Syllable repair in Sudanese Arabic

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Sudanese Arabic presents an interesting alternation of syllable repair strategies that is dependent on the environment that the unsyllabifiable clusters occur in. Two analyses (one OT and one rule based) of this phenomena will be presented. A comparison between these two analyses will then be attempted. The final conclusion is that it is very difficult to distinguish two theories based solely on empirical coverage and it is the auxiliary assumptions that are more important when evaluating a given theory.

Sudanese Arabic shows an interesting array of responses to violations of its syllable Canon that interact with a word final restriction on complex segments. Although both of these restrictions on surface forms cause problematic syllabifications to be resolved, different structural changes based on the environment that the unsyllabifiable clusters occur in emerge in response to the restrictions. An OT (Prince and Smolensky 1993) analysis will be presented that will show one possible way of reconciling these facts. A rule based analysis will also be presented. These two analyses will then be compared in hope of being able to make an argument for one of the two theoretical approaches. It will become apparent that the phenomena present in Sudanese Arabic that is discussed in this paper does not distinguish between the two theoretical approaches. The conclusion will be that much care must be taken when choosing the data that is used in order to make arguments to distinguish between two different theoretical approaches.

1.0 Syllable structure in Sudanese Arabic (SA)

The basic syllable canon in Sudanese Arabic allows CV, CVC and CVV syllables. Complex segments in both onset and coda position are banned. There is also the possibility of CVVC syllables but only in word final position. This syllable Canon will require some type of repair strategy when an underlying form can not be syllabified in a way that meets it. Two particular types of constructions will be investigated in this paper. The first type is geminated consonants and the second will be long vowels. Both of these

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1 I would like to thank the audience of the MOT Phonology Workshop, held at the University of Toronto in February 1997. Special thanks to Bill Issard and Abdel-Khaliq Ali for discussion of this material. All mistakes are my own.
2 Whether the final C in a CVVC syllable is actually the coda or extrametrical is an issue that can be debated. Either view is possible for the analyses that will be proposed in this paper so this issue will be left aside.
types of constructions will present situations where an underlying representation will not be syllabifiable without some sort of repair strategy.

1.1 *Geminates*

Geminate consonants in SA can appear in two different environments where the syllable canon can not be met by an underlying form. The first environment is where a geminated consonant is followed by another consonant and a CCC cluster is produced. The other environment is when a geminate occurs in word final position. Geminates in word final position can not be fully syllabified in SA due to the restriction on complex codas in this language. Consider the following forms.

(1) **Geminates in SA**

<table>
<thead>
<tr>
<th>UR</th>
<th>SR</th>
<th>Gloss</th>
<th>Position</th>
<th>Repair Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). sitt</td>
<td>sit</td>
<td>'lady'</td>
<td>final</td>
<td>deletion</td>
</tr>
<tr>
<td>b). sitt+na</td>
<td>sit.ta.na</td>
<td>'our lady'</td>
<td>medial</td>
<td>epenthesis</td>
</tr>
<tr>
<td>c). sitt+ak</td>
<td>sit.tak</td>
<td>'your lady'</td>
<td>medial</td>
<td>none</td>
</tr>
</tbody>
</table>

We see in (1) that the repair strategy for unsyllabifiable geminated consonants is either deletion or epenthesis and is conditioned by the environment that the geminate appears in. In word medial environments, epenthesis occurs when the geminate is followed by another consonant while deletion is the response if the geminate appears in a word final position.

1.2 *Long Vowels*

Long vowels in SA also present interesting alternations depending on the environment that they appear in. Long vowels are shortened, much like the geminates, when they appear word finally. Long vowels also trigger the deletion\(^3\) of a vowel that directly follows it. This deletion is due to the syllable canon blocking syllables with 'extra' long vowels (CVVV) an also not allowing plain V (no onset) syllables. These two alternations interact to preserve long vowels that are underlying followed by another vowel.

