EVIDENCE FOR PHONOLOGICAL DERIVATION A CASE OF OPACITY IN LUSHOOTSEED

Miae Park
University of Wisconsin, Madison

0 Introduction

Lushootseed [dxʷɬəšucɪd] is a cover term for Puget Sound Dialects of Salish spoken in the vicinity of Seattle, Washington In this language, the distribution of the fixed vowel [ɪ] in the diminutive reduplication is determined by phonological properties of the base The diminutive allomorphy interacts in an opaque fashion with stem weakening, which is morphologically-restricted to apply, only when preceded by the diminutive reduplicative prefix In this paper, I will argue that the opaque interaction between the phonologically-conditioned diminutive allomorphy and morphologically-conditioned stem weakening in Lushootseed provides evidence for a serial derivation between underlying and surface representations and propose a serial, constraint-based account couched within Lexical Phonology (LP) model

This paper is structured as follows Section 1 will be concerned with the two most common types of reduplication, the diminutive and distributive reduplication, and their allomorphic alternations in Lushootseed In section 2, I will consider a Correspondence Theoretic (CT) account of the diminutive allomorphy and compare a constraint-based and a rule-based account of it, showing that the diminutive allomorphy provides support for a constraint-based analysis In section 3, I will consider stem weakening and its opaque interaction with the diminutive allomorphy and show why the opaque interaction of the two phenomena is problematic for a non-serial, constraint-based CT account in Optimality Theory (OT) In section 4, I will discuss three non-serial CT proposals for opacity, showing that they cannot adequately handle the surface opacity in Lushootseed In section 5, I will conclude that the surface opacity in this language provides strong evidence for a serial derivation between underlying and surface representations, proposing a serial, constraint-based LP account

1 Lushootseed Reduplication

In Lushootseed, the two most common types of reduplication are the distributive and diminutive reduplication (Bates 1986, Bates, Hess and Hilbert 1994, Broselow 1983, Haeberlin 1918, Hess 1967, Urbanczyk 1995) In Lushootseed[1], the distributive reduplication, which represents plurals and repeated or frequent actions as well as distributivity, involves prefixation of a copy of the first CVC of a nominal or verbal stem to that stem, as exemplified in (1) (Broselow 1983 319)

(1)	Stem		Distributive	
	yúbɪl	'die, starve'	yúb-yubɪl	'they are starving'
	pástəd	'white person'	pás-pastəd	'white people'
	bədáʔ	'child'	bəd-bədáʔ	'children'

However, if the first two stem consonants are identical, the distributive copies the stem exclusive of the consonant following the first vowel, as illustrated in (2) (Urbanczyk 1995 514)

(2)	Stem		Distributive	
	c'íc'al	'long feathers w/ thick stems'	c'í-c'ic'al-b	'sprouted wings'
	wíw'su	'children, little'	wí-wiw'su	'little (plural)'
	ləlwáʔsə d	'sleeping platform'	lə-ləlwáʔsə d	'sleeping platforms'

In (2), reduplication of the second stem consonant in the distributive would create a geminate cluster Thus, the failure to copy the second consonant, when the first two stem consonants are identical, is attributable to antigemination[2], a prohibition against adjacent identical elements, as discussed in Urbanczyk (1995)

The other most common reduplication type in this language is the diminutive reduplication, which has the meaning of smallness, diminished action and endearment The diminutive, which also involves prefixation, has four allomorphs a copy of the first CV of the stem, a copy of the first stem consonant

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[1] In Lushootseed, the canonical root shape is monosyllabic The most prevalent root shape is CVC, as reported in Snyder (1968 14) He reports that 68% of 700 roots of southern Lushootseed he collected are CVC
[2] In Lushootseed, there is one exception to the CV-pattern of the distributive reduplication, as exemplified below
  lil 'far, far away' ʔu-lílɪl-təb 'they are separated 'from rest of group'

followed by the fixed vowel [ı] and either of these alternants with a glottal stop (CVʔ or Cıʔ), as shown in (3)

(3) a | Stem | | CV Diminutive | |
| --- | --- | --- | --- |
| | Xáhəb | 'cry' | Xá-Xahəb | 'an infant crying' |
| | suq'ʷaʔ | 'younger sibling' | sú-suq'ʷaʔ | 'little younger sibling' |
| b | Stem | | CVʔ Diminutive | |
| | ʔəxʷXálus | 'marked face' | ʔəxʷ-Xáʔ-Xalus[3] | 'racoon (lit little small face)' |
| | taləʔ | 'money' | táʔ-taləʔ | 'a little money' |
| c | Stem | | Cı Diminutive | |
| | č'λ'áʔ | 'rock' | č' ɫ-č'λ'aʔ | 'little rock' |
| | bədáʔ | 'child' | bí-bədàʔ | 'dolls, litter' |
| | s-du kʷ | 'knife' | s-dí-du kʷ | 'small knife' |
| d | Stem | | Cıʔ Diminutive | |
| | qʷɫayʔ | 'log, stick' | qʷíʔ-qʷɫə yʔ | 'stick, little stick' |
| | bəlXʷ | 'pass by' | bíʔ-bəlXʷ | 'pass by a little jog' |
| | bu s | 'four' | bíʔ-bu s | 'four little items' |

As discussed in Bates (1986), the distribution of the diminutive allomorphs is predictable from phonological properties of the stem According to Bates, the diminutive takes the Cı-alternant, when the stem begins with a consonant cluster, or has schwa or a long vowel as its first vowel, as shown in (3c) and (3d) Elsewhere, namely when the stem begins with a single consonant followed by a short, non-schwa vowel, the diminutive copies the first CV of the stem, as exemplified in (3a) and (3b) The glottal stop is not a part of the diminutive reduplicative prefix It is optionally inserted by a glottal stop insertion to close an open syllable, when that syllable bears the main stress of a word

In Lushootseed, the distributive and diminutive reduplicative prefixes may co-occur in a single word in either order A distributive form may take a diminutive prefix and vice versa, as shown in (4)

(4) a | Stem | | Diminutive-Distributive-Stem | |
| --- | --- | --- | --- |
| | bədáʔ | 'child' | bí-bəd-bədà ʔ | 'dolls, litter' |
| | qís | 'expose' | qí-qs-qıša d | 'legs partly uncovered' |
| | cək'ʷ | 'straight' | cí-ck'ʷ-cək'ʷ | 'It is straight' |
| | sáxʷəb | 'jump, run' | sáʔ-sxʷ-sa xʷəb | 'hopping' |
| b | Stem | | Distributive-Diminutive-Stem | |
| | bədáʔ | 'child, offspring' | bí-bı-bədàʔ | 'young children' |
| | č'λaʔ | 'rock' | č' ɫ-č'ı-č'λ aʔ | 'gravel' |
| | p'áλaλ | 'be of no value, importance' | p'á-p'a-p'λaλ | 'no counts, riff-raff' |
| | yúbıl | 'die, starve' | yú-yu-yəbıl | 'children are starving' |

