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

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Main Claim

- The assumption of Gradient Symbolic Representations that elements can have different **degrees of activation** allows a unified explanation for phonological **exceptions** and their properties.

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Theory: Gradient Symbolic Representations in Input/Output (=GSRO)

- All linguistic symbols have **activity** that can **gradiently** differ (=numerical values, 1 being the default activity).

  (Smolensky and Goldrick, 2016; Rosen, 2016, 2018; Faust and Smolensky, 2017; Zimmermann, 2018*a*,*b*, 2019*b*,*a*; Amato, 2019; Kushnir, 2019; Hsu, 2019; Walker, 2019)

- Activity differences can be present in **input and/or output**.

  (Zimmermann, 2017*a*,*b*; Faust and Smolensky, 2017; Jang, 2019; Walker, 2019)

GSRO: Gradient Constraint Violations and Exceptions

- constraints are **violated/satisfied relative to the activity** of the relevant elements

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Morpheme 1 in toy language

/p_1o_1/

➙ triggers vowel harmony

p_1o_1–t_1e_1		SHARE$_{bk}$ 14	ID 10	
a.	$p_1o_1t_1e_1$	-1		-14
☞ b.	$p_1o_1t_1o_1$		-1	-10

Morpheme 2 in toy language

/$p_1o_{0.5}$/

➙ doesn't trigger vowel harmony

$p_1o_{0.5}$–t_1e_1		SHARE$_{bk}$ 14	ID 10	
☞ a.	$p_1o_{0.5}t_1e_1$	-0.5		-7
b.	$p_1o_{0.5}t_1o_1$		-1	-10

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GSRO and Exceptions

➙ ‘exceptions’ = **contrastive underlying representations**

+ a single phonological grammar

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☙ this account of exceptionality predicts 4 properties:

① Unified account for (non)undergoers and (non)triggers.

② Exceptionality for more than one process.

③ Degrees of exceptionality.

④ Implicational restrictions between exceptionality patterns.

① Four types of exceptionality

(Classification into undergoers/triggers from Lakoff (1970))

Toy example: Stem-triggered VH if same height (pon–ek → ponok)
but not if different height (put–ek → putek)

1. Exceptional **non-undergoer** of a process though its context is not met
   e.g. same height but no VH: pon– et → ponet, *ponot

2. Exceptional **non-trigger** for a process though its context is met
   e.g. same height but no VH: ton –ek → tonek, *tonok

3. Exceptional **undergoer** of a process though its context is not met
   e.g. different height: VH: put– em → putom, *putem

4. Exceptional **trigger** for a process though its context not is met
   e.g. different height but VH: put –ek → putok, *putek

① Four types of exceptionality: GSRO account

1. Exceptional **non-undergoer** of stem-induced VH

   Affix has **strong** vowel that is protected by faithfulness constraints more

$p_1o_1n_1$– e_3t_1	Max[BK] 15	Sh[BK]$_{HI}$ 10	Sh[BK] 10	
☞ a. $p_1o_1n_1e_3t_1$		-2	-2	-40
b. $p_1o_1n_1e_3t_1$	**-3**			-45

2. Exceptional **non-trigger** of stem-induced VH

   Stem has **weak** vowel that does not violate markedness constraint as much

$t_1o_{0.4}n_1$ –e_1k_1	Max[BK] 15	Sh[BK]$_{HI}$ 10	Sh[BK] 10	
☞ a. $k_1o_{0.4}l_1e_1k_1$		**-0.7**	**-0.7**	-14
b. $k_1o_{0.4}l_1o_1k_1$	-1			-15

3. Exceptional **undergoer** of stem-induced VH

   Affix has **weak** vowel that is not protected by faithfulness constraints as much

$p_1u_1t_1$– $e_{0.4}m_1$	Max[BK] 15	Sh[BK]$_{HI}$ 10	Sh[BK] 10	
a. $p_1u_1t_1e_{0.4}m_1$			0.7	-7
☞ b. $p_1u_1t_1o_{0.4}m_1$	**-0.4**			-6

4. Exceptional **trigger** of stem-induced VH

   Stem has **strong** vowel that induces more markedness violations

$k_1u_3n_1$ –e_1k_1	Max[BK] 15	Sh[BK]$_{HI}$ 10	Sh[BK] 10	
a. $k_1u_3n_1e_1k_1$			**-2**	-20
☞ b. $k_1u_3n_1o_1k_1$	-1			-15

① Four Patterns of Exceptionality: Empirical Picture

1. Exceptional non-undergoers

- some M-tones resist to undergo a dissimilation into H in Kagwe (Hyman, 2010)
- some moras are non-hosts for floating tones in San Miguel el Grande Mixtec (Pike, 1944; McKendry, 2013)
- …

2. Exceptional non-triggers

- some vowels do not trigger otherwise regular ATR-harmony in Classical Manchu (Smith, 2017)
- some H-tones in Molinos Mixtec don't undergo H-spreading (Hunter and Pike, 1969)
- …

3. Exceptional undergoers

- only some vowels undergo V-harmony in Y. Mayan (Krämer, 2003)
- only some segments are deleted to avoid a marked structure in, e.g., Nuuchahnulth or Yawelmani (Noske, 1985; Zoll, 1996)
- …

4. Exceptional triggers

- some suffixes trigger deletion of a preceding V in Yine (Pater, 2010)
- some suffixes trigger raising of a preceding low V in Assamese (Mahanta, 2012)
- …

② Exceptionality for More than one Process

- ‘exceptional’ behaviour=activity of a phonological elements in a morpheme representation results in a gradient violation of constraint X