\(^3\)It is not entirely clear whether the second vowel deletes totally (including the mora) or if only the melody deletes. I am not in possession of Hamid (1984) from which Kenstowicz (1994) obtained its data. The crucial case that is missing from the paradigm is whether a short vowel followed by another short vowel becomes long or remains short. This case would indicate whether the mora of the second vowel is deleted or retained. For the purposes of this paper I will be noncommittal on this issue. To further complicate this issue Abdel-Khalig Ali, who is a native speaker of SA, informs me that there are dialectical differences in how long vowel short vowel clusters are resolved. In the other dialects that are not discussed in this paper (nor in Hamid 1984), one deletes the second vowel and shortens the long vowel while the other dialect coalesces the long and short vowel into a diphthong. These dialectical differences are not going to be discussed further in this paper but they could shed light on the adequacy of the analyses proposed.
(2) \textit{Long Vowels in SA}

<table>
<thead>
<tr>
<th>UR</th>
<th>SR</th>
<th>Gloss</th>
<th>Alternation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). dawaa</td>
<td>» dawa</td>
<td>'medicine'</td>
<td>shortening</td>
</tr>
<tr>
<td>b). dawaa+na</td>
<td>» dawaana</td>
<td>'our medicine'</td>
<td>none</td>
</tr>
<tr>
<td>c). dawaa+u</td>
<td>» dawaa</td>
<td>'his medicine'</td>
<td>deletion, no shortening</td>
</tr>
</tbody>
</table>

The most interesting facet in this paradigm is the phonological opacity (Kiparsky 1971, 1973a) of the ban on word final long vowels in form (2c). Opacity is generally troublesome for OT analyses and it will be interesting to see how or if an OT analysis can be constructed to account for these facts.

2.0 Two Analyses of Sudanese Arabic

2.1 Epenthesis and Word Final Degemination

2.1.1 An OT Account

A basic syllable repair strategy of epenthesis can be characterized by the use of Correspondence Theory (McCarthy and Prince 1995) and the constraint PARSE\(^4\). The PARSE constraint will require segments to be parsed into syllables and will not be formally defined. For our purposes we are going to assume a general constraint of Syllable Canon\(^5\) (\(\sigma \ C\)) which will be a catch all for the SA syllable canon.

(3) \textit{Constraint Ranking for Epenthesis as a Repair Strategy}

\(\sigma \ C, \text{PARSE, MAX} \gg \text{DEP}\)

These constraints and this ranking will correctly account for the simple epenthesis as a repair strategy seen in (1b). Consider Tableau 1 and note that the brackets in candidate (b) indicate that the consonant is pronounced but unparsed and that "." indicates syllable boundaries.

\begin{table}[h]
\begin{tabular}{|c|c|c|c|c|}
\hline
/sitt+na/ & \(\sigma \ C\) & PARSE & MAX & >DEP \\
\hline
a). sitt.na & *! & -- & -- & -- \\
\hline
b). sit.[i].na & -- & *! & -- & -- \\
\hline
c). sit.ta.na & -- & -- & -- & * \\
\hline
d). sit.na & -- & -- & *! & -- \\
\hline
\end{tabular}
\end{table}

\(^4\) PARSE constraints will be divorced from the assumption of stray erasure for the OT analysis in this paper. With the advent of Correspondence Theory, the presence or deletion of a segment is no longer dependent on whether it is parsed or not. Thus, the Parse constraint in this paper will only penalize unsyllabified segments but not cause or force their deletion. The deletion of segments is directly regulated by MAX.

\(^5\) This constraint can be decomposed into Onset, No Coda and a restriction on complex segments in onset or coda position. This is not crucial to the present discussion thus it is left out for expository clarity.
These constraints and ranking will not account for the deletion seen in (1a) though.