In the Dim-Dist reduplication in (4a), the distributive copies the first CVC of the stem In the last three forms in (4a), the distributive vowel is lost entirely due to stem weakening, which will be discussed in section 3 In the Dist-Dim reduplication in (4b), on the other hand, the distributive reduplicant is realized with the CV shape, since copying the consonant following the first vowel of the diminutive-prefixed form would create a geminate cluster In both types of double reduplication, the diminutive takes either the Cı(ʔ)- or CV(ʔ)-allomorph based on the phonological properties of the base The diminutive reduplicant in the last form in (4a) and in the last two forms in (4b), however, does not conform to the diminutive allomorphy In those forms, the diminutive allomorphy interacts in an opaque way with a phonological rule of Lushootseed, stem weakening

2 A Constraint-based Account of Lushootseed Diminutive Allomorphy

Urbanczyk (1995) provides a non-serial, constraint-based CT account of the allomorphic alternation in the fixed segmentism of the diminutive in Lushootseed In this section, I will first review her analysis of the diminutive allomorphy and then compare a constraint-based and a rule-based account of it, arguing that the diminutive allomorphy provides support for a constraint-based analysis

According to Alderete, Beckman, Benua, Gnanadesikan, McCarthy and Urbanczyk (1996), a fixed segment in reduplication is not a presepecified melody in the lexicon, but a kind of epenthetic segment in the sense that it is not present in the base Following them, Urbanczyk regards the fixed vowel [ı] in the

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[3] In Lushootseed, reduplication does not copy the prefix materials, as shown in the form [ʔəxʷ⁻Xaʔ-Xalus]

diminutive in Lushootseed as a kind of an epenthetic melody Thus, the occurrence of the fixed [ɪ] in the diminutive incurs a violation of the base-reduplicant (B-R) identity constraints, Dep$_{B-RDim}$, which bars non-base materials from the diminutive reduplicant, and Max$_{B\ RDim}$, which ensures complete copying of the base in the diminutive reduplicant The occurrence of the fixed segment [ɪ], when the base has an initial consonant cluster, is characterized in Urbanczyk by assuming the constraints, *Complex (no more than one C or V may associate to any terminal syllable node (such as onset, nucleus and coda)) and No Skipping (the portion of S$_1$ standing in correspondence forms a contiguous string as does the correspondent portion of S$_2$) and by ranking them above Dep$_{B\ RDim}$ and Max$_{B\ RDim}$, as represented in table 1

Table 1

Red$_{Dim}$- č'λ'a?	*Complex	No Skipping	Dep$_{B-RDim}$	Max$_{B\ RDim}$
a č'λ'á-č'λ'a?	*!	¦		*
b č'á-č'λ'a?		*!		**
c λ'á-č'λ'a?		*!		**
√d č'í-č'λ'a?			* ¦	***

In table 1, (a), (b) and (c) fare worse on the high-ranked constraint, either *Complex or No Skipping, than (d) and thus are suboptimal to (d) (d) with the fixed [ɪ] in the diminutive emerges as optimal

The fixed vowel [ɪ] also occurs, when the first vowel of the base is schwa In this case, Urbanczyk relates the occurrence of the fixed vowel [ɪ] with stress patterns in Lushootseed In this language, stress falls on the first non-schwa vowel in a word In her account, the occurrence of the fixed [ɪ] in the diminutive, when the first stem vowel is schwa, is characterized by positing the constraints, Align-L (PrWd, Ft) (feet are initial), *Unstressed-V (unstressed full vowels are prohibited) and *Stressed-ə (stressed schwa is barred) and by ranking them higher than Dep$_{B\ RDim}$ and Max$_{B-RDim}$ In Lushootseed, *Unstressed-V is ranked higher than Align-L, because stress is assigned to the first non-schwa vowel in non-initial syllables of a word, if the word-initial vowel is schwa Align-L (PrWd, Ft) and *Stressed-ə do not crucially interact and thus their ranking is not crucial, as represented in table 2

Table 2

Red$_{Dim}$-bəda?	*Unstressed-V	Align-L	*Stressed-ə	Dep$_{B-RDim}$	Max$_{B\ RDim}$
√a bí-bədà?				*	****
b bə́-bədà?			*!		***
c bə-bədá?		*!			***
d bə́-bəda?	*!		*		***

In table 2, (d) incurs a fatal violation of the undominated *Unstressed-V, while (b) and (c) fatally violate the next highest-ranked constraint, either Align-L or *Stressed-ə Thus, (a), which fares worst on the lowest-ranked faithfulness constraints, emerges as optimal

When the first stem vowel is a long vowel, the fixed vowel [ɪ] occurs in the diminutive in Lushootseed According to Urbanczyk, this is due to the fact that in this language, No Long-V (long vowels are prohibited), crucially dominates Dep$_{B-RDim}$ and Max$_{B\ RDim}$ No Long-V may be satisfied by copying a portion of the long vowel in the diminutive, which is not allowed in Lushootseed Urbanczyk attributes the failure to copy a portion of the long vowel in the diminutive to Transfer (if α (an integer) weight bearing units dominate a segment in S$_1$, then α weight bearing units dominate its corespondent in S$_2$) Transfer ensures that the weight of a vowel remains constant in base and reduplicant The diminutive with the fixed segment [ɪ] trivially satisfies Transfer, because the base long vowel has no correspondent in the reduplicant, as represented in table 3

Table 3

s-Red$_{\text{Dim}}$-du k^w	No Long-V	Transfer	Dep$_{\text{B-RDim}}$	Max$_{\text{B-RDim}}$
√a s-dídu k^w	*		*	**
b s-dúdu k^w	*	*!		*
c s-dú·du k^w	**!			.*

In table 3, (b) fatally violates Transfer, while (c) incurs more violations of No Long-V than any other candidates do Thus, they are suboptimal to (a), which emerges as optimal

In a constraint-based analysis as in Urbanczyk, the distribution of the diminutive allomorphs in Lushootseed follows from the emergence of the unmarked (TETU) The phonologically-marked structures such as long vowels, stressed-ə and complex onsets and codas are allowed in this language as a whole and thus the markedness constraints, No Long-V, *Stressed-ə and *Complex, are generally violated due to the dominant relevant input-output (I-O) faithfulness constraints However, those marked structures do not appear in the diminutive reduplicant where I-O faithfulness is not relevant The emergent unmarked structures in the diminutive reduplication, thus, follow from a general ranking schema for TETU
(5)   Emergence of the Unmarked (McCarthy and Prince 1994, 1995)
          Faithfulness$_{\text{I O}}$ >> Phono-Constraint >> Faithfulness$_{\text{B R}}$

