Consonant harmony in early grammars revisited: Domains, licensing and directionality

Heather Goad

McGill University

heather.goad@mcgill.ca

Dept of Linguistics, 1085 av. Penfield, Montréal (Qué), Canada H3A 1A7

Abstract

It is argued that consonant harmony (CH) is formally a relation holding between onsets in head and dependent syllables of the foot. Dep-to-Head CH satisfies place licensing: it allows prosodically-weak positions (foot-internal onsets) to bear Dorsal. Head-to-Dep CH satisfies segment licensing: it shields Dorsal segments in weak positions from deletion or reduction in complexity. There are parallels between Head-to-Dep CH and word-final consonants in unstressed syllables; as the latter are outside the foot, the domain of CH, they cannot be licensed and are subject to deletion/reduction.

1   The phenomenon

Consonant harmony (CH) is a commonly attested process in early grammars where consonants which are not string adjacent assimilate to one another in place features (e.g. Smith, 1973; Ingram, 1974; Vihman, 1978). The examples in (1) from Amahl at Stage 1 reveal that coronals are targets for assimilation from dorsals (the most commonly observed pattern across learners), and that harmony applies bidirectionally. In addition, the range of shapes of the forms displayed suggests that the domain of CH is the prosodic word (PWd), i.e. that CH applies independently of prosodic constituency internal to this domain.

(1) Amahl at Stage 1 (age 2.60) (Smith, 1973):

		Short Vowel:	Long Vowel:	Bisyllabic:
a.	Right-to-Left:	'sock' [gɔk]	'strike' [gaik]	'doctor' [gɔgə]
b.	Left-to-Right:	'good' [gug]	'coach' [guːk]	'glasses' [gaːgiː]

The data in (1) conceal an important asymmetry which is mentioned in the literature now and again, that L-to-R application of CH implies the presence of R-to-L application (e.g. Pater & Werle, 2001). As will be seen, this asymmetry manifests itself in Amahl's outputs, for targets of certain shapes at Stage 1 and more generally at later stages in development. As well, in spite of the apparent diversity in word shape in (1), these forms can all be characterized as left-headed feet. Since children's early words are typically maximally one foot in length, harmonized outputs are often ambiguous between a characterization of the domain of harmony as the foot or as the PWd. As will be seen, Amahl's grammar permits words that are longer than one foot at the point when CH is attested, and asymmetries in the way that CH operates enable us to speak directly to the question of the domain in which the process applies.
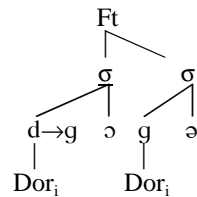
In this paper, I will argue that the directionality asymmetry observed in Amahl's outputs can be captured by appealing to two different types of licensing; R-to-L CH (dependent-to-head in trochaic languages) applies in order to license marked place features, while L-to-R CH (head-to-dependent) applies in order to license entire segments. L-to-R CH leaves grammars before R-to-L because segments must be licensed before their features can be licensed. Second, I will argue that the domain of CH is the foot (for evidence that some harmonies are bounded by the foot, see e.g. van der Hulst & van de Weijer (1995) and Piggott (1996) on vowel harmony in adult grammars and Rose (2000) on child CH in Québec French). Segments that cannot be licensed through CH – namely, consonants that are outside the foot – are subject to deletion or reduction to unmarked coronal.

2   Recent analyses of the directionality asymmetry

Two principal views of the directionality asymmetry have been proposed in the recent literature. The first, that of Pater & Werle (2001, 2003), appeals to constraints which specifically include direction of assimilation as an argument. In their most recent analysis, Pater & Werle propose that, in addition to a general AGREE constraint, which requires consonants to agree in place of articulation, there is a constraint that contains the fixed argument 'left', AGREE-LEFT-(Dor), which requires a consonant preceding a dorsal to be homorganic with it. However, other than the cross-linguistic observation that place assimilation processes typically apply from right-to-left, there is no explanation for why 'left' should be the argument specified in the constraint; there is, for example, no reference to structural considerations or to asymmetries between (prosodically) weak and strong positions more generally.

