

Constraint conflict: The source of an unusual error pattern

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Abstract

Certain phonological error patterns have been judged to be “unusual” or “idiosyncratic”, posing a number of theoretical and clinical problems. This paper reconsiders an especially challenging case of an unusual error pattern documented by Leonard and Brown (1984). T (age 3;8) replaced all word-final consonants (except for labial stops) with [s] but more importantly inserted [s] after word-final vowels. Our purpose is to show that optimality theory offers a fresh perspective on this error pattern and its course of development by providing an account of the facts that is entirely consistent with general principles relevant to the description of fully developed languages and acquisition.

Keywords: *Optimality theory, comparative markedness, unusual error pattern*

Introduction

While many different phonological error patterns are commonly occurring in both typical and atypical development, there are other error patterns that are less common and that pose theoretical and clinical challenges. These less common patterns have been viewed as unusual or idiosyncratic largely because they appear to run counter to patterns we observe in fully developed languages or principles assumed to govern language or its acquisition. Some of these error patterns can result in a sound that does not occur in the target language or a sound substitute that is more marked than the target sound. Because of the peculiarities associated with these unusual error patterns, theoreticians often find it convenient to set them aside as irrelevant to general principles of phonology. Even clinicians tend to view them as a reflection of a more severe disorder or even a deviant phonology that might be resistant to conventional remediation. The nature of these unusual error patterns, how they arise, their developmental course and even their theoretical relevance have remained open questions.

Our main purpose is to reconsider one especially challenging case study of an unusual error pattern documented by Leonard and Brown (1984). We will put forward and evaluate an optimality theoretic (Prince & Smolensky, 1993/2004) account of this error pattern and its course of development. It will be argued that this error pattern may not be so unusual

after all and that it follows from general principles of language. The error pattern's developmental course will also be shown to accord with general principles of learning.

Sketch of the case study

The child from Leonard and Brown's (1984) study, T (age 3;8), was a female with language-delays. Her presenting phonology included what has come to be a classic example of an unusual error pattern affecting word-final position. The data in (1) illustrate some of the peculiarities associated with this pattern. First, the forms in (1a) exemplify the fact that all final consonants (except labial stops) were realized as [s]. More importantly, the forms in (1b) show that [s] was inserted after word-final vowels. Finally, the forms in (1c) show that word-final labial stops were produced target-appropriately and were thus immune to the error pattern.

(1) T (3;8) baseline productions

- | | | | | | |
|---|--------|-------|--------|-------|--------|
| a. Final consonants replaced by [s] | | | | | |
| [mæs] | “Matt” | [gɜs] | “girl” | [dɔs] | “dog” |
| b. Insertion of [s] after word-final vowels | | | | | |
| [tus] | “two” | [bɔs] | “boy” | [as] | “eye” |
| c. Final labial stops preserved | | | | | |
| [kʌp] | “cup” | [gʌb] | “Gabe” | [hɔm] | “home” |

Leonard and Brown argued that the most parsimonious account of this error pattern was to posit a restricted, child-specific set of underlying representations. All words were assumed to end underlyingly in either a labial stop or /s/.

T's presenting error pattern would be interesting in its own right, but she also received treatment that was intended to eradicate the error pattern, revealing an interesting course of phonological development with three distinct stages. Using traditional treatment methods, T was first taught /f/ in word-final position. This treatment regime was only partially successful and yielded a second identifiable stage of development. That is, treatment resulted in target-appropriate realizations of final labial fricatives, but the original error pattern persisted with the other words. In a further effort to eradicate the persisting error pattern, an additional round of treatment was initiated with a focus on introducing final /d/. Again, treatment was only partially successful, resulting in a third stage of development whereby coronal stops began to be produced correctly in final position, but the error pattern affecting vowel-final words largely persisted with the insertion of final [s]. Some vowel-final words began to overgeneralize with the insertion of a final [d].

This case poses a number of problems. Why would a consonant be inserted to close a presumably unmarked open syllable word-finally? Why would some but not other final consonants be immune to this error pattern during each of the different stages? Why did this error pattern change (and even overgeneralize) as it did? And finally, is it really more parsimonious to posit unique, child-specific underlying representations for this pattern? The remainder of this paper is devoted to addressing these questions from the fresh perspective of optimality theory.