Moreover, I will assume that the quality of the fixed vowel in the diminutive follows from TETU (Alderete, Beckman, Benua, Gnanadesikan, McCarthy and Urbanczyk 1996, Urbanczyk 1995) The fixed segmentism, which is a phonological default and thus phonologically unmarked, is a case of TETU, when the emergent constraint governs segmental structure For instance, front vowels bearing the place feature [coronal] (Clements 1991, Clements and Hume 1995) are less marked than non-front vowels in terms of vowel place features This motivates the universal constraint ranking of the place markedness constraints, *Pl/Lab, *Pl/Dors >> *Pl/Cor This place markedness hierarchy ensures that the default front vowel emerges in the diminutive The universally-ranked place markedness constraints are crucially dominated by the relevant I-O faithfulness constraint, Faith$_{\text{I O(V-Pl)}}$, in Lushootseed, because both front and non-front vowels are generally allowed in this language But, they crucially dominate the relevant B-R identity constraints, Ident$_{\text{B R(V-Pl)}}$ In Lushootseed, Pl/Lab, *Pl/Dors >> *Pl/Cor are crucially dominated by No Skipping, Transfer, *Complex, No Long-V and *Stressed-ə, because the fixed [i] occurs in the diminutive only when these structural constraints are about to be violated Furthermore, the place markedness constraints are crucially dominated by Dep$_{\text{B RDim}}$ and Max$_{\text{B RDim}}$, because the first stem vowel is copied, rather than [i] is epenthesized, in the diminutive, when the stem begins with a single consonant followed by a short, full vowel, as represented in table 4[4]
Table 4

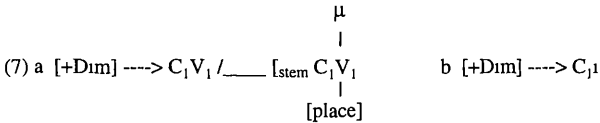| Red$_{\text{Dim}}$-Xahəb	No Skipping	Dep$_{\text{B-RDim}}$, Max$_{\text{B-RDim}}$	*Pl/Dors	*Pl/Cor
√a Xá-Xahəb		***	*	
b Xí-Xahəb		*! ****!		*
c Xə-Xáhəb	*!	***		

In table 4, (c) incurs a fatal violation of the undominated No Skipping (b) with the fixed [i] in the diminutive fares worse on the next highest-ranked B-R identity constraints than (a) and thus is suboptimal to (a) When the stem begins with a consonant followed by a short, full vowel, the form with a copy of the first stem vowel in the diminutive emerges as optimal Thus, Dep$_{\text{B-RDim}}$ and Max$_{\text{B RDim}}$ must dominate *Pl/Lab and *Pl/Dors The constraint ranking responsible for the emergent unmarked structures in the diminutive, that is, the distribution of the diminutive allomorphs, in Lushootseed is as in (6)
(6) Faith$_{\text{I-O}}$>>No Skipping, Transfer, *Complex, No Long-V, *Stressed-ə>>Dep$_{\text{B-RDim}}$, Max$_{\text{B RDim}}$>> *PL/Lab, *PL/Dors >> *PL/Cor >>Ident$_{\text{B-R(V-Pl)}}$

In a rule-based account, on the other hand, the diminutive allomorphy can be described by positing the allomorphic rules as in (7) In this paper, I will assume that schwa is underspecified for place features

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[4] In this paper, I assume that schwa is unspecified for place feautres Thus, schwa does not violate the place markedness constraints

The underspecification of schwa for place features allows us to isolate schwa from other short, full vowels and to formulate the diminutive allomorphy as in (7)

$$\mu$$
$$|$$
(7) a $[+\text{Dim}] \longrightarrow C_1V_1 /\_\_\_\_ [\text{stem } C_1V_1$ \qquad b $[+\text{Dim}] \longrightarrow C_j\text{i}$
$$|$$
[place]

The rule (7a) states that the diminutive copies the first CV of a stem, if the stem begins with a single consonant followed by short, non-schwa vowel Meanwhile, the rule (7b) shows that elsewhere, the diminutive takes the C_1-allomorph In a rule-based account, the complementarity of the two allomorphic rules can be characterized by the Elsewhere Condition (EC), which governs disjunctive relation of rules All versions of EC require the two rules to stand in a specific/general relation in order for them to be disjunctively ordered The specific/general relationship is defined by a proper inclusion of the structural description of the general rule by the specific rule The structural description of the rule (7a) properly includes the structural description of the rule (7b) Thus, the EC can govern the disjunctive relation of the diminutive allomorphic rules and describe the complementary distribution of the diminutive allomorphs A rule-based account, however, fails to explain why the diminutive copies the first CV of the stem, when the stem begins with a single consonant followed by a short, non-schwa vowel, namely a syllabically or segmentally unmarked structure, whereas it has the fixed [i] in other contexts, which are either prosodically or segmentally marked

Meanwhile, a constraint-based account can not only describe but also explain the distribution of the diminutive allomorphs As discussed above, in a constraint-based account, the diminutive allomorphy follows from the ranking schema for TETU Thus, the complementary distribution of the diminutive allomorphs, a case of TETU, provides evidence for a constraint-based account

3 Stem Weakening

Like other Salish languages, Lushootseed exhibits stem weakening in which if preceded by the diminutive prefix, an unstressed stem vowel is reduced to schwa as in (8a) or deleted entirely most often when it is flanked by voiceless consonants as in (8b)

(8) Stem   Diminutive
  a čáləs   'hand'   čá-čələs   'little hand'
    yúbil   'die, starve'   yú-yəbil   'small animal dies'
  b pástəd   'white person'   pá-pstəd   'white child'
    táš   'spin'   tá-tšad   'pet/touch very gently'
    čáxʷəb   'club'   čá-čxʷəb   'hits it lightly with a stick'

In case of double reduplication, the distributive prefix vowel is weakened by stem weakening in the Dim-Dist reduplication, while the deeply-embedded stem vowel is reduced to schwa or lost entirely by stem weakening in the Dist-Dim reduplication, as shown in (4) and repeated in (9) for the sake of convenience In both (9a) and (9b), the first double reduplication form vacuously undergoes stem weakening

(9) a Stem   Diminutive-Distributive-Stem
      bədáʔ   'child'   bí-bəd-bədàʔ   'dolls, litter'
      qís   'expose'   qí-qs-qišəd   'legs partly uncovered'
      cək'ʷ   'straight'   cí-ck'ʷ-cək'ʷ   'It is straight'
      sáxʷəb   'jump, run'   sáʔ-sxʷ-saxʷəb 'hopping'
   b Stem   Distributive-Diminutive-Stem
      bədáʔ   'child, offspring'   bí-bi-bədàʔ   'young children'
      č'λáʔ   'rock'   č'í-č'i-č'λ aʔ   'gravel'
      p'áλaλ   'be of no value, importance' p'á-p'a-p'λaλ 'no counts, riff-raff'
      yúbil   'die, starve'   yú-yu-yəbil   'children are starving'

In Lusootseed, stem weakening is regular, but it is not without exceptions, as exemplified in (10) In (10a), the unstressed stem vowel is not affected by stem weakening at all, whereas in (10b), it is lost entirely in environments other than between voiceless consonants