**Tableau 2**

<table>
<thead>
<tr>
<th>/sitt/</th>
<th>σC</th>
<th>PARSE</th>
<th>MAX</th>
<th>&gt;DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). sit.ta</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
</tr>
<tr>
<td>b). sit</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
</tr>
</tbody>
</table>

This problem can be remedied by a new constraint from the ANCHOR family. This particular ANCHOR constraint will require that the melody that appears at the right end of the input appear at the right end of the output. The formulation of this ANCHOR constraint follows previous autosegmental analyses of Arabic (Kerstowicz 1986, Halle and Vergnaud 1980 and Clements and Keyser 1982) by exploiting the distinction between melodic and segmental levels.

(4) **Anchor Melody Right (AMR):**

If \(\exists x \in I \mid \forall y \in I \not x^y\) then \(\exists p \in O \mid \text{Corr.} (p,x)\) and \(\forall r \in O \not p^r\), where \(x=\) melody, Corr. = the Correspondence relation and ‘^’ is immediate precedence.

The formulation of this constraint to only apply to melodies will allow geminates to be shortened without violating it. By ranking this constraint over MAX we can revisit Tableau 2 (below as Tableau 3) with more success.

**Tableau 3**

<table>
<thead>
<tr>
<th>/sitt/</th>
<th>σC</th>
<th>PARSE</th>
<th>AMR</th>
<th>&gt;MAX</th>
<th>&gt;DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). sit.ta</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
</tr>
<tr>
<td>b). sit</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
<td>(_)</td>
</tr>
</tbody>
</table>

We see here that the requirement of preserving the melody at the edge of the word prevents epenthesis from being the repair strategy at the ends of words. This is only a temporary victory though once some other forms are considered. The following presents a paradigm which shows that epenthesis may apply at the edge of the word to save a segment from deleting.

(5) **Epenthesis at the word edge**

\[
\begin{array}{cccc}
UR & SR & \text{Gloss} & \text{Alternation} \\
\hline
a). \text{hamal}+\varnothing & \text{hamal} & '\text{he carried}' & \text{none} \\
b). \text{hamal}+\varnothing+u & \text{hamalu} & '\text{he carried him}' & \text{none} \\
c). \text{hamal}+t+u & \text{hamaltu} & '\text{I carried him}' & \text{none} \\
d). \text{hamal}+t & \text{hamalta} & '\text{I carried}' & \text{epenthesis}
\end{array}
\]

Here we see that the morpheme /-t/ 'I' does not delete when it can not be syllabified, contradicting the above conclusion from the 'sitt » sit' alternation. This apparent counter example can be accounted for if MAX as a constraint is
split into MAX: Melody (MM) and MAX: Segment (MS). This refinement of
the MAX Constraint will now allow the difference between single segments
and geminates to be shown. By placing MM and MS at different places in the
constraint ranking, geminates will be allowed to shorten to satisfy the σ C
constraint while epenthesis occurs (causing violation of AMR) when a whole
segment would be deleted. Consider the following tableaus which show
how this new view of MAX distinguishes between

\textbf{Tableau 5}

\[
\begin{array}{|c|c|c|c|c|c|c|}
\hline
 & \sigma C & \text{PARSE} & \text{MM} & \text{AMR} & \text{MS} & \text{DEP} \\
\hline
 a). \text{ha.malt} & *! & -- & -- & -- & -- & -- \\
 b). \text{ha.mal} & -- & -- & *! & * & -- & -- \\
 c). \text{ha.mal}[t] & -- & *! & -- & -- & -- & -- \\
 d). \text{ha.mal.ta} & -- & -- & -- & * & -- & * \\
\hline
\end{array}
\]

\textbf{Tableau 6}

\[
\begin{array}{|c|c|c|c|c|c|c|}
\hline
 & \sigma C & \text{PARSE} & \text{MM} & \text{AMR} & \text{MS} & \text{DEP} \\
\hline
 a). \text{sit.ta} & -- & -- & -- & -- & *! & -- & * \\
 b). \text{sit} & -- & -- & -- & -- & * & -- & -- \\
\hline
\end{array}
\]

These two tableaus show that deleting duplicate parts of structure (geminates
in this case, reduplication in Raiemy and Idsardi 1997) is not as detrimental as
the deletion of an entire structure when evaluating a candidate. We can now
conclude that OT can correctly account for this set of data.