- → it also results in a gradient violation of constraint Y and might result in **‘exceptional’ behaviour for another process**

② Exceptionality for More than one Process

Example: Exceptional H-tone-morphemes in Molinos Mixtec

(Hunter and Pike, 1969)

H_1 always associates

	MaxH	*Cont	*Float	MaxT	Spec	
	100	100	71	24	8	
a.			-1			-71
☞ b.				-1		-24

$H_{0.4}$ optionally associates

	MaxH	*Cont	*Float	MaxT	Spec	
	100	100	71	24	7	
☞ a.			**-0.4**			-28.4
☞ b.				-1	**-0.6**	-28.2

H_1 always triggers H-speading

	MaxH	*Float	*[MH]	MaxT	
	100	71	28	24	
a.		-1	-1	-1	-123
☞ b.		-1		-2	-119

$H_{0.4}$ never triggers H-speading

	MaxH	*Float	*[MH]	MaxT	
	100	71	28	24	
☞ a.		-0.4	**-0.7**	-1	-72
b.		-0.4		-2	-76,4

③ Degrees of Exceptionality

- true gradience of activity=**multiple thresholds** for 'exceptional' behaviour

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Example: Finnish and multiple thresholds to avoid ai-sequences

(Anttila, 2002; Pater, 2006)

a#	surface	#i
/a_1/	[$a_1 i_1$]	
/$a_{0.8}$/	[$a_{0.8} i_1$]	/i_1/
/$a_{0.6}$/	[$a_{0.6} i_1$]	
/a_1/	[$o_1 i_3$]	
/$a_{0.8}$/	[$o_{0.8} i_3$] ~ [i_3]	/i_3/
/$a_{0.6}$/	[i_3]	

Two thresholds for /a/ in /ai/-repair contexts: under-goer of deletion, assimilation, or optionality between both

Threshold for /i/: Trigger for /ai/-repair or not

④ Implicational Relations

- if all exceptionality results from differences in activity of phonological elements, not all imaginable combinations of exceptionality patterns in a language are possible: **Certain exceptionality patterns imply each other**

E_{1+x+y} ➙ Exceptional Behaviour X+Y

Stronger: Threshold 2

E_{1+x} ➙ Exceptional Behaviour X

Stronger: Threshold 1

E_{1} ➙ 'Normal' Behaviour

Weaker: Threshold 1

E_{1-v} ➙ Exceptional Behaviour V

Weaker: Threshold 1

E_{1-v-w} ➙ Exceptional Behaviour W

④ Implicational Relations: GSRO and exceptionality patterns

Example for an *excluded pattern with multiple self-reversing thresholds

	P1	P2
X_{1+X}	Y	N
X_1	N	Y
X_{1-X}	Y	Y

Implicational restriction on exceptionality patterns

If a language L has

- a phonological element of (a) morpheme(s) that shows behavior$_1$ for process P1 and behavior$_2$ for process P2
- and (a) morpheme(s) where the same phonological element shows behavior$_3$ for process P1 and behavior$_4$ for process P2
- there cannot be (a) morpheme(s) where the same phonological element shows behavior$_1$ for process P1 and behavior$_4$ for process P2

④ Implicational Relations: The Empirical Picture

(1) Yine

(Lin, 1997*a*,*b*; Pater, 2010)

	triggers deletion	undergoes deletion
$V_{1.5}$	N	N
V_{1}	N	Y
$V_{0.5}$	Y	Y

(2) Welsh

(Zimmermann, 2019*b*)

	deletion to avoid coda	realized as default
C_{1}	N	Y
$C_{0.6}$	Y	Y
$C_{0.2}$	Y	N

(3) Finnish

(Anttila, 2002; Pater, 2006)

	is deleted #_i_3	assimilates #_i_3
a_{1}	Y	N
$a_{0.8}$	O	O
$a_{0.6}$	N	Y

(4) Lexical accent competition in Moses Columbian Salish

(Czaykowska-Higgins, 1985, 1993*a*,*b*, 2011; Willett, 2003; Zimmermann, 2018*b*)

	deleted if $\varphi_{>0.9}$ present	deleted if $\varphi_{>0.8}$ present	deleted if $\varphi_{>0.6}$ present	deleted if $\varphi_{>0.4}$ present
φ_{1}	N	N	N	N
$\varphi_{0.9}$	N	N	N	Y
$\varphi_{0.8}$	N	N	Y	Y
$\varphi_{0.6}$	N	Y	Y	Y
$\varphi_{0.4}$	Y	Y	Y	Y

→ multiple thresholds that are never **self-reversing**

Comparison: Three Accounts of Exceptionality

LIC ‘Lexically Indexed Constraints’: constraints can exist in versions indexed to (classes of) morphemes that are only violated if the scope of the violation contains material of an indexed morpheme (e.g. Ito and Mester, 1990; Golston and Wiese, 1996; Fukazawa, 1999; Pater, 2000; Pater and Coetzee, 2005; Pater, 2006; Flack, 2007; Pater, 2010)

ASD ‘Autosegmental Defectivity’: Morphemes can be underspecified or overspecified: Floating features/moras/tones, lack of features/moras/tones,... (Lieber, 1992; Stonham, 1994; Saba Kirchner, 2010; Trommer, 2011; Bermúdez-Otero, 2012; Bye and Svenonius, 2012; Trommer and Zimmermann, 2014; Zimmermann, 2017*c*)

	LIC	ASD	GSRO
① 4 patterns	☹	☺	☺
② More than one process	☹	☺	☺
③ Degrees of exceptionality	☺	☹	☺
④ Implicational restrictions	☹	☹	☺

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