Stress-Feature Interactions in Harmonic Serialism*

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> He that is unhappy in one place will seldom be content in another.
>
> Aesop

1 Introduction

Blumenfeld (2006) points out a Too-Many-Repairs (TMR) problem in the area of stress assignment in Optimality Theory (Prince and Smolensky, 2004). Constraints that motivate the appearance of certain features on stressed syllables predict unattested languages in which stress is attracted to syllables with those features present underlyingly. For example, English aspiration on stressed syllables may be captured with a constraint Stress⇒Asp:

Stress⇒Asp 'If stress then aspiration' or 'stress to aspiration': assign a violation mark for every stressed syllable in the output that lacks an aspirated onset.

But this constraint predicts a language in which stress is usually word-initial, but will move when aspiration is underlyingly present on the onset of the final syllable. I will show that with the introduction of a representational unit for onsets, Stress⇒Asp can be broken into two constraints. The gradualism of HS can prevent both of these constraints from being satisfied at the same time by deviating from the usual stress pattern of the language.

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2 Demonstration of the Problem

2.1 The Problem in OT

Although the language represented in (1)–(3) is generally trochaic, candidate a. wins in (1) even though its stress is iambic. Stress⇒Asp is undominated, and it can be satisfied by violating Trochee, which is less costly than violating Id-Asp by inserting aspiration in the first syllable. This pattern is not observed in natural languages, so our theory should not produce it.

(1)

pit^{h}a	Stress⇒Asp	Id-Asp	Trochee
a. ☞ **pit^{h}á**			*
b. p^{h}ít^{h}a		*!	
c. pít^{h}a	*!		

(2)

p^{h}ita	Stress⇒Asp	Id-Asp	Trochee
a. ☞ p^{h}íta			
b. p^{h}itá	*!		*
c. pit^{h}á		**!	*
d. píta	*!	*	

(3)

	pita	Stress⇒Asp	Id-Asp	Trochee
a. ☞	p^{h}íta		*	
b.	pit^{h}á		*	*!
c.	píta	*!		

- Similar unattested languages are predicted for other features and processes that affect stressed syllables[1](Blumenfeld, 2006; González, 2003):
  - Lengthening of onset consonants
  - Glottalization of onset consonants
  - Strengthening (decreasing of sonority) of onset consonants
  - Onset epenthesis[2]
- Blumenfeld proposes procedural constraints to deal with this problem, but I will show that Harmonic Serialism combined with a unit of onset strength can solve the problem without introducing new kinds of constraints.

2.2 The Problem in Harmonic Serialism

- Harmonic Serialism (HS) (Prince and Smolensky, 2004; McCarthy, 2000, 2008a,b) is a constraint-based framework in which the constraints are ranked, like in OT, but the generation and evaluation of candidates is serial. GEN is restricted to generating candidates with only one change from the input. EVAL evaluates the candidates and

[1]Blumenfeld also lists pre-aspiration of codas as a feature that is motivated by stress but never attracts stress. However, in the cases I have found, stress appears to be either unrelated to pre-aspiration, or a necessary but not sufficient condition for it (Foster and LeCron, 1969; Helgason, 1999, 2002; Keer, 1998; Whorf, 1946). This removes the need for a constraint Stress⇒Pre-aspiration, and therefore there is no problem of overgeneration.

[2]There are claims that the presence of an onset, and even the strength of the onset, can attract stress (Davis, 1988; Gordon, 2005; Strehlow, 1942; Yallop, 1977). However, the majority of these cases can also be analyzed without reference to the presence or strength of onsets (Buller et al., 1993; Gahl, 1996; Goedemans, 1997, 1998). Pirahã (Everett and Everett, 1984), the subject of much controversy, Puluwat (Elbert, 1974), an under-documented language, and narrowly restricted morphological domains in English (Nanni, 1977) and Italian (Davis et al., 1987) are to my knowledge the only cases that have not been alternatively analyzed, and I do not find any of these cases convincing enough to conclude that the prediction in (1)–(3) is warranted.

the winner becomes the input to the next step. When a form wins twice in a row, it exits the loop and surfaces as the output.

- Staubs (2010) shows that HS combined with reasonable assumptions about GEN automatically blocks Feature-Driven Stress when the feature belongs to a segment that participates in bidirectional interactions with stress, such as a vowel.
- Jesney (2008) shows that HS blocks a pathology in which stress is repelled by underlying aspiration in order to allow the consonant to deaspirate without violating positional faithfulness constraints.
- However, Staubs notes that HS does not block the attraction of stress to features like aspiration of onset consonants.
- The problem works in much the same way in HS as it does in OT. The tableau in (1) differs only in that b. is not a candidate in HS, because it has been changed from the input in two ways (aspiration and stress). Candidate a. still wins because it satisfies the higher-ranked STRESS⇒ASP at the cost of violating TROCHEE.
- Thus, the gradualism of HS fails exclude the pathological candidate a, because STRESS⇒ASP can be satisfied with just one change to the input.

