0 Introduction

Lushootseed [də̞wə̞sə̞xu] 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 [i] 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, Haebel-In 1918, Hess 1967, Urbanczyk 1995). In Lushootseed, 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
    yubīl  'die, starve'  yūb-yubīl  'they are starving'
    pāsād 'white person'  pās-pāsād  'white people'
    bādāʔ 'child'         bād-bādāʔ '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'ič'al 'long feathers w/ thick stems'  c'ič-c'ič'al-b 'sprouted wings'
    wīw'su 'children, little'              wīw-wīw'su 'little (plural)'
    lāl-wāl'wād 'sleeping platform'        lāl-lāl-wāl'wād '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 antigemination², 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.

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.

"hil 'far, far away' hu-fillil-tab  'they are separated from rest of group'"
followed by the fixed vowel [i] and either of these alternants with a glottal stop (CV? or C[?]), as shown in
(3)

(3) a Stem
Xïhosb 'cry' Xá-Xïhosb 'an infant crying'
saq"wa? 'younger sibling' šu-saq"wa? 'little younger sibling'
b Stem
'lobw-Xâlus 'marked face' ?obw-Xâl-Xalus? 'racon (lit. little small face)'
talo? 'money' tò-talo? 'a little money'
c Stem
ë'â'æ? 'rock' ê' f-ë'â'æ? 'little rock'
bàdâ? 'child' bif-bàdâ? 'dolls, litter'
s-du kw 'knife' s-di-du kw 'small knife'
d Stem
qâway? 'log, stick' qâw?qâwey? 'stick, little stick'
balXw 'pass by' bif-balXw 'pass by a little jog'
buf 'four' bif-buf 'four little items'

As discussed in Bates (1986), the distribution of the diminutive allomorph is predictable from phonological properties of the stem. According to Bates, the diminutive takes the C1-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
badâ? 'child' bif-bad-badâ? 'dolls, litter'
qis 'expose' qi-qis-qis d 'legs partly uncovered'
câk’w 'straight' ci-câk’ w 'it is straight'
sâx’wob 'jump, run' sâw-sx’w-sx’wob 'hopping'

b Stem
badâ? 'child, offspring' bif-bi-badâ? 'young children'
ed’â’æ? 'rock' ê’ f-ed’â’æ? 'gravel'
pâ’xâ’l 'be of no value, importance' p’a-p’a-p’a’l 'no counts, riff-raff'
yûbl 'die, starve' yû-yû-yûbl 'children are starving'

In the Dim-Dist reduplication in (4a), the distributive copies the first CV 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 C(?) or CV(?)-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 role-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 prespecified 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 [i] in the

3 In Lushootseed, reduplication does not copy the prefix materials, as shown in the form [?obw-Xâl-Xalus]

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dimmutive in Lushootseed as a kind of an epenthetic melody. Thus, the occurrence of the fixed [i] in the
dimmutive incurs a violation of the base-reduplicant (B-R) identity constraints, DepB-RDim, which bars
non-base materials from the dimmutive reduplicant, and MaxB-RDim which ensures complete copying of
the base in the dimmutive reduplicant. The occurrence of the fixed segment [i], 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 S₁ standing in correspondence forms a contiguous string as does the


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 [i] in the dimmutive emerges as optimal.

The fixed vowel [i] also occurs, when the first vowel of the base is schwa. In this case, Urbanczyk
relates the occurrence of the fixed vowel [i] 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 [i] in the
dimmutive, 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-a
(stressed schwa is barred) and by ranking them higher than DepB-RDim and MaxB-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-a do
not crucially interact and thus their ranking is not crucial, as represented in table 2.

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-a. 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 [i] occurs in the dimmutive in
Lushootseed. According to Urbanczyk, this is due to the fact that in this language, No Long-V (long
vowels are prohibited), crucially dominates DepB-RDim and MaxB-RDim. No Long-V may be satisfied by
copying a portion of the long vowel in the dimmutive, which is not allowed in Lushootseed. Urbanczyk
attributes the failure to copy a portion of the long vowel in the dimmutive to Transfer (if α (an integer)
weight bearing units dominate a segment in S₁, then α weight bearing units dominate its correspondent
in S₂). Transfer ensures that the weight of a vowel remains constant in base and reduplicant. The dimmutive
with the fixed segment [i] trivially satisfies Transfer, because the base long vowel has no correspondent in
the reduplicant, as represented in table 3.
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.