An optimality theoretic account of Stage 1: Pretreatment baseline

We will take up Stage 1 in a series of steps, explaining first the insertion of a consonant to vowel-final words, next the realization of consonant-final words, and finally the choice of the specific sound substituted or inserted. We begin with an account of the more unusual aspect of the pretreatment error pattern, namely the insertion of a final [s] to vowel-final words. The apparent anomaly here is that on both cross-linguistic and developmental grounds, open syllables are usually considered unmarked relative to closed syllables. We thus might have expected that a closed syllable could have given way to an open syllable, but not the reverse where an unmarked structure would be realized as more marked. The fact is, however, that a number of languages prefer the occurrence of a word-final consonant over a final vowel. McCarthy (1993) thus proposed the markedness constraint FINAL-C, which bans word-final vowels. If FINAL-C were ranked above a generalized faithfulness constraint, FAITH, which militates against any changes relative to the underlying representation, the greater demand to comply with FINAL-C would compel the insertion of a word-final consonant.

We tentatively adopt the constraints and ranking in (2) to account for this aspect of T’s error pattern.

(2) Constraints and ranking (tentative)

- FINAL-C: Word-final vowels are banned
- FAITH: Inputs and outputs must be identical
- Ranking: FINAL-C >> FAITH

The tableau in (3) shows how a vowel-final word such as “two” would be realized with a final [s]. Faithful candidate (a) is eliminated by undominated FINAL-C; even though candidate (b) violates FAITH, the lower ranking of that constraint allows candidate (b) to be selected as optimal, shown by the manual indicator. We are assuming for the moment that the child could have internalized target-appropriate underlying representations for words with and without final vowels. This is in accord with “richness of the base” (Prince & Smolensky, 1993/2004), which prohibits language-specific or child-specific restrictions on underlying representations. Even if this child had incorrectly internalized the input as identical to the errored output, the same candidate would be selected as optimal with this hierarchy. The important point is that there is no need to exclude vowel-final words from T’s set of underlying representations.

(3) Insertion of [s] for vowel-final words

/tu/ ‘two’	FINAL-C	FAITH
a. tu	*!	
☞ b. tus		*

This same constraint hierarchy, combined with the assumption of target-appropriate input representations, predicts that target words with final consonants will be realized faithfully. While this would correctly account for T’s realization of some consonant-final words, it makes the wrong prediction about many others. For example, target words with final coronal stops or labial fricatives were realized unfaithfully with a final [s]. This brings us to the second part of our solution, i.e., accounting for the substitution pattern associated with many consonant-final words.

T clearly favored some final consonants over others. Coronal stops and labial fricatives (among others) were banned from final position. With some final consonants being absolutely banned and with it being equally important that some consonant occur in final position as required by FINAL-C, the conflict between these opposing demands would have to be resolved by some other constraints. We appeal to an exploded version of a general markedness constraint, NOCODA, which abbreviates a larger family of constraints banning different classes of coda consonants, a partial listing of which is given in (4).

(4) Exploded version of NOCODA (NC)

- NC-t: Coda coronal stops are banned
- NC-s: Coda coronal fricatives are banned
- NC-p: Coda labial stops are banned
- NC-f: Coda labial fricatives are banned
- Tentative ranking: FINAL-C, NC-t, NC-f >> FAITH >> NC-p, NC-s

By ranking some of the NOCODA constraints above FAITH and others below FAITH, certain final consonants would be eliminated in favor of others. Undominated FINAL-C requires that some consonant be present word-finally. The lower ranking of the other NOCODA constraints renders their violations less serious. Thus, we can eliminate candidates with a final coronal stop or labial fricative by ranking NOCODA-t and NOCODA-f above FAITH. We can also account for the occurrence of final coronal fricatives and labial stops with the ranking of NOCODA-s and NOCODA-p below FAITH. This is illustrated in the following series of tableaux.

