Gradient Symbolic Representations in the Output: A typology of lexical exceptions

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Main Claim: The assumption of Gradient Symbolic Representations (=GSR; Smolensky and Goldrick, 2016; Rosen, 2016) allows a unified account of lexical exception patterns. A modified GSR system where gradiently active phonological elements can exist in both input and output predicts a typology of at least 6 exceptionality pattern that arise from different interactions of markedness and faithfulness constraints. It is argued that this typology is indeed borne out, focusing on a case study of competition between gradiently active elements in the stress pattern on Moses-Columbia Salish.

Theoretical background: GSR states that phonological elements can have different degrees of presence in an underlying representation, expressed as numerical activities (Smolensky and Goldrick, 2016). In the original proposal, all output elements have the full activity 1.0: different underlying activities hence only have a consequence for evaluating faithfulness constraints. In contrast, it is argued here that elements may retain their (weak) activity in phonological output structures, termed 'Gradient Symbolic Representations in the Output' (=GSRO). The evaluation of markedness constraints can hence be influenced by different activities as well: they are violated/satisfied to a weaker degree if their context is met by weakly active elements. If a markedness constraint *M is violated by an element /$M_{0.7}$/ that has an activity smaller than 1, *M is only violated by this number. The harmony evaluation in GSRO is formally modeled inside Harmonic Grammar where constraints are weighted, not ranked (Legendre et al., 1990).

Typology of exceptions predicted by GSRO: At least 6 different lexical exceptionality patterns are predicted by the GSRO system. A first class are morphemes that contain exceptional elements that only surface if they receive certain support. In **(1-A)**, this support is lexical and comes from a neighbouring morpheme. This is the basic logic underlying the original GSR-analyses in Smolensky and Goldrick (2016) and Rosen (2016) where realization of weak elements depends on the activity of an adjacent element from a neighbouring morpheme. In **(1-B)**, on the other hand, the support for the weakly active element is phonological: The phonology favours its realization since it avoids a marked structure. In another predicted grammar, the realization of a weakly active element is the expected default that is blocked by a markedness constraint in certain contexts whereas fully active elements are preserved in the same context **(2)**. A third pattern of exceptionality crucially depends on the assumption of weak elements in the output and is hence only predicted in the modified system of GSRO. For one, the realization of a weak output element can be blocked since it is not a good enough satisfaction of a M! markedness constraint **(3-A)**. On the other hand, a marked structure may only surface in certain lexical environments since the element creating the marked structure is only weakly active and a violation of *M is hence not a good enough reason to delete it **(3-B)**. The final class of effects is true competition between elements that are in complementary distribution for independent phonological reasons and where realization of the element with the highest activity is preferred **(4)**.

1)	Weak elements are only realized. . . **A)** with lexical support (e.g. Japanese rendaku; GSR analysis in Rosen (2016)) **B)** with phonological support (e.g. Catalan /u/-alternation (Bonet et al., 2007))
2)	Weak elements dropped in marked environments (e.g. Nuuchahnulth unstable consonants (Kim, 2003))
3)	Weak output elements are. . . **A)** dropped since not a good enough solution for a markedness constraint (e.g. S.M.G. Mixtec weak tonal hosts (McKendry, 2013)) **B)** realized since not a bad enough problem for a markedness constraint (e.g. Piro non-deleting /–wa/ (Pater, 2006))
4)	Elements of different activities compete for realization (e.g. stress in M.-C. Salish (Czaykowska-Higgins, 1993))

A case study from stress: This talk focuses mainly on a case study that exemplifies pattern **(4)**: The true competition between elements that are active to different degrees. Such a pattern can be found in the intricate stress system of Moses-Columbia Salish (=MCS; Czaykowska-Higgins, 1985, 1993). In