Table 3

<table>
<thead>
<tr>
<th>s-Red\textsubscript{Dim}</th>
<th>No Long-V</th>
<th>Transfer</th>
<th>Dep\textsubscript{B-R\textsubscript{Dim}}</th>
<th>Max\textsubscript{B-R\textsubscript{Dim}}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a s-d\textsubscript{du} k\textsuperscript{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b s-s\textsubscript{du} k\textsuperscript{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c s-d\textsubscript{du} k\textsuperscript{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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-a and complex onsets and codas are allowed in this language as a whole and thus the markedness constraints, No Long-V, *Stressed-a 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\textsubscript{I-O} >> Phono-Constraint >> Faithfulness\textsubscript{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\textsubscript{I(O-V,PI)}, 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\textsubscript{B R(V,PI)} in Lushootseed, Pl/Lab, *Pl/Dors >> *Pl/Cor are crucially dominated by No Skipping, Transfer, *Complex, No Long-V and *Stressed-a, 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\textsubscript{B-R\textsubscript{Dim}} and Max\textsubscript{B-R\textsubscript{Dim}}, 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.

Table 4

<table>
<thead>
<tr>
<th>Red\textsubscript{Dim}</th>
<th>X\textsubscript{ab}</th>
<th>No Skipping</th>
<th>Dep\textsubscript{B-R\textsubscript{Dim}}</th>
<th>Max\textsubscript{B-R\textsubscript{Dim}}</th>
<th>*Pl/Dors</th>
<th>*Pl/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a X\textasciitilde\textsubscript{Xab}</td>
<td>***</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b X\textasciitilde\textsubscript{Xab}</td>
<td>*</td>
<td>*</td>
<td>***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c X\textasciitilde\textsubscript{Xab}</td>
<td>*</td>
<td>***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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\textsubscript{B-R\textsubscript{Dim}} and Max\textsubscript{B-R\textsubscript{Dim}} 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\textsubscript{I-O} >> No Skipping, Transfer, *Complex, No Long-V, *Stressed-a >> Dep\textsubscript{B-R\textsubscript{Dim}}, Max\textsubscript{B-R\textsubscript{Dim}} >> *Pl/Lab, *Pl/Dors >> Ident\textsubscript{B R(V,PI)}

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 unspecified for place features.

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4 In this paper, I assume that schwa is unspecified for place features. Thus, schwa does not violate the place markedness constants.
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)

\[ \mu \]

\[ \text{[stem] C_1 V_1 \text{ / } \]}

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 Ci-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).

\[(8)\]

\begin{array}{ll}
\text{Stem} & \text{Diminutive} \\
\hline
\text{a čálæs} & \text{čá-čálæs} \\
\text{yúñbl} & \text{yú-ñbl} \\
\text{b pástdæ} & \text{pá-pstådæ} \\
\text{tås} & \text{tå-tsåd} \\
\text{čá-} & \text{čá-čåm} \\
\text{pa-} & \text{på-pståd} \\
\text{tås} & \text{tå-tsåd} \\
\text{čá} & \text{čá-čåm} \\
\text{pa} & \text{på-pståd} \\
\text{tås} & \text{tå-tsåd} \\
\end{array}

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 (9) and repeated in (10) for the sake of convenience.

In both (9a) and (9b), the first double reduplication form vacuously undergoes stem weakening.

\[(9)\]

\begin{array}{ll}
\text{Stem} & \text{Diminutive-Distributive-Stem} \\
\hline
\text{badå?} & \text{bi-bad-badå?} \\
\text{qîs} & \text{qî-qîs-qîs} \\
\text{cåk} & \text{cå-cåk} \\
\text{såxwåb} & \text{så-såxwåb} \\
\text{b} & \text{bi-bi-badå?} \\
\text{bå} & \text{bå-bå-bå?} \\
\text{på-å-på} & \text{på-å-på} \\
\text{yúbl} & \text{yú-yúyúbl} \\
\end{array}

In Lushootseed, 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.