(10) a č'λáʔ   'rock'   č'í-č'λ aʔ   'little rock'
       suq'ʷaʔ 'younger sibling   sú-suq'ʷaʔ   'little younger'
       Xáhəb   'cry'   Xá-Xahəb   'an infant cry'

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b láḡʷəb	'youth'	lí-lḡʷəb	'little fellow'

b láḡʷəb   'youth'   lí-lḡʷəb   'little fellow'
čáj   'hide'   čá-čjɪbəb 'kill w/o anyone knowing or suspecting'
jəqíl   'crawl, have head down' jí-jqɪl'   'crawl just a bit '

The exceptions in (10) indicate that stem weakening should be lexically-marked as well as morphologically-restricted, as Broselow (1983 322) formulates it as in (11)

(11) Stem Weakening

V -----> Ø~ə / [Dim X[Stem C_____ Y (applies in lexically marked stems)
|
[-stress]

As discussed above, the distribution of the fixed vowel [ɪ] in the diminutive depends on phonological properties of the base the diminutive takes the C1-alternant, if the base begins with a consonant cluster, or has schwa or a long vowel as its first vowel, elsewhere, it copies the first CV of the base Stem weakening, which yields schwa or a consonant cluster as a result, crucially interacts with the diminutive allomorphy It appears that the distribution of the diminutive allomorphs in Lushootseed is determined by the underlying properties of the stem if the stem begins with a consonant sequence or has schwa as its first vowel in underlying representation, the diminutive assumes the C1-alternant, as shown in (3c) and (3d), if the stem has an initial consonant cluster or schwa in surface representation due to stem weakening, the diminutive copies the first CV of the underlying stem, as shown in (8) and (9) The forms in (3c) and (3d) are surface-transparent with respect to the diminutive allomorphy On the other hand, the forms in (8) and (9) are surface-opaque with respect to the diminutive allomorphy, because in those forms, the diminutive takes the CV-alternant, even if the base begins with a consonant cluster or has schwa as its first vowel on the surface In the forms in (8) and (9), the C1-alternant is expected to occur in the diminutive In short, in Lushootseed, the diminutive allomorphy and stem weakening interact in an opaque way The opaque forms in (8) and (9) are of special interest, because, first, they raise a serious challenge to non-derivational approaches such as many versions of OT and, second, in those forms, the diminutive reduplicant directly copies the input stem, disregarding stem weakening in the base This direct matching of the reduplicant to the input stem introduces into the basic CT model (McCarthy and Prince 1995) an additional correspondence relationship, as discussed in section 4 In what follows, I will consider a constraint-based account of the basic phonology of stem weakening and then show why the opaque interaction of stem weakening with the diminutive allomorphy in Lushootseed is problematic for a non-serial OT account

In constraint-based terms, stem weakening can be roughly stated as in (12)

(12) Stem Weakening   μ   μ
| |
*Red$_{Dim}$+{C$_{[voi]}$VC$_{[-voi]}$, CVC}(in lexically marked stems)
| |
[-stress] [place, -stress]

The stem weakening constraint in (12) bans a stem-initial unstressed short vowel between voiceless consonants and a stem-initial unstressed short, non-schwa vowel in environments other than between voiceless consonants, when preceded by the diminutive As discussed above, schwa is assumed to bear no place features In this paper, I suggest that the reduction of the stem-initial vowel into schwa should be regarded as the deletion of vocalic place features Thus, the relevant faithfulness constraint militating against the reduction of the stem-initial vowel is Max$_I$ $_{O(V-[PI])}$ On the other hand, the relevant faithfulness constraint against the stem vowel deletion is Max$_I$ $_{O(V)}$ For stem weakening to be active as in Lushootseed, the stem weakening constraint must dominate Max$_I$ $_{O(V-[PL])}$ and Max$_I$ $_{O(V)}$ The stem weakening constraint also crucially dominate *Complex, a ban against complex onsets and codas, since stem weakening can generate complex syllable structures in surface representation, as shown in table 5 Table 5

Red$_{Dim}$-pastəb	Stem Weakening	Max$_I$ $_{O(V)}$	*Complex
a pá-pastəb	*!		
√ b pá-pstəb		*	*

In table 5, (a) incurs a fatal violation of the high-ranked stem weakening constraint and thus loses to (b), which violates only the low-ranked constraints

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Taking into consideration the constraint hierarchy established for the distribution of the fixed [i] in the diminutive and stem weakening, let us now examine if a non-serial OT analysis can adequately account for the opaque interaction between the diminutive allomorphy and stem weakening in Lushootseed As discussed above, when an initial consonant sequence or schwa of the stem is underlying, then the Ci-alternant occurs in the diminutive in conformity with the diminutive allomorphic alternation, as illustrated in (3c) and (3d) The constraint hierarchy independently motivated for the diminutive allomorphy and stem weakening makes a correct prediction about the transparent forms, selecting the actual output as optimal, as represented in table 6[5] In table 6 and throughout the tables in this paper, I will indicate only violations of the markedness constraints, *PL/lab, *Pl/Dors >> *Pl/Cor, incurred in the diminutive reduplicant
In table 6, the stem-initial consonant cluster is underlying
Table 6

Red$_{Dim}$-čλ'a?	No Skip	S Weak	Max$_{I-O(V)}$	*Comp	Dep$_B$ R	Max$_{B-R}$	*Pl/Dors	*Pl/Cor
a čá-čλ'a?	*!					**	*	
√b či-čλ'a?	1				*	***		*

As represented in table 6, (a) fatally violates the undominated No-Skipping and thus loses to (b) Therefore, the transparent candidate (b) with the fixed segment [i] is correctly selected as optimal
On the other hand, if the stem has an initial consonant cluster or schwa in surface representation due to stem weakening, the first CV of the underlying stem are copied in the diminutive, rendering the diminutive allomorphy surface-opaque The constraint ranking given for the diminutive allomorphy and stem weakening makes an incorrect prediction about the opaque forms, as represented in table 7
Table 7

Red$_{Dim}$-tá$_1$ša$_2$d	No Skip	S Weak	Max$_{I-O(V)}$	*Complex	Dep$_B$ RDim	Max$_B$ RDim	*Pl/Dors	*Pl/Cor
a tá$_1$-ta$_1$ša$_2$d		*!				***	*	
b tá$_1$-tša$_2$d			*		*	***	*!	
c tí-ta$_1$ša$_2$d		*!			*	****		*
√d tí-tša$_2$d			*		*	***		*

In table 7, (a) and (c) incur a fatal violation of the highest-ranked stem weakening Therefore, they lose to (b) and (d) The two surviving candidates equally satisfy and violate the ranked constraints until they meet *Pl/Dors (b) loses to (d) due to a fatal violation of *Pl/Dors A standard OT account, thus, incorrectly predicts that the transparent candidate (d) should emerge as optimal and thus fails to properly account for the phonological opacity of the diminutive allomorphy in Lushootseed

4 Non-serial, Constraint-based OT Accounts of Opacity
Some attempts have been made to characterize surface opacity within a non-serial, constraint-based OT model In this section, I will examine three proposals and see if they can adequately characterize the surface opacity in Lushootseed