3 Representing Onset Strength

In order to use HS to solve the problem, we need a system in which the derivational path that attracts stress to aspiration is not harmonically improving at all steps, while the path that attracts aspiration to stress is always harmonically improving. In this section, I argue that a unit of onset strength can provide us with a mechanism for creating such a system.

- The features and processes that interact with stress unidirectionally affect onsets only and seem to increase onset strength.
  - Strengthening decreases sonority, which is correlated with intensity (Parker, 2002)
  - Aspiration and glottalization may be types of strengthening (Lavoie, 1996, 2001). In Squamish (Dyck, 2006) and Kwak'wala (Zec, 1995), glottalized sonorants appear to be nonmoraic while unglottalized sonorants are moraic; given the claim that moras are assigned to segments above a language-specific sonority threshold (Prince, 1983; Zec, 1995), this provides evidence for this claim for glottalized consonants.
  - Onset epenthesis creates a period that is lower in sonority than the rime, allowing for recovery.

  - Lengthening, and perhaps aspiration, increase this period of recovery. Further research is needed to determine whether longer periods of recovery are more effective.

- Gordon (2005) argues that strong onsets provide a period of recovery in order to increase the perceived loudness of a stressed rime.
  - Adaptation: The auditory system perceives noise as less loud over time.
  - Recovery: Adaptation can be undone by a period of decreased intensity in the sound stream.

- I propose an abstract representational unit ν. As the mora (μ) represents rime length, ν represents onset strength.

- I suggest that stress motivates an increase in onset strength by motivating the insertion of ν, which motivates various strengthening processes. STRESS⇒ASP is replaced with the following two constraints:

  Stress⇒ ν Assign a violation for every stressed syllable in the output that does not contain ν.[3]

  ν ⇒**Asp** Assign a violation for every segment in the output dominated by ν that is not aspirated.

4 HS and ν Solve the Problem

4.1 Absence of the Unattested Prediction

The input /pit^{h}a/ can map in the first step to any of candidates a.–d. or f, depending on the ranking of constraints. Candidate e, which is the unattested output, is harmonically bounded by candidate f. I show f. as the winner in order to show that it cannot lead to the unattested output further in the derivation.

[3]For the moment I assume a constraint on GEN banning ν from dominating nuclei or codas, so that this constraint will not be satisfied that way.

(4) Step 1

	pit^{h}a	HaveStress	S⇒ ν	ν ⇒Asp	Id-S	Id-Asp	Trochee
a.	pit^{h}a	W	L		L		
b.	p^{h}it^{h}a	W	L		L	W	
c.	pita	W	L		L	W	
d.	p^{h}ita	W	L		L	W	
e.	pit^{h}á		*		*		W
f. ☞	pít^{h}a		*		*		

a is the faithful candidate, so if it wins, it will surface. It does not show the pathology.

b, c, and d pose no threat because they make the first syllable equal or better as a site for stress by changing the distribution of aspiration.

e is the unattested output, but it is harmonically bounded by f. because the violation of Trochee does not buy satisfaction of Stress⇒ ν the way it does with Stress⇒Asp.

f can converge at any point along the derivation pít^{h}a → p$_{\nu}$ít^{h}a → p$^{h}_{\nu}$ít^{h}a. The only way it could become pathological is if stress were added to the second syllable or flopped from the first syllable to the second, but such candidates would be harmonically bounded at any point in the derivation:

Step 2 pít^{h}a → pit^{h}á is bounded for the same reason that e. was: it doesn't improve on Stress⇒ ν.

Step 3 p$_{\nu}$ít^{h}a → p$_{\nu}$it^{h}á is bounded because it doesn't improve on ν ⇒Asp, and introduces a violation of Stress⇒ ν, as shown in (5).

Step 4 p$^{h}_{\nu}$ít^{h}a → p$^{h}_{\nu}$it^{h}á is bounded because the faithful candidate violates no constraints.