\[(10)\]

\begin{array}{ll}
\text{Stem} & \text{Diminutive-Distributive-Stem} \\
\hline
\text{bå} & \text{bi-bi-badå?} \\
\text{bå} & \text{bå-bå-bå?} \\
\text{på-å-på} & \text{på-å-på} \\
\text{yúbl} & \text{yú-yúyúbl} \\
\end{array}

\[345\]
The morphologically restricted, as Broselow (1983:322) formulates, phonological (11) Stem deminitive of the reduphcant to the consonant cluster, or has schwa or a long vowel as diminutive constraint-based determined by the way The opaque the reduphcant directly weakening, base Stem schwa as first vowel on the surface (3c) and (3d), The stem (3c) and (3d) are surface-transparent sexual (12) Stem interaction voiceless place features In constramt against consonants and a Lushootseed, the stem regarded as the Table 5 weakening stem weakening can generate complex syllable structures 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

<table>
<thead>
<tr>
<th>Redim</th>
<th>-pastab</th>
<th>Stem Weakening</th>
<th>Maxi O(V)</th>
<th>*Complex</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>pä-pastab</td>
<td>*I</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>v</td>
<td>b-pä-pastab</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.
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 C1-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. In Table 6, the stem-initial consonant cluster is underlying.

Table 6

<table>
<thead>
<tr>
<th>Diminutive</th>
<th>No Skip</th>
<th>Stem Weak</th>
<th>MaxL (V)</th>
<th>#Complex</th>
<th>Dep R Dm</th>
<th>Max R Dm</th>
<th>*Pl/Dors</th>
<th>*Pl/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a ʔa-ʔa?</td>
<td>*!</td>
<td>*</td>
<td></td>
<td>**</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>vb ʔa-ʔa?</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>!</td>
<td>!</td>
</tr>
</tbody>
</table>

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 allomorphic 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

<table>
<thead>
<tr>
<th>Diminutive</th>
<th>No Skip</th>
<th>Stem Weak</th>
<th>MaxL (V)</th>
<th>#Complex</th>
<th>Dep R Dm</th>
<th>Max R Dm</th>
<th>*Pl/Dors</th>
<th>*Pl/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a ʔi-ʔa?</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>!</td>
<td>!</td>
</tr>
<tr>
<td>vb ʔi-ʔa?</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>!</td>
<td>!</td>
</tr>
<tr>
<td>c ʔi-ʔa?</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>!</td>
<td>!</td>
</tr>
<tr>
<td>vb ʔi-ʔa?</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
<td>**</td>
<td>!</td>
<td>!</td>
</tr>
</tbody>
</table>

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)

```
Faith R
Input          Faith I-B
Reduplicant    Base
Ident B-R

```

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.
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, DepI_RDIM, an 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

<table>
<thead>
<tr>
<th>RedRDIM-ta</th>
<th>No Skip</th>
<th>Weak</th>
<th>MaxL-O(V)</th>
<th>*Comp</th>
<th>DepB-RDIM</th>
<th>MaxB-RDIM</th>
<th>DepI-RDIM</th>
<th>*Pl/Dors</th>
<th>*Pl/Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>a ta1-ta2</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>vb ta1-ta2</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c ti-ta2d</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d ti-ta2d</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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 DepI-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

<table>
<thead>
<tr>
<th>RedRDIM-cd</th>
<th>No Skip</th>
<th>Weak</th>
<th>MaxL-O(V)</th>
<th>*Compl</th>
<th>DepB-RDIM</th>
<th>MaxB-RDIM</th>
<th>DepI-RDIM</th>
<th>*Pl/Dors</th>
<th>*Pl/Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>a cd-cd'</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>vb cd-cd'</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>°</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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, 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)

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
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>
<thead>
<tr>
<th>Red_Dim-Red_Dist-ca2k'w</th>
<th>*Stress</th>
<th>S Weak</th>
<th>Max1 O(V)</th>
<th>*Comp</th>
<th>DepB RDm</th>
<th>Max8 RDm</th>
<th>DepPi RDm</th>
<th>*PI/Dors</th>
<th>*PI/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a cā1-cē2k'w-ca2k'w</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b cā1-cē2k'w-ca2k'w</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c cē2k'w-cā2k'w</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d cē2k'w-cā2k'w</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