2.1.2 \textit{A Rule Based Account}

A rule based account of the alternation between epenthesis and word
final degemination can be formulated as follows.

\textit{(6) Syllabification Rules for Sudanese Arabic}

(a) Core Syllabification: \[ CV > \sigma \]

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
 & \sigma_i & \sigma_i^2 \\
\hline
 CV & /1 & /1 \\
\hline
\end{array}
\]

(b) Coda: \[ C > \sigma_i \]

\[
\begin{array}{|c|c|c|c|}
\hline
 & \sigma_i & \sigma_i^2 \\
\hline
 C & /1 & CV \\
\hline
\end{array}
\]

* Another possible way of accounting for this phenomenon would be to posit a constraint that
requires all morphemes to have a phonetic output. Thus the difference between shortening of
geminate /t/ at the end of a word and deleting the affix /-t/ is that deleting /-t/ removes all
phonetic exponence of an affix while degemination does not. This approach will not be pursued
in this paper though.

7 The subscript is meant to indicate that the C is being syllabified into an already existing
syllable and not that the C is heading its own new syllable.
The ordering of these rules is intrinsic and can be derived by the Elsewhere Condition (EC) (Kiparsky 1973b). Core Syllabification will occur before epenthesis because it is the more specific rule. This is the same situation between the Coda rule and Epenthesis. Since the Coda rule cannot apply until there are syllables, this intrinsically orders Core Syllabification before the Coda rule. Finally, WFD will also be ordered before Epenthesis because it is also more specific due to the fact that it has an environmental requirement on its application. Since Epenthesis does not require any special environment it is more general and thus will apply after WFD. This set of rules will successfully account for the data.

The Epenthesis rule will not apply to save word final geminates because the EC orders WFD before Epenthesis. WFD will not apply to the word internal geminates because they do not satisfy the triggering environment for degemination and thus the Epenthesis is free to apply. Consider the derivations in (7).

(7) **Epenthesis vs. Degemination**

<table>
<thead>
<tr>
<th>UR:</th>
<th>/sitt/</th>
<th>/sitt+na/</th>
<th>/hamal+t/</th>
<th>/hamal+t+u/</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Syll.,</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>Coda:</td>
<td>/\</td>
<td>/\</td>
<td>/\</td>
<td>/\</td>
</tr>
<tr>
<td>CVCC</td>
<td>CVCC</td>
<td>CVCC</td>
<td>CVCC</td>
<td>CVCCCV</td>
</tr>
<tr>
<td>s i t</td>
<td>s i t</td>
<td>n a</td>
<td>h a m a l t</td>
<td>h a m a l t u</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degemination:</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVC</td>
<td></td>
</tr>
<tr>
<td>s i t</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Epenthesis:</th>
<th>σ</th>
<th>σ</th>
<th>σ</th>
<th>σ</th>
<th>σ</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface:</td>
<td>s i t</td>
<td>s i t.t a.n a</td>
<td>h a.m a l.t a</td>
<td>h a.m a l.t u</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*Special thanks to Bill Idsardi for pointing this out to me.*
We see here that the Elsewhere Condition correctly orders all of the rules intrinsically and the paradigm falls out. Thus, we can conclude that the rule based approach also accounts for this set of data.

2.2 Word Final Long Vowel Shortening and Phonological Opacity

2.2.1 An OT Account and Opacity

As already seen in (2), long vowels shorten when they appear in word final position. In order to trigger this process, the following constraint can be used.