4 1 McCarthy and Prince 1995 (Faithfulness and Reduplication Identity)
In the CT model, I-O faithfulness is extended to reduplicative morphology In this account, the reduplicant achieves its segmental content via correspondence with its base As discussed above, in the opaque diminutive forms in (8) and (9), the diminutive reduplicant disregards stem weakening in the base and directly matches the input stem This direct matching introduces into the basic CT model an additional input-reduplicant (I-R) correspondence relation, which allows the reduplicant direct access to the input, as represented in (13)
(13) Full Model (McCarthy and Prince 1995)

Input

Faith$_{I R}$ ↗ ↑ ↓ Faith$_{I-B}$

Reduplicant ←→ Base

Ident$_{B-R}$

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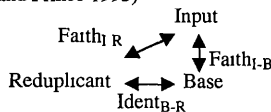
[5] The form in table 6 is exceptional to stem weakening and thus all output candidates in table 6 trivially satisfy the stem weakening constraint

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In what follows, I will examine if the full CT model can provide an account of the opacity of the diminutive allomorphy in Lushootseed

In this language, the relevant I-R faithfulness constraint, Dep$_I$ $_{RDim}$, a ban against non-input materials from the reduplicant, must dominate the place markedness constraints, since the direct identity between the diminutive reduplicant and the input stem in the opaque forms is achieved at the price of the place markedness constraints, *Pl/Dors and *Pl/Lab, as represented in table 8

Table 8

Red$_{Dim}$-ta$_1$ša$_2$d	No Skip 'S Weak	Max$_{I-O(V)}$	*Comp	Dep$_B$-RDim	Max$_B$ RDim	Dep$_I$ RDim	*Pl/Dors	*Pl/Cor
a tá$_1$-ta$_1$ša$_2$d	*!				***		*	
√b tá$_1$-tša$_2$d		*		*	***		*	
c tí-ta$_1$ša$_2$d	*!			*	***!	*		*
d tí-tša$_2$d			*	*	***	*!		ʔ

In table 8, (a) and (c) incur a fatal violation of stem weakening and thus lose to (b) and (d) The transparent diminutive form (d) incurs a fatal violation of Dep$_{I-RDim}$ and thus loses to the opaque form (b) Thus, the opaque form (b) is correctly selected as optimal by introducing I-R correspondence into the basic CT model This account also makes a correct prediction about the transparent diminutive forms, as represented in table 9

Table 9

Red$_{Dim}$-čλ'aʔ	No Skip Ṣ Weak	Max$_{I-O(V)}$	*Comp	Dep$_B$ RDim	Max$_B$ RDim	Dep$_I$ RDim	*Pl/Dors	*Pl/Cor
a čá-čλ'aʔ	*!				**		*	
√b čí-čλ'aʔ				*	***	*		*

In table 9, (a), which fatally violates No Skipping, is suboptimal to the transparent candidate (a) Thus, the transparent form (b) is correctly predicted to emerge as optimal

The full model with I-R correspondence, however, makes no provisions for the opacity of the diminutive allomorphy in double reduplication where the base of the word-initial reduplicant is also a reduplicative morpheme, as exemplified in (9) The segmentism of the two reduplicants in double reduplication, particularly the segmental dependency of the distributive on the diminutive in the Dist-Dim reduplication in (9b), indicates that the string to the immediately right of the distributive reduplicant is the base of the distributive reduplication and the string to the immediately right of the diminutive is the base of the diminutive reduplication The correspondence relationships of double reduplication in Lushootseed forms can be represented within the full CT model as in (14)

(14)   Red ———— Red ———— Stem
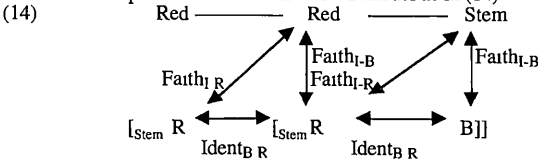
As represented in (14), the embedded reduplicant has input-base (I-B) correspondence with its underlying representation, input-reduplicant (I-R) correspondence with the input stem and base-reduplicant (B-R) correspondence with the output stem, whereas the outermost reduplicant has I-R correspondence with the embedded input reduplicative morpheme and B-R correspondence with the embedded reduplicant plus stem Of particular interest is the Dim-Dist double reduplication where the embedded distributive reduplicant gets segmental specification either from the input stem through I-R correspondence or from the output stem through B-R correspondence On the other hand, the outermost diminutive reduplicant obtains segmental content either from the distributive reduplicant through B-R relationship or from the underlying distributive prefix through I-R correspondence In this double reduplication type, the outermost diminutive reduplicant can get vocalic specification from its correspondents neither through B-R identity, because the embedded distributive reduplicant, preceded by the word-initial diminutive, loses its vowel by stem weakening, nor through I-R faithfulness, since its input correspondent is a reduplicative morpheme with no segmental specification in underlying representation Henceforth, the vocalism of the word-initial

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diminutive is determined by the phonological constraints accountable for the distribution of the diminutive allomorphs Thus, an account with the full CT model incorrectly selects as optimal the double reduplication form in which the diminutive reduplicant is transparent to the diminutive allomorphy across the transparent and opaque diminutive forms, as represented in table 10 and 11, respectively
Table 10

Red_{Dim}-Red_{Dist}-$cə_2k'^w$	*Str-ə	S Weak	Max_I O(V)	*Comp	DepB RDim	MaxB RDim	Dep_I RDim	*Pl/Dors	*Pl/Cor
a $cə́_1$-$cə_1k'^w$-$cə_2k'^w$	**!	*				****!			
b $cə́_1$-ck'^w-$cə_2k'^w$	**!			*	*	****			
c $cí$-$cə_1k'^w$-$cə_2k'^w$	*	*!			*	*****!			*
√d $cí$-ck'^w-$cə_2k'^w$	*			*	*	***!*			*

In table 10, (a) and (b) incur more violations of the undominated *Stressed-ə than (c) and (d), while (c) fatally violates the highest-ranked stem weakening constraint Therefore, the form (d) with the transparent diminutive reduplicant is correctly selected as optimal
Table 11

Red_{Dim}-Red_{Dist}-$sa_1x^wəb$	No Skip Ŝ Weak	$Max_{I-O(V)}$	*Comp	DepB RDim	MaxB RDim	Dep_I RDim	*Pl/Dors	*Pl/Cor
a $sá_1ʔ$-sa_1x^w-$sa_2x^wəb$	*!				******!		*	
b $sá_1ʔ$-sx^w-$sa_2x^wəb$			*	*	!**!*** !		*!	
c $sí?$-sa_1x^w-$sa_2x^wəb$	*!			*	*******!¹			*
√d $sí?$-sx^w-$sa_2x^wəb$			*	*	******			*