The position taken here follows instead from the view that CH applies to satisfy licensing and thus involves a relation between heads and dependents (Rose, 2000; Goad, 2001). Focussing on R-to-L (Dep-to-Head) harmony, the structure in (2) shows how the proposal works in brief: CH enables marked features (Dor; also Lab) in prosodically-weak positions (e.g. foot-internal onset, coda) to surface by being associated to and thus licensed by a strong position (e.g. foot-edge onset). (The head σ is underlined.)

(2)   'doctor' → [gɔgə]:

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                          Ft
                        /    \
                      σ        σ
                    /|        /|
                d→g  ɔ      g   ə
                 |          |
               Dorᵢ        Dorᵢ
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3   Consonant harmony data from Amahl

The data to be discussed are drawn from the first five stages of Amahl (Smith, 1973), ages 2.60-2.144. The focus is on CH and on final consonant deletion/reduction patterns. The five stages fall into two periods as concerns these phenomena; Period 1 corresponds to Smith's Stage 1, and Period 2 to Stages 2-5.

The data in (3)-(4) reveal that Dep-to-Head (R-to-L) CH is obligatory at Periods 1 and 2, regardless of the quality of the target. (The focus of this paper is on the behaviour of coronals and dorsals only.)

(3)   Dep-to-Head CH: a.   Obstruent Targets: Obligatory: b.   Nasal Targets: Obligatory:
     Period 1:   'duck'   [gʌk]   'snake'   [ŋeik]
                  'tickle'   [gigu]

(4)   Dep-to-Head CH: a.   Obstruent Targets: Obligatory: b.   Nasal Targets: Obligatory:
     Period 2:   'take'   [geik]   'neck'   [ŋɛk]
                  'doggie'   [gɔgiː]   'nanga'   [ŋʌŋgə] (Hindi)

Head-to-Dep CH, by contrast, is obligatory only for obstruent targets at Period 1 (5a); nasals are not targeted (5b). By Period 2, Head-to-Dep CH no longer applies (6).

(5)   Head-to-Dep CH: a.   Obstruent Targets: Obligatory: b.   Nasal Targets: No CH:
     Period 1:   'good'   [gug]   'skin'   [gin]
                  'glasses'   [gaːgiː]   'corner'   [gɔːnə]

(6)   Head-to-Dep CH: a.   Obstruent Targets: No CH: b.   Nasal Targets: No CH:
     Period 2:   'cat'   [gæt]   'gone'   [gɔn]
                  'curtain'   [gədən]   'green'   [giːn]

4 Dependent-to-Head (Right-to-Left) CH as place licensing

As mentioned in Section 2, I consider the movitation for both types of CH to be licensing (following Piggott (1996, 1997) for vowel harmony). Focussing for the moment on the data in (3) and (4), I propose that Dep-to-Head CH allows prosodically-weak positions to surface with marked PLACE. I consider all of the targetted positions in (3) and (4) to be in foot-medial onset position. This position has been convincingly argued to be a weak licenser by Harris (1990). Concerning the CVC forms, however, this view requires that word-final consonants not be codas, but instead, onsets of empty-headed syllables (OEHS) (following e.g. Kaye, 1990; see Goad, 2002 and Goad & Brannen, 2003 for motivatation for right-edge onsets in early grammars). Phonetic evidence that final stops are onsets in Amahl's grammar comes from Smith's comment that, in this position in the word, Amahl's stops are realized as fortis (Smith, 1973:37), a property not typical of codas which are instead often subject to weakening across languages. As will be seen below, there is also phonological evidence for final consonants as onsets in Amahl's grammar.

The triggers of Dep-to-Head CH are marked place features (Dor, as well as Lab) that originate in prosodically-weak positions where, by virtue of their markedness relative to the unmarked Cor to their left, they cannot be licensed. These features must therefore be licensed by association to a prosodically-strong position (foot-edge onset). Association of a feature to a strong position can be achieved through metathesis (e.g. 'duck' $\rightarrow$ [gΛt], spreading/sharing, or copying (Goad, 2001); CH involves copying (Goad, 1997). Feature copy improves segmental markedness, as the marked feature Dor is licensed by association to a strong position; in this way, CH 'rescues' Dor from deletion. See (7a) for CVC forms and (7b) for CVCV forms. (In the interest of space, structures are abbreviated when possible.)