(8)  
\[ \text{*Word Final Long Vowels (*V:*)} \]
\[ \text{\(V\)} \]
\[ \text{/} \quad \text{\(\mu\)} \]
\[ \text{\(\mu\)} \quad \text{\(\mu\)} \quad \text{Prwd} \]

This constraint will be phonologically active when ranked above the Correspondence constraints and the present ranking will provide the proper optimal candidate.

| Tableau 7 |
| /dawaa/   |
| a). dawaa | — | — | — | — | — | — | — | — |
| b). dawa  | — | — | — | — | — | — | — | * | — |
| c). dawaaC| — | — | — | — | — | — | * | — | — |
| d). daw  | — | — | — | — | — | — | — | — | — |

The present constraint hierarchy is set up to favor general epenthesis as the response to violations of higher ranked constraints. We will see that this characterization of epenthesis in SA is too broad though.

Two characteristics of SA that need to be noted here are that hiatus is not allowed and that vowels delete as the response when hiatus occurs. The present set of constraints does not reflect these realities.

| Tableau 8 |
| /dawaa+u/ |
| a). da.waa.u| — | — | — | — | — | — | — | — |
| b). da.waa  | — | — | — | — | — | — | — | — | — |
| c). da.wa   | — | — | — | — | — | — | — | — | — |

In Tableau 8, candidate (a) is optimal but the actual surface form is candidate (b). In order to correctly predict candidate (b) to be the optimal form we must first add a new constraint and modify one of the already existing ones. First, we will add a Hiatus Constraint (*H) that will penalize V₁V₂ clusters. The
second thing we must do is to split the DEP Constraint into DEP: Consonant (DC) and DEP: Vowel (DV). DC will be ranked high in order to block epenthetic consonants while DV will be ranked where the general DEP constraint is presently ranked.

Tableau 9

<table>
<thead>
<tr>
<th></th>
<th>*H</th>
<th>DC</th>
<th>*V:## &gt;MM &gt;AMR&gt;MS</th>
<th>&gt;DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). da.waa.u</td>
<td>*!</td>
<td>-</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td>b). da.waa.Cu</td>
<td>-</td>
<td>*!</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>c). da.waa</td>
<td>-</td>
<td>-</td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>d). da.wa</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>*</td>
</tr>
</tbody>
</table>

We see that the present formulation of the *V:## constraint prevents candidate (c) from being the optimal candidate. This is problematic though because this candidate is the output form. In order to solve this problem, we must find some way of formulating this constraint that will allow the output representation [dawaa] from the input /dawaa+u/ but not from the input /dawaa/. This is a case of rule opacity which is problematic for most versions of OT.

Fortunately, McCarthy (1995) discusses how OT could possibly deal with the opacity of phonological rules in a given grammar. Opacity is very difficult for OT to handle due to the claims of parallelism made by OT and its focus on output constraints. The main point of McCarthy (1995) is that opacity can be handled in OT if constraints are allowed to be parametrized on where they are evaluated. Thus, constraints can be sensitive to underlying forms, to either underlying or surface forms or to just surface forms when they evaluate outputs. To facilitate the discussion of this topic, McCarthy (1995) presents a table that fully indicates the characteristics of a constraint.

(10) **Canonical Constraint Schema (McCarthy 1995)**

<table>
<thead>
<tr>
<th></th>
<th>Condition</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>α</td>
<td></td>
<td></td>
</tr>
<tr>
<td>β</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear Order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Condition column in this table describes the phonological characteristics of the constraint. Thus, α and β describe what segments are named in the constraint, Linear Order specifies a precedence relation (α must precede β etc.) and Adjacency describes the distance required between α and β. The Level column now allows each of the Conditions to be specified for which level (or both) they will hold at.

