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New insights from optimality theory for acquisition

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Introduction

The purpose of this paper is to compare rule-based derivational theories and constraint-based optimality theory in terms of the empirical prediction they make about the occurrence and interaction of seemingly independent error patterns in the course of acquisition.

Derivational theories typically account for children's error patterns by attributing to their grammar certain rules (or processes). The claim is that grammar can differ or change over time by the addition, loss or reordering of those rules. Optimality theory, on the other hand, accounts for errors by the dominance of markedness constraints over antagonistic faithfulness constraints. The claim is that grammar differs only in the ranking of constraints.

The substance of these claims can be examined by considering two common error patterns, Consonant Harmony and Gliding. Harmony is an assimilatory process that typically targets glides and is triggered by a manner feature, e.g. [nasal] (for representative data and literature review, see Dinnsen (1998)). Given a word such as 'won', the initial glide would be replaced by a nasal, to yield a word such as 'none'. Gliding accounts for the non-occurrence of liquid consonants and their replacement by a glide (Smit, 1993). A word such as 'ray' might be produced as 'way'. If these two rules were to co-occur in a child's grammar, they could interact as a result of different rule ordering relationships. For example, the word 'run' would be realized as 'none' if the two rules applied in a feeding order and as 'won' if they applied in a counterfeeding order. Derivational theories also predict that either rule might occur without the other, or that neither rule could occur. The predicted typology is given in table 1.

A review of the literature and the author's own database, which includes detailed phonological descriptions of ~200 children with functional (non-organic) speech disorders, fails to identify any case studies where Harmony occurs without Gliding.

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Table 1. *Derivational theory predictions*

Error pattern(s)	Empirical characteristics	
	won	*run*
(a) Harmony and Gliding (counterfeeding order)	none	won
(b) Gliding and Harmony (feeding order)	none	none
(c) Gliding, but no Harmony	won	won
(d) No Harmony and no Gliding (adult English)	won	run
(e) Harmony, but no Gliding	none	run

This suggests that there may be an implicational relationship among these error patterns, such that the occurrence of Harmony implies necessarily the occurrence of Gliding, but not vice versa. Derivational theories cannot explain the asymmetry in the occurrence of these error patterns.

Optimality theory offers a principled account for the (asymmetrical) occurrence of these error patterns and their interactions with the constraints and universal ranking shown here:

- Constraints
  - (a) Markedness
    *R: Avoid [r]'s
    Align: A specified Manner feature (e.g. [nasal], [approximant]) must be aligned with the left edge of a prosodic domain
    License: Glides do not license the feature [approximant]
  - (b) Faithfulness
    Max[root]: Parse all input Root features ([consonantal], [sonorant])
    Max[manner]: Parse all input Manner features ([nasal], [approximant])
  - (c) Harmonic ranking
    *R $\gg$ Align

If the markedness constraint *R were highly ranked, it would account for the Gliding error pattern by disfavouring the co-occurrence of the root feature [+ consonantal] with the manner feature [approximant]. The Harmony error pattern is achieved largely by the dominance of Align, which demands that a manner feature (such as [nasal] or [approximant]) be associated with the left edge of a syllable. License militates against redundant features, i.e. all [–consonantal] segments are redundantly [approximant]. The two faithfulness constraints demand identity between the input and output in terms of root features and manner features. For example, Gliding and Harmony both incur a Max[root] violation because of their changes to the feature [consonantal]. Failure to parse the manner feature [approximant] (of an /r/) or [nasal] (as a trigger for Harmony) would violate Max[manner]. These constraints are free to vary in their rankings, except for the harmonic (universal) ranking of *R over Align. This particular fixed ranking is necessary to exclude the unattested case where Harmony would occur to the exclusion of Gliding. Additionally, as *R is demoted over time, Align will also necessarily be demoted.

Tableau 1 illustrates how some relevant competitor candidates would be evaluated by these constraints for an input such as 'run', in a grammar where both Harmony and Gliding co-occurred with the equivalent of a counterfeeding relation. In tableau 1, candidate (b) wins in this case because it preserves the manner feature

Tableau 1. *Tableau for input 'run' realized as 'won'*

'r$_A$un'	*R	Max[manner]	Align	License	Max[root]
(a) won		*!	*		*
(b) w$_A$on☞				*	*
(c) r$_A$un	*!				
(d) none		*!			

☞ = optimal output; * = constraint violation; ! = fatal violation; A = [approximant].

[approximant] of the input /r/ and aligns that feature to the left edge of a syllable. The phonetically identical candidate (a) loses for its failure to parse the input manner feature.

Table 2 summarizes the account of the typology (with the required constraint rankings) and the predicted developmental progression from an initial state to the end state.

The optimality theoretic account has some intriguing clinical implications. Consider, for example, a child who presents with both Harmony and Gliding. At least two treatment possibilities are available with different predicted consequences. On the one hand, Harmony might be targeted for treatment by opposing 'won' and 'none'. In optimality theoretic terms, this would call for the demotion of Align below Max[root]. While such treatment might eliminate Harmony, it would have no necessary consequence for the Gliding error pattern, because *R could remain undominated. If, however, treatment were directed at eliminating the Gliding error pattern, then *R would have to be demoted below Max[root], which would, in turn, require that Align also be demoted, because of the associated harmonic ranking of these two constraints. The predicted result is that eradication of Gliding should eliminate Harmony without direct treatment on Harmony.

In conclusion, a comparison of derivational theories and optimality theory finds important differences in their empirical predictions. One prediction of derivational theories is that Harmony should be able to occur without Gliding. This prediction was, however, not borne out, suggesting a previously unnoticed implicational relationship between Harmony and Gliding. The particular facts about the occurrence and non-occurrence of these error patterns was shown to follow necessarily from the constraints and constraint rankings of optimality theory. Optimality theory was also shown to offer novel treatment and learning predictions.

Table 2. *Typology and constraint rankings*

Error pattern(s)	Ranking
(a) Gliding and Harmony (feeding)	*R ≫ Align, License ≫ Max[root], Max[manner]
(b) Harmony and Gliding (counterfeeding)	*R, Max[manner] ≫ Align, License ≫ Max[root]
(c) Gliding, but no Harmony	*R, Max[manner] ≫ License, Max[root] ≫ Align
(d) No Harmony and no Gliding (adult English)	Max[manner], Max[root] ≫ *R, License ≫ Align
(e) Harmony, but no Gliding	Impossible, due to harmonic ranking

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