(7) a. Word-final OEHS: /dΛk/ $\rightarrow$ [g$_i\Lambda$k$_i$]: 　　　b. Foot-internal Onset: /tiku/ $\rightarrow$ [g$_i$ig$_i$u]:
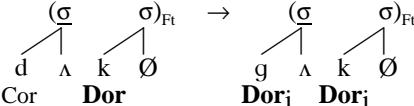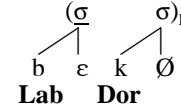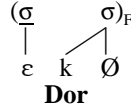

On this approach, where CH results in large part from the fact that a marked feature originates in a prosodically-weak position, it must be explained why the process does not apply in Labial + Dorsal contexts (see (8a)) nor in contexts where Dorsal-final words begin with onsetless syllables (8b).

(8) a. No CH in Lab + Dor Contexts: 　　　b. No CH in Onsetless + Dor Contexts:

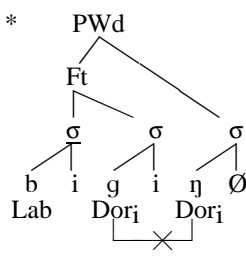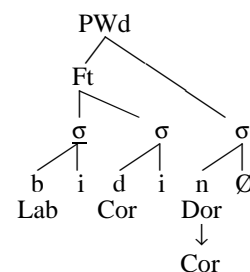|						
'back'	[bɛk]	*[gɛk]		'egg'	[ɛk]	*[gɛk]
'finger'	[wiŋə]	*[giŋə]		'angry'	[ɛŋiː]	*[gɛŋiː]

Dor must be allowed to appear in the dependent when it is not preceded by Cor in the head. To capture this, I appeal to Dresher & van der Hulst's (1998) work on Head-Dependent Asymmetries where they argue that dependents cannot be more complex than their heads (see also Harris, 1990). If the place complexity scale is as in (9) (formalized through a fixed ranking of place-referring constraints or through feature-geometric representations), the absence of CH in (8a) can be captured.[1] In (10a), CH must apply as Cor is less complex than Dor, while in (10b), CH does not apply as there is no difference in the markedness/complexity of the two place features involved. In (10c), CH does not apply as there is no onset in the head syllable; no comparison can thus be made between the complexity of Dor and the onsetless syllable to its left with the result that Dor is permitted in the dependent without CH applying to license it.

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[1]　There is some evidence that the complexity hierarchy is instead Dor > Lab > Cor. This would account for the fact that, for some children, labials are targets for CH from dorsals (e.g. Trevor's 'bug' $\rightarrow$ [gΛg]; Pater, 1997), as well as for the fact that CH triggered by labials is less robust than CH triggered by dorsals (compare Amahl's Lab CH 'stop' $\rightarrow$ [bɔp] ~ [dɔp] vs. Dor CH 'stuck' $\rightarrow$ [gΛk], *[dΛk] at St 1).

(9) More complex $\longleftrightarrow$ Less complex

Dor, Lab $>$ Cor

(10) a. Coronal + Dorsal:
/dʌk/ → [gʌk]:

$(σ \quad σ)_{Ft} \quad → \quad (σ \quad σ)_{Ft}$

d ʌ k Ø   g ʌ k Ø

Cor **Dor**   **Dorᵢ Dorᵢ**

b. Labial + Dorsal:
/bæk/ → [bɛk]:

$(σ \quad σ)_{Ft}$

b ɛ k Ø

Lab Dor

c. Onsetless + Dor:
/ɛg/ → [ɛk]:

$(σ \quad σ)_{Ft}$

ɛ k Ø

Dor

We have seen that CH applies between consonants in 'short' (CVC(V)) strings of the shape Cor + Dor. Evidence that the domain of the operation is truly the foot comes from longer forms where the Cor + Dor string crosses the foot boundary. While CH operates in short nasal-final words such as 'ring' → [giŋ], it does not apply between the medial Cor and final Dor nasal in longer forms such as 'spitting'. This form does not surface as the expected [bigiŋ] (see (11a)) but, instead, as [bidin] where CH does not apply and the complexity of the final nasal is reduced to coronal (11b). The connection between CH and reduction to coronal will be discussed further in Section 5.