In table 10, (a) and (b) incur more violations of the undominated *Stressed-a 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>
<thead>
<tr>
<th>Red_Dim-Red_Dist-sa1xwab</th>
<th>No Skipping</th>
<th>S Weak</th>
<th>Max1 O(V)</th>
<th>*Comp</th>
<th>DepB RDm</th>
<th>Max8 RDm</th>
<th>DepPi RDm</th>
<th>*PI/Dors</th>
<th>*PI/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a sa1-sa2xw-sa2xw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b sa1-sa2xw-sa2xw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c sl-sa1xw-sa2xw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>d sl-sa1xw-sa2xw</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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, DepPi RDm, 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 *PI/Dors (b) with the vowel [a] in the diminutive fatally violates *PI/Dors and thus loses to the candidate (d) with the fixed vowel [i] 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 Faith1-B >> Faith1-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 Faith1-B >> Faith1-R fails to limit the effects of I-R faithfulness. That is, the subsidiary effects of I-R faithfulness are 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 facental typology. Furthermore, as pointed out by Spaulds (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 [i] 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...
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)  
<table>
<thead>
<tr>
<th>Condition</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{\text{sem}}C_1C_2V_1$</td>
<td>underlying</td>
</tr>
<tr>
<td>$C_1V_{\text{dim}}$</td>
<td>surface</td>
</tr>
<tr>
<td>&gt;</td>
<td>indifferent</td>
</tr>
<tr>
<td>M-to-M</td>
<td>indifferent</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Reduplication</th>
<th>No Skip</th>
<th>S</th>
<th>Weak</th>
<th>Max$V$</th>
<th>$*$</th>
<th>Comp</th>
<th>Dep$B$</th>
<th>Max$B$</th>
<th>Dep$1$</th>
<th>*Pl/Dors</th>
<th>*Pl/Cor</th>
</tr>
</thead>
</table>
| a $\hat{a}$-$\hat{a}'$-$a'$ | * | | | | | * | | | | * | *
| b $\hat{g}$-$\hat{g}'$-$a'$ | | | | | | | | | | | *

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

<table>
<thead>
<tr>
<th>Reduplication</th>
<th>No Skip</th>
<th>S</th>
<th>Weak</th>
<th>Max$V$</th>
<th>$*$</th>
<th>Comp</th>
<th>Dep$B$</th>
<th>Max$B$</th>
<th>Dep$1$</th>
<th>*Pl/Dors</th>
<th>*Pl/Cor</th>
</tr>
</thead>
</table>
| a $\hat{a}_1$-$\hat{a}_2$-$a'_1$ | * | | | | | | | | | | *
| b $\hat{a}_1$-$t \hat{a}_2$-$a'_1$ | | | | | | | | | | | *
| c $t \hat{a}_1$-$t \hat{a}_2$-$a'_1$ | | | | | | | | | | | *
| d $t \hat{a}_1$-$t \hat{a}_2$-$a'_1$ | | | | | | | | | | | *

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) in the diminutive forms has 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

<table>
<thead>
<tr>
<th>Red_{\text{DepB}}Red_{\text{Dors}}-sa_{i}x^{w}sb</th>
<th>No Skip S Weak</th>
<th>Max{O(V} *\text{Comp}</th>
<th>Dep_{\text{B-RDm}}Max_{B-RDm}Dep_{\text{B-RDm}}</th>
<th>*\text{Pl/Dors}</th>
<th>*\text{Pl/Cor}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a \text{c}<em>{i}^{1}\text{-c}</em>{i}^{2}k^{w}\text{-c}_{i}^{2}k^{w}</td>
<td>**1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b \text{c}<em>{i}^{1}\text{-ck}^{w}\text{-c}</em>{i}^{2}k^{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c \text{cf}<em>{i}\text{-c}</em>{i}^{2}k^{w}\text{-c}_{i}^{2}k^{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>v/d \text{cf}\text{-ck}^{w}\text{-c}_{i}^{2}k^{w}</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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 $\text{Dep}_{\text{RDm}}$ 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-\(a\) 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