(5) Step 3

	HaveStress	S⇒ ν	ν ⇒Asp	Id-S	Id-Asp	Trochee
a. $p_\nu$ít^{h}a			*			
b. p^h_νít^{h}a					*	
c. $p_\nu$it^{h}á		*	*	*		*

- This solution depends on the restriction that ν **is never present underlyingly**, so that the input /pit$^h_\nu$a/ never occurs. In such an input, violating Trochee by adding stress to the final syllable would remove a violation of ν ⇒Asp, and so would not be harmonically bounded. In (6), candidate b. could win and converge, resulting in the form that is not attested.

(6) Pathological case: underlying ν

	HaveStress	S⇒ ν	ν ⇒Asp	Id-S	Id-ν	Trochee
a. pit$^h_\nu$a	W			L		L
b. ☞ pit$^h_\nu$á				*		*
c. pít$^h_\nu$a		W		*		L

- Motivating ν with positional constraints would cause the problem in the same way later in the derivation. The unit must only be motivated by stress.

- Furthermore, the framework must be serial. In OT, banning ν from inputs does not avoid the problem, because ν can be inserted or moved at the same time as stress. Thus, Stress⇒ ν and ν ⇒Asp can be satisfied at the same time by attracting stress and ν to the aspirated syllable.

(7) Pathological case in OT

	pit^{h}a	HaveStress	S⇒ ν	ν ⇒Asp	Id-S	Id-ν	Id-Asp	Trochee
a.	pit^{h}a	W			L	L		L
b. ☞	pit$^{h}_{\nu}$á				*	*		*
c.	p$^{h}_{\nu}$íta				*	*	W	L

- Beyond these requirements, the system is quite robust.
- Underlying stress, as in /pít^{h}a/, does not introduce the pathology, since we have seen how the derivation from that form ((4)f.) cannot lead to the unattested output.
- A constraint motivating aspiration on the final syllable fails to cause the pathology.
- A constraint ν ⇒Stress fails to cause the pathology, but is unhelpful. It is simply blocked from doing any work because it is only harmonically improving to insert ν where stress is already present.
- For this same reason, it does not cause the pathology to interpret ν directly as strength the way moras are interpreted directly as length, rather than motivating the addition of length through a constraint. However, strength can take many different forms, so constraints seem necessary. I propose that con also contains constraints such as the following for capturing the other processes that behave like stress-conditioned aspiration:

  ν ⇒**Long** Assign a violation to every segment dominated by ν that is not long.

  ν ⇒**Glottalized** Assign a violation to every segment dominated by ν that is not glottalized.

  ν ⇒**Voiceless** Assign a violation to every segment dominated by ν that is [+voice].

  ν ⇒**Onset** Assign a violation to every syllable containing ν that has no onset.

4.2 Presence of the Attested Prediction: Squamish Aspiration

In Squamish, unglottalized plosives are aspirated when they occur in the onset of a stressed syllable (Kuipers, 1969). The Squamish stress system is sensitive to vowel sonority and position; for the purposes of these examples, FtBin and HaveStress are undominated (Dyck, 2006; Demers and Horn, 1978).

(8) *tʰíwət* 'Indian tribe'[4]

a. Step 1

tiwət	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a. ☞ tə́iwət	*				
b. tiwə́t	*			W	W

b. Step 2

tə́iwət	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a. tə́iwət	W	L			
b. ☞ t$_\nu$ə́iwət		*			

c. Step 3

t$_\nu$ə́iwət	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a. t$_\nu$ə́iwət		W	L		
b. ☞ t$^{\text{h}}_\nu$ə́iwət			*		

[4]Examples are from Dyck (2006), which does not represent Squamish aspiration. I have added it where Kuipers says it appears.

(9) Squamish example: *səpʰíɬk* 'yellow salmonberry'

a. Step 1

	səpiq	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a. ☞	səpíq	*				*
b.	sə́piq	*			W	L

b. Step 2

	səpíq	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a.	səpíq	W	L			*
b. ☞	səp$_\nu$íq		*			*

c. Step 3

	səp$_\nu$íq	S⇒ ν	ν ⇒Asp	Id-Asp	*ə́	Trochee
a.	səp$_\nu$íq		W	L		*
b. ☞	səp$^{\text{h}}_\nu$íq			*		*

As you can see, this system can produce aspiration on both initial and final stressed syllables.

5 Conclusion

Harmonic Serialism alone cannot block the attraction of stress to features of onsets. However, a theory of onset strength that includes a representational unit that is never underlying and uses the gradualism of Harmonic Serialism can correctly model the unidirectional relationship between onset features and stress. Furthermore, the perceptual grounding of this theory

provides a unified explanation for the similar behavior of these features. Further research will show if this solution can be extended to processes of lenition in unstressed syllables.

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