(5) Realizations of consonant- and vowel-final words

/mæt/ ‘Matt’	FINAL-C	NC-t	NC-f	FAITH	NC-p	NC-s
a. mæt		*!				
b. mæ	*!			*		
c. mæf			*!	*		
ɸ d. mæs				*		*
/naɪf/ ‘knife’	FINAL-C	NC-t	NC-f	FAITH	NC-p	NC-s
a. naɪf			*!			
b. na	*!			*		
c. naɪ		*!		*		
ɸ d. naɪs				*		*
/tu/ ‘two’	FINAL-C	NC-t	NC-f	FAITH	NC-p	NC-s
a. tu	*!					
b. tut		*!		*		
c. tuf			*!	*		
ɸ d. tus				*		*

In (5), all candidates with a final vowel are eliminated by FINAL-C. These tableaux begin to illustrate how the substitution pattern comes about for certain final consonants. The faithful candidates for the inputs ‘Matt’ and ‘knife’ are eliminated by NOCODA-t or

NOCODA-f, respectively, and the winners violate only the lower ranked constraints, FAITH and NOCODA-s.

This same constraint hierarchy also begins to explain why it was [s] rather than certain other consonants that was inserted after a final vowel. This is illustrated in the third tableau in (5). However, the astute observer will note that the tableaux in (5) did not consider one important candidate, namely one with a final labial stop. Such a candidate would incur a violation of low-ranked NOCODA-p, resulting in a tie with the intended and empirically attested winner with final [s]. We thus cannot account yet for why it was [s] rather than a labial stop that served as the substitute for certain consonant-final words or as the inserted segment for vowel-final words. This brings us to the third part of our solution, i.e., accounting for the specific sound that was substituted or inserted.

To address this aspect of the problem, we appeal to a recent proposal, “comparative markedness”, which was put forward by McCarthy (2002) as a refinement to the theory’s account of other phenomena in fully developed languages. Comparative markedness modifies original conceptions of markedness by splitting up each markedness constraint into two distinct versions of the same constraint. One version of a given constraint would assign a violation mark for an offending property that is fully faithful. Such a violation is considered “old” in the sense that it carries over from the input representation. The other version of that same constraint would assign a violation mark for an offending property that differs in any way from the fully faithful candidate (FFC). Such a violation is considered “new” because it is not directly supplied by or inherited from the input. The two versions of a given markedness constraint yield exactly the same combined violations of a conventional markedness constraint. The only real difference is that comparative markedness allows the violations to be partitioned into two non-overlapping sets with marks being assigned separately by the different versions of the two freely permutable constraints.

Comparative markedness is relevant to the case at hand because it allows us to explain why a target labial stop could surface faithfully but could not be inserted or be the substitute for another sound. An example of a NOCODA constraint in comparative markedness terms is given in (6) along with a revised hierarchy.

(6) Comparative markedness version of NOCODA-p and ranking

- ${}_O$ NC-p: Coda labial stops shared with the FFC are banned
- ${}_N$ NC-p: Coda labial stops not shared with the FFC are banned
- Ranking: FINAL-C, ${}_N$ NC-p, NC-t, NC-f >> FAITH >> ${}_O$ NC-p, NC-s

This involves splitting the constraint that disfavors final labial stops (NOCODA-p) into one that assigns a mark for an “old” violation, ${}_O$ NOCODA-p, and another that assigns a mark for a “new” violation, ${}_N$ NOCODA-p. It is assumed that all of the other markedness constraints are also split in this same way; however, because this stage provides no evidence of differential behavior in the case of these other constraints, we abbreviate both versions of each constraint under one label. The component parts of the constraints will be differentiated as evidence necessitates in the subsequent stages. By ranking ${}_O$ NOCODA-p below FAITH, we are claiming that faithful final labial stops are protected or immune from change (dubbed a “grandfather effect”). By ranking ${}_N$ NOCODA-p above FAITH, any unfaithful labial stop will be assessed a fatal violation mark and will be eliminated from the competition.

The grandfather effect associated with target words ending in a labial stop is illustrated in the tableau in (7). Many of the competitors are eliminated by the undominated markedness constraints. Candidate (e), the next most harmonic candidate, is eliminated by FAITH, allowing the fully faithful candidate to win.