In table 11, (a) and (c) incur a fatal violation of the highest-ranked stem weakening and thus are suboptimal to (b) and (d) The I-R faithfulness constraint, Dep_I RDim, is ineffective, since the input with which the diminutive reduplicant holds I-R correspondence is a reduplicative morpheme, which is phonologically empty in underlying representation (b) and (d) equally satisfy and violate the ranked constraints until they arrive at *Pl/Dors (b) with the vowel [a] in the diminutive fatally violates *Pl/Dors and thus loses to the candidate (d) with the fixed vowel [ı] in the diminutive In this account, the candidate (d) with the transparent diminutive reduplicant is predicted to be selected as optimal, counter to fact

In addition to the empirical inadequacies of the full model, the introduction of I-R correspondence into the basic model is conceptually insufficient The effects of I-R faithfulness are very uncommon crosslinguistically and its effects are almost completely masked McCarthy and Prince (1995) argue that the subsidiary role of I-R faithfulness essentially follows from a universally-fixed ranking of $Faith_{I-B}$>>$Faith_{I-R}$ According to them, I-R faithfulness appears in a subordinate position in every ranking, dominated by I-B faithfulness and thus its effects are significantly limited In case of the opaque forms in (8) and (9) in which phonological alternations take place in the base and the reduplicant directly matches the input stem, the universally-fixed ranking of $Faith_{I-B}$>>$Faith_{I-R}$ fails to limit the effects of I-R faithfulness That is, the subsidiary effects of I-R faithfulness is not limited by the universal meta-condition in Lushootseed, counter to McCarthy and Prince's claim Therefore, the introduction of I-R correspondence to the basic model increases the number of permuted rankings significantly and has ruinous consequences for the factorial typology Furthermore, as pointed out by Spaelti (1997), in the full CT model, most of the predictions about the emergence of the unmarked are lost, since it is potentially possible that the reduplicant is more faithful to the underlying representation than to the base In sum, a CT account with the full CT model is insufficient both on conceptual and empirical grounds

4 2 McCarthy 1995 (Remarks on Phonological Opacity)

McCarthy proposes a CT analysis to phonological opacity where aspects of markedness constraints, the trigger, the target, linear order and adjacency of the trigger and target, are enriched with parameter settings, underlying, surface or indifferent In this section, I will consider if a CT account with parameterized output constraints may provide a solution to problems that a standard CT account faces in handling the surface opacity of the diminutive in Lushootseed I will illustrate how this analysis works with the occurrence of the fixed [ı] in the diminutive, when the stem begins with a consonant sequence The relevant constraints are No Skipping and *Complex For illustration, I will parameterize No Skipping

constraint only In this account, each condition imposed on No Skipping should be specified for the level at which it is satisfied, as in (15) The condition on the trigger should be set at the underlying, because the selection of the diminutive allomorphs is sensitive to the underlying properties of the stem, as discussed in section 3

(15)

No Skipping	Condition	Level
trigger	$[_{Stem}C_1C_2V_I$	underlying
target	C_1V_{1Dim}	surface
linear order	>	indifferent
adjacency	M-to-M	indifferent

This constraint is meant that it is violated, if the diminutive, followed by the stem containing an initial consonant cluster in underlying representation, copies the C_1V_1 of the stem at the surface, skipping C_2 In case of the forms where the stem-initial consonant cluster is yielded as a result of stem weakening, the conditions of the parameterized No Skipping are not met, because an initial consonant cluster is not present in underlying representation of the stem and thus the parameterized constraint is inapplicable to those forms, which, therefore, trivially satisfy the parameterized constraint The parameterized constraint with the constraint ranking independently established for the diminutive allomorphy and stem weakening allows us to account for both transparent and opaque diminutive forms in single reduplication, as represented in table 12 and 13, respectively
Table 12

Red$_{Dim}$-čλ'a?	No Skip	Weak	Max$_{I-O(V)}$	Comp	DepB-RDim	MaxB-RDim	Dep I-RDim	*Pl/Dors	*Pl/Cor
a čá-čλ'a?	*!					**		*	
√b čí-čλ'a?					*	***!	*		*

In table 12, (a) fatally violates the highest-ranked parameterized No Skipping constraint, since the diminutive reduplicant does not form a contiguous string of the underlying stem Meanwhile, (b) with the fixed vowel [i] in the diminutive trivially satisfies No Skipping, since the fixed segment [i] has no correspondent in the input stem Thus, (b) emerges as optimal
Table 13

Red$_{Dim}$-ta$_1$ša$_2$d	No Skip	Weak	Max$_{I-O(V)}$	Comp	DepB RDim	MaxB-RDim	DepI-RDim	*Pl/Dors	*Pl/Cor
a tá$_1$-ta$_1$ša$_2$d		*!				****		*	
√b tá$_1$-tša$_2$d			*		*	***		*	
c tí-ta$_1$ša$_2$d	*!				*	****!	*		*
d tí-tša$_2$d			*		*	***	*!		*

In table 13, all the candidates satisfy No Skipping, since the diminutive reduplicant in (a) and (b) constitutes a contiguous string of the underlying stem, while in (c) and (d), the fixed [i] in the diminutive has no correspondent in the input (a) and (c) fatally violate Stem Weakening Thus, they lose to (b) and (d) (d) fatally violates Dep$_{I-RDim}$ and thus is suboptimal to (b) The opaque form (b) correctly emerges as optimal
        Like a CT account with I-R faithfulness, a CT analysis with the enriched No Skipping constraint, however, fails to adequately capture the distribution of the diminutive allomorphs in the double reduplication As represented in table 14 and 15 respectively, it incorrectly selects as optimal the forms with the transparent diminutive reduplicant across the transparent and opaque diminutive forms in the Dim-Dist reduplication

Table 14

RedDim-RedDist-cək'ʷ	*Str-ə	No Skip S Weak	MaxI O(V)	*Comp	DepB RDim	MaxB-RDim	DepI-RDim	*Pl/Dors	*Pl/Cor
a cə́₁-cə₁k'ʷ-cə̀₂k'ʷ	**!	*				****!			
b cə́₁-ck'ʷ-cə̀₂k'ʷ	**!			*		****			
c cí-cə₁k'ʷ-cə̀₂k'ʷ	*	*!			*	*****			*
√d cí-ck'ʷ-cə̀₂k'ʷ	*			*	*	****			*

All the candidates in table 14 satisfy the parameterized No Skipping constraint, because the input base of the diminutive reduplicant is a reduplicative morpheme, which has no segmental content in underlying representation Dep I RDim is also ineffective, because the input corresponding structure of the diminutive reduplicant is a reduplicative prefix (a) and (b) fatally incur more violations of the undominated *Stressed-ə than (c) and (d) (c) fatally violates Stem Weakening and thus is suboptimal to (d) This analysis correctly selects (d) with the transparent diminutive reduplicant as optimal

Table 15

RedDim-RedDist -saₓxʷəb	No Skip S Weak	MaxI O(V)	*Comp	DepB-RDim	MaxB-RDim	DepI-RDim	*Pl/Dors	*Pl/Cor
a sá₁ʔ -sa₁xʷ-sa₂xʷəb	*!				******!		*	
b sá₁ʔ -sxʷ-sa₂xʷəb		*			******		*!	
c sí? -sa₁xʷ-sa₂xʷəb		*!		*	*******			*
√d sí? -sxʷ-sa₂xʷəb			*	*	******			*

