Assimilation and Local Conjunction in Arabic

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Voice and emphasis assimilation in Arabic take place only when adjacent segments agree in all other feature specifications. In effect, this creates a paradox as to the ranking of a constraint that requires adjacent segments to agree in all features relative to other constraints that demand faithfulness to the feature 'voice' or 'emphasis' when the adjacent segments differ in any other feature(s). In the language as well, coronal sonorants /n/ and /l/ undergo total assimilation to a following /r/ but not to any other continuant. The aim of this paper is to propose local conjunction as an appropriate tool for handling voice, emphasis, and continuance assimilation in stem-stem clusters in Arabic.

Keywords*: assimilation, local conjunction, Arabic, Optimality Theory*

1. Introduction

There have been various approaches within Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1993) to handling assimilation processes. In one approach, assimilation is seen as a result of compromise between articulatory and perceptual demands in speech. Place assimilation, for instance, has been considered as not only an articulatorily motivated process, but also an adaptation to the listener's needs (Mohanan 1993; Jun 1995; 2005). Other approaches, however, incorporate the notion of correspondence between input and output features. Assimilation results from a conflict between faithfulness constraints demanding identity between input and output features on the one hand, and syntagmatic constraints which demand adjacent output segments to agree in feature specifications (Lombardi 1995, 1996, 1999; Bakovic 1999, 2000, Walker 2000; Hansson 2001; Rose and Walker 2004; McCarthy 2006).

2. Irbid Urban Arabic (IUA)

Arabic is a Semitic language with various dialects spoken in Arab countries in the Middle East and North Africa. Major Arabic dialects are Iraqi, Egyptian, Levantine, Gulf, Northwest African, and Yemeni. The Levantine dialect is spoken primarily in Palestine, Lebanon, Syria, and Jordan with some phonological and lexical differences. Jordanian Arabic may be further divided into three basic sub-dialects: Urban, Rural, and Bedouin. Within each sub-dialect, further divisions may be made depending on geography or ethnic background. This paper considers an Urban variety of Jordanian Arabic spoken in the city of Irbid located at the northern part of Jordan. The presence of emphatic consonants is a common feature to all Arabic dialects, written here as /C□/. Emphatics are produced with a secondary constriction in the posterior vocal tract (Lehn 1963;

Al-Ani 1970; Card 1983; Zawaydeh 1999; among others). The consonant inventory of IUA is provided in (1)

(1) Consonant inventory in IUA:

	Labial	Labiodental	Inter-dental	Alveolar	Palatoalveolar	Palatal	Velar	Pharyngeal	Glottal
Plosive	b			t d t[ʔ]			k g		[ʔ]
Nasal	m			n					
Trill				r					
Fricative		f	θ ð ð[ʔ]	s z s[ʔ]	[ʃ]		x ɣ	ħ [ʕ]	h
Affricate					[ʧ]				
Approximant				l					
Glide	w					j			

2.1 *Assimilation in IUA*

Within Optimality Theory (OT), assimilation, or the lack of it, is directly related to ranking conflicts between faithfulness constraints that seek preservation of an input feature specification [IDENT-F] (2) with markedness constraints that obligate agreement in feature specifications of neighboring segments [AGREE-F] (3). Dominance of IDENT blocks assimilation in the feature in question while dominance of AGREE triggers assimilation in the targeted feature. AGREE is understood as a set of constraints each of which requires agreement in a particular feature. Pulleyblank (1997) refers to this syntagmatic constraint set as IDENTICAL CLUSTER CONSTRAINTS.

(2) IDENT(F): Correspondent segments have identical values for feature [F]

(3) AGREE(F): A sequence of segments have identical values for feature [F].

This paper is intended to investigate the use of local conjunction of constraints in handling voice, emphasis, and continuance assimilation in IUA.

3. Local Conjunction

A locally-conjoined constraint C (Smolensky 1993) is violated iff both of its conjuncts, C1 and C2, are violated in a local domain D. The basic implication is that a violation of both constraints is more fatal than the violation of any of the conjoined constraints. This is illustrated in (4).