To better understand McCarthy’s proposal, let us consider the problematic constraint in the present analysis of SA.
(11) **Schema for *Word Final Long Vowels (V:*)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>$V_i$</td>
</tr>
<tr>
<td></td>
<td>$\mu_a$</td>
</tr>
<tr>
<td>$\beta$</td>
<td>$V_i$</td>
</tr>
<tr>
<td></td>
<td>$\mu_b$</td>
</tr>
<tr>
<td>Linear Order</td>
<td>$\alpha &gt; \beta$</td>
</tr>
<tr>
<td>Adjacency</td>
<td>strict</td>
</tr>
</tbody>
</table>

This is the default formulation of *V:# in that all of the Level specifications are set at ‘surface’. It is interesting to notice how the actual formulation of this constraint is broken down into McCarthy’s $\alpha$ and $\beta$ form. The long vowel structure is indicated by the different moras (indicated by subscripting) in the $\alpha$ and $\beta$ rows being attached to the same V node (indicated by subscripting). The word final requirement is added to $\beta$ by the edge of a prosodic word notation and this is a slight elaboration on the original formation of the Constraint Schema in McCarthy (1995). Our present problem arises due to the fact that this formulation of *V:# can not distinguish between the two following input/output structures.

(12) **Input/Output for ‘dawa’ and ‘dawaa’**

(a)  
```
    V  V
 | \ /  
```

INPUT:  
```
 d a w a a
```

OUTPUT:  
```
    V  V
 | \ /  
```

(b)  
```
    V  V
 | \ /  
```

INPUT:  
```
 d a w a a u
```

OUTPUT:  
```
 d a w a a
```

The difference in outputs for these two different forms is that in (12a) the long vowel structure remains the same in both the input and output. The constraint *V:# correctly penalizes this structure in its current formulation. (12b) has a change in structure between the long vowel in the input and output though.

The structure in (12b) has deleted the melody of the /u/ in order to satisfy the *Hiatus constraint. This leaves a floating mora which presents an interesting question for how this form can best satisfy its given grammar. If the mora is incorporated into the syllable (creating a trimoraic syllable) the $\sigma$C constraint will be violated. If the mora is simply deleted then the *V:# is violated (this would produce the output structure in (18a)). A possible
different response is for the /u/ melody to delete, the long vowel to shorten (loosing \( \mu_2 \)) and then to lengthen by incorporating \( \mu_1 \). This produces the given output structure in (12b)\(^9\).

This complicated story is a wonderful tale but the present formulation of \(*V\#\) can not tell the difference between the outputs in (12 a/b) because it only considers structures at the surface level. According to McCarthy (1995) this constraint can now be parametrized to look at the underlying structure and this change will allow the difference between (12a) and (12b) to be seen. Here is the new Constraint Schema for \(*V\#\).

\[
\begin{array}{|c|c|c|}
\hline
\text{Condition} & \text{Level} \\
\hline
\alpha & V_i & \text{surface} \\
\beta & \mu_a & \text{surface} \\
\text{Linear Order} & \alpha > \beta & \text{surface} \\
\text{Adjacency} & \text{strict} & \text{underlying} \\
\hline
\end{array}
\]

The only modification made here is that the Adjacency requirement is now at the underlying level. This minor modification is enough to now distinguish between the output structures in (12 a/b). Consider the evaluation of (12a) and (12b) with the new and improved \(*V\#\).

\[
\begin{align*}
(12a) & \quad \begin{array}{ll}
V & V \\
\mu & \mu_1 \mu_2 \\
d & a & w & a & a
\end{array} \\
(12b) & \quad \begin{array}{ll}
V & V \\
\mu & \mu_1 \mu_3 \\
d & a & w & a & a
\end{array}
\end{align*}
\]

Evaluation:

\[
\begin{array}{|c|c|c|}
\hline
\text{Condition} & \text{Level} \\
\hline
\alpha & \text{yes} & \text{yes} \\
\beta & \text{yes} & \text{yes} \\
\text{Linear Order} & \text{yes} & \text{yes} \\
\text{Adjacency} & \text{yes} & \text{NO} \\
\text{Result} & \ast & -\text{--} \\
\hline
\end{array}
\]

\(^9\)Note that this type of analysis would be favored if we realize every morpheme approach to the /-t/ data mentioned in Footnote 7 is adopted. This ‘mora flop’ would allow the deleted /u/ to be realized in the output as the additional mora.