MCS, two different suffix types (dominant ‘D’ and recessive ‘R’) and a special stem type (‘E’) that has an exceptional dispreference for adjacent stress can be identified. In addition, stems are distinguishable into strong (‘S’) and weak (‘W’) ones. For the E-stems, the strong-weak distinction can be reduced to the phonological difference between stems with an underlying vowel (‘SE’) and those without a vowel that surface with a predictable /ə/ (‘WE’); these stem types behave identical with respect to stress assignment. Given this classification, the position of main stress in MCS is predictable as in (1). The basic generalization about stress assignment in morphologically complex forms is that default-stress is rightmost and that D-suffixes are preferably stressed whereas R-suffixes and W-stems are preferably not stressed. S-stems are only stressed if followed by an R-suffix but unstressed preceding (a) D-suffix(es). There is hence a clear hierarchy of stress preferences for morphemes. In addition, SE/WE-stems show a very interesting threshold effect: They are always stressed, even when followed by a D-suffix (cf. SE/WE-b+d). Only when followed by more than two D-suffixes (SE/WE-c) do they loose their stress. A Harmonic Grammar account based on gradient representations not only predicts the intricate competition between (non)stress positions in MCS, it also straightforwardly accounts for this threshold effect.

1. Stress generalizations MCS; main stress=boldface (Czaykowska-Higgins, 1993, 235)

	SE	S	WE	W
a.	**SE**-R(-R)	**S**-R(-R)	**WE**-R(-R)	W(-R)-**R**
b.	**SE**-D	S-**D**	**WE**-D	W-**D**
c.	SE-D(-D)-**D**	S-D(-D)-**D**	WE-D(-D)-**D**	W-D(-D)-**D**
d.	**SE**-D-R(-R)	S-**D**-R(-R)	**WE**-D-R(-R)	W-**D**-R(-R)

Analysis for MCS stress: The analysis for this complex stress pattern in GSRO is based on different underlying degrees of stress for morphemes in MCS. The basic distinction is the one between underlyingly stressed and underlyingly unstressed ones, modeled here as the absence and presence of underlying prosodic feet that are protected by a faithfulness constraint Max-Φ. In addition, underlying feet have different activity levels: whereas SE- and WE-stem have a fully active Φ_1 in their representation (2a+b), D-suffixes contain a weakly active $\Phi_{0.8}$ (2c), and S-stems an even weaker $\Phi_{0.6}$ (2d). R-suffixes and W-stems, finally, are underlyingly unstressed and hence contain no foot in their prosodic structure (2e+f).

2. Underlying Representations						*3. Constraint Weights*		
a. Φ_1	b. Φ_1	c. $\Phi_{0.8}$	d. $\Phi_{0.6}$	e.	f.	Max-Φ	All-Φ-R	Dep-Φ
SE	WE	D	S	R	W	100	11	5

Basic markedness constraints demanding a right-aligned default stress together with Max-Φ predict the stress system of MCS from these representations (cf. the most important constraint weights in (3)). If no underlying feet are present, stress is predicted to be on the rightmost vowel; an epenthetic foot is hence inserted (4a). If only one underlying foot is present, stress remains inside this foot as in (4b). Crucially now, since only a single main-stressed vowel is possible, competition arises between multiple underlying feet. If multiple feet with the same strength are present, the preference for rightmost stress emerges and only the rightmost foot is realized (4c). If, however, feet with different underlying strengths are present, the one with the highest activity is realized faithfully (4d+e). The interesting threshold effect for SE/WE-stems can be seen in (4e+f): Stress remains on a SE/WE-stem if it is followed by only a single D-suffix (4e) but shifts to the rightmost D-suffix if more than one is present (4f). This is a straightforward gang-effect predicted in Harmonic Grammar: A violation of All-Φ-R and non-realization of one $\Phi_{0.8}$ is tolerated if a stronger Φ_1 can be realized (4e) but violations of All-Φ-R gang up against Max-Φ if the stronger foot is too far away from the right edge (4f).

4. Competition between feet (underlying structure; surface stress=grey background)					
a.	b. $\Phi_{0.8}$ (over D)	c. $\Phi_{0.8}$ $\Phi_{0.8}$	d. $\Phi_{0.6}$ $\Phi_{0.8}$	e. Φ_1 $\Phi_{0.8}$	f. Φ_1 $\Phi_{0.8}$ $\Phi_{0.8}$
W R	W D R	W D D	S D	SE D	SE D D

This analysis relies on three activity levels for elements in one language and is thus a strong argument for gradiently active elements in the phonology and against representational accounts that only allow a binary division between ‘normal’ and ‘defective’ elements (e.g. Yearley, 1995; Inkelas et al., 1997).