As in table 14, all the candidates in table 15 trivially satisfy the enriched No Skipping constraint (a) and (c) incur a fatal violation of Stem Weakening and thus lose to (b) and (d) (b) and (d) equally violate the ranked constraints until they arrive at *Pl/Dors (b), which has the vowel [a] in the diminutive, fatally violates *Pl/Dors and thus is suboptimal to (d) In this account, (d) is incorrectly predicted to emerge as optimal In short, a CT account with the parameterized constraint fails to adequately characterize the distribution of the diminutive allomorphs in double reduplication

This constraint parameterization approach is also inadequate on conceptual ground The constraint parameterization schema permits constraints in which all parameters are set at the underlying, as noted by McCarthy According to McCarthy (1995), the constraints play no role in evaluating output candidates in a given candidate set, because they are equally obeyed or violated by all the output candidates in the candidate set Even if it can never be decisive in output evaluation, the constraint with all the levels set to the underlying introduces a form of restrictions on underlying representations According to Prince and Smolensky (1993), the set of possible underlying forms is universal and there are no language-particular restrictions on underlying representations This principle is called richness of the base Accordingly, in OT, any observed restrictions on input representations is an epiphenomenon of the constraints on output representations The constraints with all parameters set to the underlying is at odds with richness of the base, which cannot be easily dispensed with within OT accounts, since it provides a solution to conspiracies (Kisseberth 1970) or the duplication problem (Kenstowicz and Kisseberth 1977)

4 3 McCarthy 1997 (Sympathy and Phonological Opacity)

McCarthy proposes another approach to phonological opacity, sympathy, as a general model of surface opacity within OT In this account, the output candidates have a correspondence relationship with a failed output candidate, which most harmonically satisfies a designated faithfulness constraint The failed sympathetic candidate exerts an influence on the selection of the optimal output through sympathetic faithfulness In this section, I will show that sympathy cannot provide a proper account of the opaque and transparent diminutive forms in Lushootseed

Sympathy offers two alternatives to the surface opacity of the diminutive allomorphy in Lushootseed One is to select the I-R faithfulness constraint, DepI-RDim, as the designated constraint and thus choose as the sympathetic candidate the most harmonic form in which the diminutive reduplicant has the vowel identical to the input stem vowel In this alternative, the sympathetic candidate has an influence on other candidates through the sympathetic constraint, Ident Dim(V)DepI-R🍎[6], which enforces the vocalic

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[6] 🍎 is used to represent sympathetic candidates and sympathetic constraints

identity of the diminutive reduplicant between the sympathetic candidate and other candidates In order to characterize the forms with the opaque diminutive reduplicant as optimal, the sympathetic constraint must dominate the constraints responsible for the occurrence of the fixed [1] This alternative is, however, disfavored, since the vocalic identity between the reduplicant and the input stem in the opaque diminutive forms can be accomplished by I-R faithfulness alone That is, the sympathetic constraint, $Ident_{Dim(V)DepI R}$, is superfluous and the problem of analytic duplication of effort arises Furthermore, like a standard CT account, this analysis makes an incorrect prediction about the forms with the transparent diminutive reduplicant, because the undominated sympathetic constraint ensures the vocalic identity of the diminutive reduplicant identical to the input stem vowel across the transparent and opaque diminutive forms, as represented in table 16

Table 16

Red_{Dim}-č'λ a?	$Ident_{Dim(V)DepI-R}$	No Skip	S Weak	$Max_{I-O(V)}$	*Comp	Dep_{B-R}	Max_{B-R}	Dep_{I-R}	*Pl/Dors	*Pl/Cor
√a č'a-č'λa?		*					**	√	*	
b č'í-č'λa?	*!					*	***	*		*

In table 16, only (a) meets the designated constraint, Dep_{I-RDim}, and thus is selected as the sympathetic candidate In overall evaluation, (a) satisfies the ranked constraints more harmonically than (b) and thus is incorrectly chosen as optimal

In the other alternative, the I-O faithfulness constraint, $Max_{I O(V)}$ or $Max_{I-O(V-[pl])}$, is chosen as the designated constraint and the most harmonic candidate, which meets the designated constraint, is selected as the sympathetic candidate In this alternative, the sympathetic candidate exerts influence on other candidates through the sympathetic constraint, $Ident_{B RDim(V)MaxI O(V)}$, which ensures the vocalic faithfulness between the base of sympathetic candidate and the diminutive reduplicant of other output candidates, as represented in table 17

Table 17

Red_{Dim}-ta₁ša₂d	$Ident_{B RDim(V)MaxI O(V)}$	No Skip	S Weak	$Max_{I O(V)}$	*Comp	$Dep_{B R}$	$Max_{B R}$	$Dep_{I R}$	*Pl/Dors	*Pl/Cor
a tá₁-ta₁ša₂d			*!	√			***		*	
√b tá₁-tša₂d				*		*	**!		*	
c tí-ta₁ša₂d	*!		*	√		*	****!	*		*
d tí-tša₂d	*!			*		*	*!*!	*		*

In table 17, (a) and (c) satisfy the designated I-O faithfulness constraint In sympathetic evaluation, the sympathetic constraint is invisible to the selection of the sympathetic candidate (a) is more harmonic than (c) in sympathetic evaluation and thus selected as the sympathetic candidate In overall evaluation, (c) and (d) fatally violate the highest-ranked sympathetic constraint, whereas (a) incurs a fatal violation of the next highest-ranked Stem Weakening Thus, (b) with the opaque diminutive reduplicant is selected as optimal Even if this alternative makes a correct prediction about the forms with opaque diminutive reduplicant, it makes an incorrect prediction about the forms with the transparent diminutive reduplicant, as shown in table 18

Table 18

Red_{Dim}-č'λ a?	$Ident_{B RDim(V)MaxI O(V)}$	No Skip	S Weak	$Max_{I O(V)}$	*Comp	$Dep_{B R}$	$Max_{B R}$	$Dep_{I R}$	*Pl/Dors	*Pl/Cor
√a č'á-č'λ a?		*		√			**		*	
b č'í-č'λa?	*!			√		*	***	*		*

In table 18, both (a) and (b) satisfy the designated $Max_{I-O(V)}$ constraint (b) is more harmonic than (a) in sympathetic evaluation and thus (b) is selected as the sympathetic candidate In overall evaluation, (a) is more harmonic than (b) and thus is incorrectly selected as optimal In short, CT alternatives with sympathetic faithfulness fail to properly account for the opacity and transparency of the diminutive allomorphy, yielding a ranking paradox That is, constraint ranking, which successfully characterizes the forms with the transparent diminutive reduplicant, fails to characterize the forms with the opaque diminutive reduplicant and vice versa

