceptionally strongly active $/i_3/$ (3d-f) violate the markedness constraint against */ai/ enough to trigger a repair. For a preceding /a/ with default activity of 1, assimilation is the predicted repair (3d). But if a preceding /a/ has the lexical idiosyncratic property of containing less activity, deletion (3f) or free variation between both (3e) is predicted. Those degrees of exceptionality are easily captured under GSRO and LIC (cf. Pater, 2006) but are more difficult under ASD. And *fourth*, it predicts implicational relations between exceptionality classes within a language. If, for example, one morpheme class is an exception and fails to trigger/undergo process P_2 but regularly triggers/undergoes process P_1, then it is impossible under the gradience account that

(3)

	ur: a#	surface	ur: #i
a.	$/a_1/$	$[a_1i_1]$	
b.	$/a_{0.8}/$	$[a_{0.8}i_1]$	$/i_1/$
c.	$/a_{0.6}/$	$[a_{0.6}i_1]$	
d.	$/a_1/$	$[o_1i_3]$	
e.	$/a_{0.8}/$	$[o_{0.8}i_3] \sim [i_3]$	$/i_3/$
f.	$/a_{0.6}/$	$[i_3]$	

yet another morpheme class is only exceptional for P_1 but not P_2 if both refer to the same phonological structure. The typology of exceptions seems to confirm such general restrictions.

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