(7) Faithful realization of final labial stops: A grandfather effect

/kʌp/ ‘cup’	FINAL-C	_N NC-p	NC-t	NC-f	FAITH	_o NC-p	NC-s
FFC ESP a. kʌp						*	
b. kʌ	*!				*		
c. kʌf				*!	*		
d. kʌt			*!		*		
e. kʌs					*!		*

The next two tableaux in (8) show how a candidate with a final [s] is preferred over other candidates whether inserted at the end of vowel-final words or substituted for a final consonant. Note that _NNOCODA-p finally plays a role here, where it eliminates candidate (b) in each tableau. The other undominated markedness constraints eliminate all other competitors. The winning candidate incurs a violation of NOCODA-s.

(8) Final [s] preferred whether inserted or substituted

/tu/ ‘two’	FINAL-C	_N NC-p	NC-t	NC-f	FAITH	_o NC-p	NC-s
FFC a. tu	*!						
b. tup		*!			*		
c. tuf				*!	*		
d. tut			*!		*		
ESP e. tus					*		*
/naɪf/ ‘knife’	FINAL-C	_N NC-p	NC-t	NC-f	FAITH	_o NC-p	NC-s
FFC a. naɪf				*!			
b. nap		*!			*		
c. nat			*!		*		
d. na	*!				*		
ESP e. nas					*		*

Summing up to this point, we have accounted for Stage 1 of T’s seemingly unusual error pattern by appealing to two independently motivated but conflicting markedness constraints (FINAL-C and NOCODA). Comparative markedness also played a role in explaining the grandfather effect whereby labial stops were simultaneously immune to the error pattern and unacceptable substitutes for the other sounds that participated in the error pattern. Finally, in accord with richness of the base, we did not need to make any child-specific assumptions about underlying representations.

An optimality theoretic account of Stages 2 and 3: After treatment

The changes in T’s phonology as a result of treatment follow quite naturally from the constraint demotion algorithm (Tesar & Smolensky, 1998). In response to treatment on

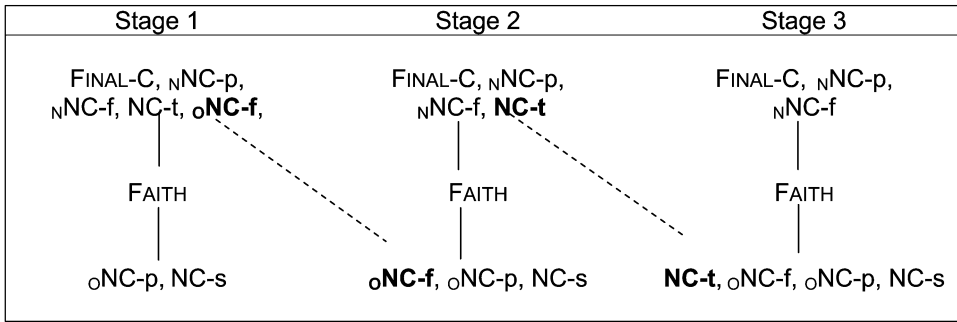


Figure 1. Changes to the constraint hierarchy over time.

final /f/, T achieved target-appropriate realizations of final labial fricatives in Stage 2 by demoting _oNC-f below FAITH. Similarly, in response to treatment on final /d/, T demoted NC-t resulting in target-appropriate production of final coronal stops in Stage 3. Because of the demotion of both _oNC-f and NC-t, some vowel-final words exhibited overgeneralization with the insertion of final [d]. Our account and the constraint demotions at each stage are summarized in Figure 1 by highlighting in bold the affected constraint at each stage with the dotted line showing the demotion.

Conclusion

Our optimality theoretic reconsideration of T's unusual error pattern found that the error pattern was not so unusual after all. It was instead argued to be the natural result of constraint conflict. The conflict between the two independently motivated markedness constraints, FINAL-C and NOCODA, was at the heart of the problem. Comparative markedness also played a role in resolving the conflict between these constraints and explained the grandfather effects observed at different points in time. Additionally, in accord with richness of the base, we did not need to make any child-specific assumptions about underlying representations. Finally, the changes in the error pattern over time also followed from the constraint demotion algorithm. The result is that this error pattern, while challenging on analytical grounds, does have an explanation within optimality theory.

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