(11) a. *   PWd

Ft

σ   σ   σ

b i   g i   ŋ Ø

Lab   Dorᵢ   Dorᵢ

b.   PWd

Ft

σ   σ   σ

b i   d i   n Ø

Lab   Cor   Dor
↓
Cor

5   Head-to-Dependent (Left-to-Right) CH as segment licensing

In this section, I will show that there is a parallel between Head-to-Dep (L-to-R) CH and the material permitted in what will be descriptively referred to as word-final position in unstressed syllables. (12) reveals that, at Period 1, final obstruents in this position delete (12a), the same point that obstruents undergo Head-to-Dep CH (e.g. 'good' → [gug] (5a)). The final obstruent cannot be rescued by CH (12b), suggesting that the domain of CH is the foot and that this consonant is outside the foot as an OEHS (see (17) below). At Period 2, the deletion problem is overcome (13), the same point that Head-to-Dep CH is no longer required (e.g. 'cat' → [gæt] (6a)). (Note that in Amahl's corpus at Periods 1-2, all final obstruents in target words of this shape are coronal.)

(12) Word-final Obstruent in Unstressed Syllables: Period 1:
   a. Obstruent → Ø:
      'scissors'   [didə]   *[didət]
      'carpet'   [ga:bi:]   *[ga:bit]
   b. Final Obstruent Not Target for CH:
      'biscuit'   [bigi:]   *[bigik]
      'chocolate'   [gɔgi:]   *[gɔgik]

(13) Word-final Obstruent in Unstressed Syllables: Period 2:
   a. Obstruent → [t]:
      'garbage'   [ga:bit]
      'carpet'   [ga:bit]
   b. Final Obstruent Not Target for CH:
      'necklace'   [gɛgit]
      'pocket'   [bɔkit]

The parallel extends to forms with word-final nasals as well. The data in (14) reveal that, in contrast to coronal obstruents, final [n] in unstressed syllables is permitted during Period 1 (14a), parallel to (5b) where CH need not apply to [n] (e.g. 'skin' → [gin]). Final [ŋ] is illicit; it neutralizes to unmarked [n]

(14b) and cannot be rescued by CH in words where it is preceded by a dorsal consonant (14c).[2] At Period 2, there is no change (15a-c), parallel to no change being observed in the CH data (6b).
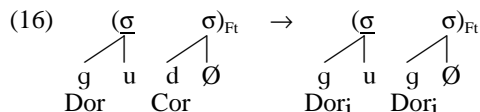
(14) Word-final Nasal in Unstressed Syllables: Period 1:

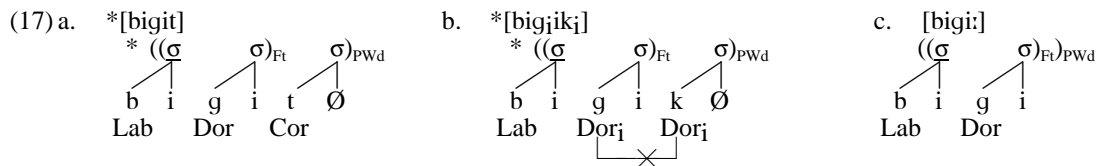| a. Target [n] Okay:	b. Target [ŋ] → [n]:	c. Dor Place Not Rescued by CH:
'curtain' [gəːgin]	'driving' [waibin] *[waibiŋ]	'working' [wəːgin] *[wəːgiŋ]
'kitchen' [gigən]	'shouting' [daudin] *[daudiŋ]	'taking' [gekin] *[gekiŋ]

(15) Word-final Nasal in Unstressed Syllables: Period 2:

a. Target [n] Okay:	b. Target [ŋ] → [n]:	c. Dor Place Not Rescued by CH:
'curtain' [gəːdən]	'sitting' [didin] *[didiŋ]	'breaking' [beːgin] *[beːgiŋ]
'medicine' [mɛdin]	'squatting' [gɔpin] *[gɔpiŋ]	'taking' [gekin] *[gekiŋ]

I argue that the parallel between Head-to-Dep CH and the patterns permitted for final consonants in unstressed syllables reveals what underlies this type of CH: Head-to-Dep CH licenses SEGMENTS in prosodically-weak positions and protects them from deletion/reduction. The analysis for word-final obstruents at Period 1 is provided in (16) and (17). For the short forms, the final obstruent is foot-internal (16): Head-to-Dep CH can therefore apply in order to license this segment and shield it from deletion.