<table>
<thead>
<tr>
<th>Red_{\text{Dors}}Red_{\text{Dors}}-sa_{i}x^{w}sb</th>
<th>No Skip S Weak</th>
<th>Max{O(V} *\text{Comp}</th>
<th>Dep_{\text{B-RDm}}Max_{B-RDm}Dep_{\text{B-RDm}}</th>
<th>*\text{Pl/Dors}</th>
<th>*\text{Pl/Cor}</th>
</tr>
</thead>
<tbody>
<tr>
<td>a \text{s}<em>{i}^{2}\text{s}</em>{i}^{2}\text{-sa}<em>{i}x^{w}\text{-sa}</em>{i}x^{w}sb</td>
<td>*1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>b \text{s}<em>{i}^{2}\text{-sx}^{w}\text{-sa}</em>{i}x^{w}sb</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>c \text{sf}<em>{i}\text{-sa}</em>{i}x^{w}\text{-sa}_{i}x^{w}sb</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>v/d \text{sf}<em>{i}\text{-sx}^{w}\text{-sa}</em>{i}x^{w}sb</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

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 *\text{Pl/Dors} (b), which has the vowel \([a]\) in the diminutive, fatally violates *\text{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 scheme 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, $\text{Dep}_{\text{B-RDm}}$ 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, $\text{Ident}_{\text{Dmm(V)}\text{Dep}_{\text{R}}}^{6}$, which enforces the vocalic

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6 $\text{Ident}_{\text{Dmm(V)}\text{Dep}_{\text{R}}}^{6}$ 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 [i]. 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, \( \text{Iden}_D(V) \), 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**

<table>
<thead>
<tr>
<th>Redup( \text{Dim} )</th>
<th>( \text{Iden}_D(V) \text{Depl-R} )</th>
<th>No Skip</th>
<th>S Weak</th>
<th>Max1( O(V) ) *Comp</th>
<th>DepB-R</th>
<th>MaxB-H</th>
<th>DeplR</th>
<th>*PI/Dors</th>
<th>*PI/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Va ( \text{e}^\prime \text{a} \text{-e}^\prime \text{a} \text{a} \text{f} )</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b ( \text{e}^\prime \text{i} \text{-e}^\prime \text{a} \text{a} \text{f} )</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Table 16, only (a) meets the designated constraint, \( \text{Depl}_R \text{Dim}_R \), 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, \( \text{Max}_1(O(V)) \text{ or Max}_1(O(V-[pl])) \), 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, \( \text{Iden}_R \text{Dim}_R(V) \text{Max}_1(O(V)) \), 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**

<table>
<thead>
<tr>
<th>Redup( \text{Dim} )</th>
<th>( \text{Iden}_R \text{Dim}_R(V) \text{Max}_1(O(V)) )</th>
<th>No Skip</th>
<th>S Weak</th>
<th>Max1( O(V) ) *Comp</th>
<th>DepB-R</th>
<th>MaxB-H</th>
<th>DeplR</th>
<th>*PI/Dors</th>
<th>*PI/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>a ( \text{t}^\prime \text{a} \text{-t} \text{a} \text{a} \text{d} )</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b ( \text{t}^\prime \text{i} \text{-t} \text{a} \text{a} \text{d} )</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c ( \text{t}^\prime \text{t} \text{-t} \text{a} \text{a} \text{d} )</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d ( \text{t}^\prime \text{i} \text{-t} \text{a} \text{a} \text{d} )</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Redup( \text{Dim} )</th>
<th>( \text{Iden}_R \text{Dim}_R(V) \text{Max}_1(O(V)) )</th>
<th>No Skip</th>
<th>S Weak</th>
<th>Max1( O(V) ) *Comp</th>
<th>DepB-R</th>
<th>MaxB-H</th>
<th>DeplR</th>
<th>*PI/Dors</th>
<th>*PI/Cor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Va ( \text{e}^\prime \text{d} \text{-e}^\prime \text{a} \text{a} \text{f} )</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b ( \text{e}^\prime \text{i} \text{-e}^\prime \text{a} \text{a} \text{f} )</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

In Table 18, both (a) and (b) satisfy the designated Max1\( O(V) \) constraint. However, (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.

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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), Booj (1997) and Rubach (1998).

In a classical LP model, there is a systematic distinction between lexical and postlexical phonology. 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. Meanwhile, 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, Booj 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).

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), Booj (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).

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point of derivation when morphology is added. In Lushootseed, the phonological representation of a lexical stem 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 allomorph, 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.

As discussed above, the non-senal 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-senal and senal accounts, because in double reduplication, the conditioning environments for the diminutive allomorphy are obtained in neither underlying nor surface representation, as illustrated in (18).

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 allomorph holds on the phonological representation of the distributive form, which has not undergone stem weakening. After the diminutive allomorph, 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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