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With this new modified *V:# constraint we can now revisit Tableau 9 with more felicitous results (below as Tableau 10).

Tableau 10

<table>
<thead>
<tr>
<th>/dawa₂a₃u₃</th>
<th>*H</th>
<th>DC</th>
<th>*V# &gt;MM &gt;AMR &gt;MS &gt;DV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a). dawa₂a₃</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>b). dawa</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>c). dawaau</td>
<td>*!</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>d). dawaCu</td>
<td>--</td>
<td>*!</td>
<td>--</td>
</tr>
<tr>
<td>e). dawa₃a₃</td>
<td>--</td>
<td>--</td>
<td>*!</td>
</tr>
</tbody>
</table>

We see that this parametrization of the level at which the *V:# constraint evaluates its candidates allows the proper candidate to be optimal. Thus, if McCarthy (1995) is adopted, OT can account for this data also.

2.2.2 A Rule Based Account

Most of the rule based account of Sudanese Arabic has already been presented in 2.1.2. The Word Final Degemination Rule presented there was purposely made as general as possible in order for it to accomplish both degemination and word final vowel shortening. The only additional rule that is needed is one that will resolve hiatus. This can be formulated as follows.

(15) Hiatus Resolution: \( V_1V_2 > V_1 \)

The only remaining question now is how this rule is ordered in relation to the others rules already proposed. The important fact here is that WFD must apply before Hiatus Resolution in order to prevent Hiatus Resolution from feeding WFD. This ordering can be derived from the Elsewhere Condition just as the ordering of WFD and Epenthesis was though. Thus, since Hiatus Resolution does not have a required environment, it can be considered to be less specific than WFD which does have a specified environment. This allows the following derivations.
(16) **Vowel Shortening vs. Degemination**

Underlying:  
/dawaa/  
Core Syll.,  
σ σ  
Coda:  
/1/1  
CVCV  
 conceptualization:  
/1/1  
CVCV  
da wa a  
WFD:  
σ σ  
/1/1  
CVCV  
/1/1  
CVCV  
da wa a u  
Hiatus  
Resolution:  
/1/1  
CVCV  
/1/1  
CVCV  
da wa a  
Surface:  
/1/1  
CVCV  
/1/1  
CVCV  
da wa a  
With these derivations we can see that a rule based approach can also account for the data.

3.0 **Comparison of the OT and rule based analyses**

We presently have two different accounts of data that shows syllable repair strategies in Sudanese Arabic. Both of these analyses correctly account for the data under investigation so the first possible way of distinguishing between these two analyses, empirical coverage, does not decide between the two. Special note must be made about using empirical coverage to make arguments about the adequacy of a theory in accounting for data. Empirical coverage is only a useful test when one account can not handle the data under any circumstance. This is a very important point because a very feeble argument could have been made that the rule based account was superior to

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10 Another potential account for this data is that since there is no rule that syllabifies V into its own syllable in SA and there is no epenthesis rule that inserts a C to resolve hiatus, that this /u/ is never syllabified and is thus deleted due to some formulation of Stray Erasure. This type of account will not be pursued but would have the advantage that there is no additional need for rule ordering because there is no rule added. Only the assumption that Stray Erasure applies after all rules is needed.
the OT account in handling Sudanese Arabic based on the opacity\textsuperscript{11} in the word final long vowel data. This is not a very good argument though, because OT can be modified a bit in order to account for the data in question. This is exactly what McCarthy (1995) did and this move makes the OT and rule based account of SA to be equal in empirical coverage. In order to use empirical coverage as an effective argument, both theories must be fully developed in very careful and principled ways in order to present the best version of each. Otherwise, an argument based on empirical coverage does not hold.