(16)

The final obstruent in longer forms cannot occur at this stage because non-harmonized obstruents are not yet allowed in prosodically-weak positions (*[t] in (17a)). In contrast to the short forms, the final obstruent cannot be rescued by CH as it is not inside the foot (17b). It must therefore delete (17c).

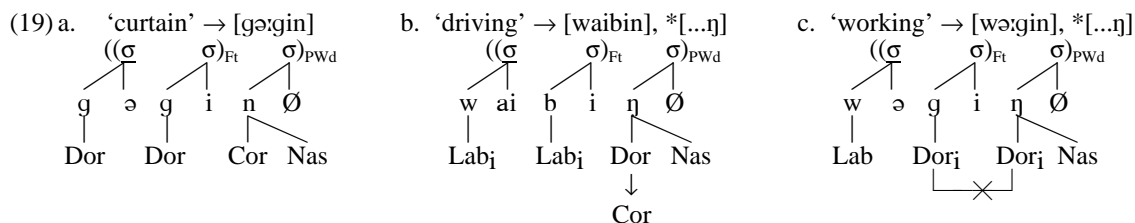(17) a. *[bigit] b. *[bigᵢikᵢ] c. [bigiː]

Concerning the final coronal nasal at Period 1, Head-to-Dep CH need not apply; see (18). This is because nasals are less marked than obstruents in prosodically-weak positions, parallel to cross-linguistic observations on licensing restrictions (e.g. [n] (or [ŋ] in some languages) is the optimal word-final coda).

(18) a. b.

For longer forms, no deletion of the final nasal is required (see (19a) overleaf), parallel to (18). However, these nasals must be unmarked for place and thus target dorsal becomes coronal (19b), as seen earlier in (11b). Dorsality cannot be saved through the application of CH since the nasal is not inside the foot (19c).

At Period 2, Head-to-Dep CH no longer affects obstruents (e.g. 'cat' → [gæt], *[gæk] (6a)), and final obstruents are no longer deleted (e.g. 'garbage' → [gaːbit], *[gaːbiː] (13a)). There is no change for nasals.

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[2] [ŋ]→[n] cannot reflect perceptual confusion between [n] and [ŋ], as target [m]→[n] as well: 'bottom' [bɔdin] (Stage 1). Note as well that [ŋ]→[n] in this position is not characteristic of the ambient dialect.

(19) a. 'curtain' → [gəːgin]

((σ   σ)Ft σ)PWd

g ə g i n Ø

Dor Dor Cor Nas

b. 'driving' → [waibin], *[...ŋ]

((σ   σ)Ft σ)PWd

w ai b i ŋ Ø

Lab_i Lab_i Dor Nas
                ↓
               Cor

c. 'working' → [wəːgin], *[...ŋ]

((σ   σ)Ft σ)PWd

w ə g i ŋ Ø

Lab Dor_i Dor_i Nas
        └──×──┘

6 Conclusion

I have argued that Dep-to-Head and Head-to-Dep CH are both motivated by licensing: marked segmental content must be licensed by association to a prosodically-strong position. Dep-to-Head CH satisfies place licensing: CH permits prosodically-weak positions to bear Dor. Head-to-Dep CH satisfies segment licensing: CH rescues Dor segments in weak positions from deletion/reduction. The source of Head-to-Dep CH as segment licensing was determined through parallels between this type of CH and the patterns observed for word-final consonants in unstressed syllables: coronal obstruents are targets for CH at the same time as they are deleted in word-final unstressed syllables. Consonants in the latter position cannot be rescued by CH, as they are outside the foot, the domain of harmony. Both Head-to-Dep CH and final obstruent deletion are overcome at the same time. As coronal nasals are not targets for CH, they are allowed to occur word-finally in unstressed syllables, as expected. Dorsal nasals are replaced by coronal in this position; as they are outside the foot, they cannot be preserved through harmony.

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