5 Constraint-Based Lexical Phonology

Thus far, I have examined the inadequacies of the three non-serial, constraint-based CT analyses of opacity in handling the opaque interaction of the diminutive allomorphy with stem weakening in Lushootseed In this section, I will argue for the need of a serial derivation between underlying and surface representations, proposing a constraint-based account couched within LP advocated by Kiparsky (1997), Booij (1997) and Rubach (1998)

In a classical LP model, there is a systematic distinction between lexical and postlexical phonology[7] In the lexicon, phonological rules are interspersed with word formation rules The cyclic application of lexical rules follows from the basic claim of LP that each application of morphological rules creates a potential domain of application of lexical phonological rules Meantime, postcyclic lexical (word-level) rules, which apply at the level between the cyclic lexical level and the postlexical phrasal level, interact with morphological rules in a noncyclic fashion In the LP model (Kiparsky 1985, Booij and Rubach 1984, 1987) that I assume in this paper cyclic and postcyclic lexical rules constitute separate blocks and thus the cyclicity of lexical phonological rules is no longer a property of rules themselves, but follows from the organization of the lexicon, as represented (16)

(16)
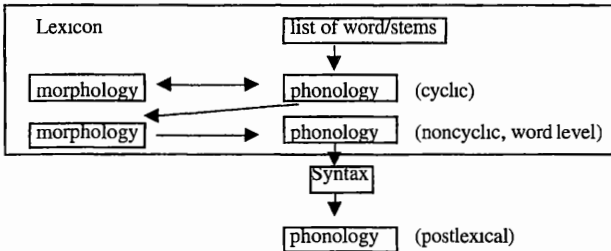
In the LP model in (16), the application of a rule on a cycle before the application of another rule on the subsequent cycle, the application of cyclic lexical rules before postcyclic lexical rules and the application of lexical rules before postlexical rules follow from the organization of grammar

Kiparsky (1997), Booij (1997) and Rubach (1998) advocate a hybrid account wherein the three ordered levels, cyclic level, word level and postlexical level, but no ordered rules, are assumed In their accounts, the three ordered levels are constituted by a constraint system The constraint systems of the three levels differ in the ranking of constraints At each level, output representations are evaluated simultaneously by a set of ranked constraints at that level The output of a level is the input to the subsequent derivation In other words, the optimal output of a level plays as the base of the next level Thus, in this account, faithfulness holds between the output of a level and its derivative representations of the subsequent level

As discussed above, a rule-based account fails to explain the complementary distribution of the diminutive allomorphs, a case of TETU, which provides evidence for a constraint-based account Meanwhile, the opaque interaction of stem weakening with the diminutive allomorphy presents a serious challenge to a non-derivational account In what follows, I will propose that a constraint-based LP account, which allows only a restricted form of derivation that follows from the organization of grammar, can provide an adequate account of the opaque interaction of the diminutive allomorphy with stem weakening in Lushootseed

In this paper, I have shown that the non-serial CT accounts where B-R correspondence is non-directional incorrectly predicts that the diminutive allomorphy should be sensitive to surface representations of the base where the stem vowel is altered by stem weakening In Lushootseed, however, the distribution of the diminutive allomorphs does not depend on derived phonological representations of the base, rendering the diminutive allomorphy surface-opaque In a constraint-based LP account, the surface opacity of the diminutive allomorphy follows from the organization of grammar In this analysis, phonological constraints on the selection of allomorphs depend on the phonological representation at the

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[7] The need for the lexical and postlexical distinction is, also, recognized within an OT account by McCarthy and Prince (1993) and McCarthy and Cohn (1994)

point of derivation when morphology is added. In Lushootseed, the phonological representation of a lexical item before any morphological affixations is identical to the underlying representation, since no structure-changing phonological rules apply. The lexical form is sent to morphology, which adds the diminutive prefix to the stem. The allomorphic alternation of the diminutive holds on the phonological representation of the base at a point of derivation when the diminutive is prefixed. That is, the diminutive allomorphs are determined by phonological representation of the stem, which has not undergone stem weakening, because stem weakening itself is conditioned by the affixation of the diminutive prefix. After the diminutive allomorphy, the diminutive-prefixed forms are sent to phonology where the stem vowel is reduced to schwa or lost by stem weakening, as represented in (17). In this account, the surface opacity of the diminutive allomorphy follows from the grammar organization, which captures the interaction between morphology and phonology.

(17)	UR	/pastəd/	/qʷɬayʔ/
	Phonology	-----	-----
	Morphology Red$_{Dim}$ and Allomorphy	pa-pastəd	qʷɪ-qʷɬayʔ
	Phonology Stem weakening	pá-pstəd	qʷɪ́-qʷɬəyʔ
	SR	[pá-pstəd]	[qʷɪ́-qʷɬəyʔ]

As discussed above, the non-serial OT accounts can capture the opacity of the diminutive allomorphy in single reduplication by allowing constraints to make reference to underlying representation through either I-R faithfulness or parameterized output constraints. However, they fail to account for the opaque interaction of the diminutive allomorphy with stem weakening in double reduplication. The surface opacity of the diminutive allomorphy in double reduplication makes a distinction between non-serial and serial accounts, because in double reduplication, the conditioning environments for the diminutive allomorphy are obtained in neither underlying nor surface representation, as illustrated in (18)

(18)	UR	/saxʷəb/	/bədaʔ/
	Phonology	-------	------
	Morphology Red$_{Dist}$	saxʷ-saxʷəb	bəd-bədaʔ
	Phonology	-------	------
	Morphology Red$_{Dim}$ and Allomorphy	sá-saxʷ-saxʷəb	bí-bəd-bədaʔ
	Phonology Stem Weakening	sá-sxʷ-saxʷəb	-------
	SR	[sá-sxʷ-saxʷəb]	[bí-bəd-bədàʔ]

In the Dim-Dist reduplication as shown in (18), the embedded distributive reduplicative prefix is the base of the diminutive reduplication. Therefore, the phonological properties of the base, which determine the distribution of the diminutive allomorphs, are not present in underlying representation. Nor are they present in surface representation, because the vowel of the distributive reduplicant is altered by stem weakening. In (18), the underlying lexical form, to which no phonology applies, is sent to morphology, which adds the distributive prefix to the stem. The distributive-prefixed form is sent back to phonology where no phonological rules apply to the distributive-prefixed form. The distributive form goes back to morphology where it takes the diminutive prefix. The diminutive allomorphy holds on the phonological representation of the distributive form, which has not undergone stem weakening. After the diminutive allomorphy, the diminutive form is fed to phonology where it undergoes stem weakening. The constraint-based LP model enables us to characterize the phonological opacity and transparency of the diminutive allomorphy in single and double reduplication by allowing restricted form of serial derivation in which the phonological distinctions, which determine the distribution of the diminutive allomorphs, are maintained. Moreover, this derivational, constraint-based analysis eliminates I-R faithfulness, parameterized markedness constraints and sympathetic faithfulness, which has been shown to be failed attempts at surface opacity in this paper

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