Once empirical coverage is set aside, other parameters of analyses can be compared in an attempt to distinguish between two theories. One potential avenue of comparison of OT and rule based analyses is to compare the amount of rules vs. constraints that are required for a proposed analysis to work. This is another area of argumentation that is very dubious in its value. At the present time there is no consensus on what the ‘value’ or ‘liability’ each constraint or rule places on a theory. Prince and Smolensky (1993) try to claim this type of argument in favor of OT by stating that all constraints are universal and are thus ‘costless’. The rest of this argument is that all rules are stipulated on a language specific basis and thus ‘cost’ much more than universal constraints. This argument is muddy at best though because while universal constraints might be free, what is the ‘cost’ of the language specific ranking of each constraint? Furthermore, what is the cost of a rule based account that has all of the rules ordered intrinsically? Specifically in our case of Sudanese Arabic, which is better, a rule based account of 5 rules with no extrinsic ordering or an OT account with 7\textsuperscript{12} constraints and some rankings? How does one count different rankings? Do derived rankings from transitivity (A>B, B>C therefore A>C) count as much as purely stipulated rankings? These are very hard questions that do not have answers at the present time thus this type of argument also does not decide between the theories.

The final type of argumentation that I am going to discuss that can be used to distinguish theories is typological. Prince and Smolensky (1993) make the claim that all constraints are universal and that the only thing that distinguishes between specific languages is the particular ranking of constraints. So given any OT analysis we could permute a given constraint ranking and see if the new ranking actually corresponds to another language. Continuing with this type of assumption, we would also hope that minor changes in a given ranking would create a closely related language (or dialect) while major changes in the ranking would create a less related language.

\textsuperscript{11}OT not being able to handle opacity is not a feeble argument in itself though. Idsardi (1998) shows that OT (pre McCarthy (1997)) is unable to account for Tiberian Hebrew spirantization under any circumstance. McCarthy (1997) introduces the idea of Sympathy as a way for OT to handle opacity. Idsardi (1997) shows that Sympathy is not without its problems and it is not entirely clear if Sympathy in fact does allow OT to handle all instances of opacity while maintaining the claims of parallelism.

\textsuperscript{12}How does one count MAX? Does this just count as one constraint or does it count as many constraints (MAX: Melody, MAX: Segment, MAX: C, MAX: V, etc.)?
This appears to be a potentially useful type of argumentation until we attempt to do this with a rule based analysis. How should this type of theoretical evaluation be utilized in a rule based framework? Rule based theories do not claim universality of all rules. Furthermore, not all rules can be ordered all ways. Rule based theories that invoke the Elsewhere Condition or other types of intrinsic rule ordering make claims about what possible grammars can exist because analyses of this type deny some possible orderings of rules. The point here is that this type of evaluation is crucially dependent on how particular rules or constraints are formulated. Since an argument of this type is dependent on the particular rule or constraint, the argument will disappear if the rules or constraints are changed even if the analysis remains the same. Thus, once again differentiating between OT and a rule based analysis becomes a very difficult task.

In summary, it appears that syllable repair strategies in Sudanese Arabic do not appear to be a test case which will differentiate between a rule based and OT based analysis. I think if time is spent most of the arguments for OT based on particular analyses will also suffer from this fate. The area of distinguishing between OT and rule based analysis needs much further research before any definite answer can be given.

4.0 Conclusion

Sudanese Arabic presents interesting alternations in responses to restrictions on its syllable structure. Two accounts of these alternations have been presented here. Both the OT and the rule based analyses can account for the data. The OT analysis required some modification of the theoretical framework in order to account for the data. The main difference between the two approaches are the broader theory specific claims that they make about language in general. Expansion of a theory to achieve more empirical coverage can be done in principled ways which add to our general understanding of language. All theories have undergone such enrichments and as our knowledge and understanding of language grow so will new theories.

Possible ways of making arguments that distinguish between these two approaches are then discussed. The main conclusion from this section is that it is very difficult to formulate a good argument that distinguishes between a rule based theory and OT. The final conclusion is that we must be very careful in evaluating all arguments for or against any given theory because it is more than likely that data that will not determine which theory is better but the claims that the theories make about the data will.

References