(4) Local Conjunction of Constraints (LCC), (Itô& Mester 1998:10)

a. Definition
Local conjunction is an operation on the constraint set forming composite constraints: Let C1 and C2 be members of the constraints set CON. Then their local conjunction C1&C2 is also a member of COD.

b. Interpretation
The local conjunction C1&C2 is violated if and only if both C1 and C2 are violated in some domain δ.

c. Ranking (universal)
C1&C2 >> C1
C1&C2 >> C2

Lubowicz (2005) provides a survey of the various applications of local conjunction. She notes that local constraint conjunction (Smolensky 1993, 1995, 1997) has been proposed to account for coda condition (Smolensky 1993, Itô & Mester 1998), sonority hierarchy (Smolensky 1995), cluster restrictions and syllable contact (Baertsch 1998, 2002, Baertsch & Davis 2003, Davidson *et al.* 2004), derived environments (Lubowicz 2002, Itô & Mester 2002, Downing 2001), vowel harmony (Smolensky 1997, 2005, Bakovic 2000, Itô & Mester 2002), chain shifts (Kirchner 1996, Moreton & Smolensky 2002, Beckman 2003), OCP (Alderete 1997, Itô & Mester 1998, Suzuki 1998), accentual phenomena (Alderete 1999), dissimilation (Alderete 1997), and language acquisition (Levelt & van de Vijver 1998). This paper adds to the wide range of phonological processes that are handled through local conjunction within OT by arguing that this notion may be extended to account for voice, emphasis, and continuance assimilation in Arabic thus contributing to a typological survey of the merits of local conjunction as a valuable tool within OT that is part of universal grammar. In this paper, the domain governing locally conjoined constraints is a word boundary.

Various types of constraints may be locally conjoined. For instance, Kirchner (1996) uses local conjunction of faithfulness constraints to account for synchronic chain shifts, Itô & Mester (1998) show how positional markedness effects can be accounted for through the local conjunction of markedness constraints, and Lubowicz (2002) proposes to account for derived environment effects with the local conjunction of markedness and faithfulness constraints.

However, the local conjunction of markedness and faithfulness constraints has undesirable consequences (Itô & Mester 1998). To constrain local conjunction and avoid the undesirable consequences, Bakovic (1999) notes that locally conjoined constraints are to be co-

relevant. In essence, both constraints will have to make reference to a particular feature for them to be conjoined. In this paper, locally conjoined constraints involve a markedness and faithfulness constraint that are co-relevant.

4. AGREE and Local Conjunction in IUA

AGREE is used in this paper as a blanket constraint for a set of AGREE constraints that make individual reference to feature specifications. Since AGREE is a set of constraints, its use in local conjunction may be interpreted in two different ways. On the one hand, it may be seen as the local conjunction of all members of AGREE with some other constraint (5), or as a variety of locally conjoined constraints each using a single AGREE constraint with some other constraint (6) in which case all these locally conjoined constraints are crucially non-ranked in the language.

(5) AGREE & IDENT (F) = AGREE (place) & AGREE (voice) & AGREE (nasal) & AGREE (continuance) & AGREE (lateral) & all other AGREE constraints & IDENT (F).

(6) AGREE & IDENT(F) = AGREE (place) & IDENT (F) , AGREE (voice) & IDENT (F), AGREE (nasal) & IDENT (F) , AGREE (continuance) & IDENT (F), AGREE (lateral)& IDENT (F), … etc.

To avoid conjoining more than two constraints, we are assuming the interpretation in (6) throughout the rest of this paper.

As will be shown in the following sections, the local conjunction of AGREE with IDENT (voice) to account for voice assimilation, and with IDENT (emphasis) to account for emphasis assimilation differs from the local conjunction of AGREE with IDENT (continuance) to account for assimilation in continuance. In the first two, optimizing a candidate is the function of AGREE while in the latter case, determining the optimal candidate is left for a lower ranked constraint. This is not due to a difference between IDENT (voice) and IDENT (emphasis) on the one hand and IDENT (continuance) on the other. The difference lies in the overall constraint hierarchy in the language as will be shown during the discussion.

As defined in (4), a locally conjoined constraint is violated iff both its conjuncts are violated within a certain domain. This is known in the literature as ‘worst of the worst’ (**WOW**) conception of local conjunction (Smolensky 1993, Moreton and Smolensky 2002). Another conception of local conjunction is known as ‘best of the best’ (**BOB**), where a candidate satisfies a conjunction iff it passes every conjunct (Crowhurst and Hewitt 1997). The differences between the two are schematized in (7) below:

(7) Differences between ‘worst of the worst’ & ‘best of the best’

i) **WOW**

i)	C1&C2	C1	C2
Cand.1	*	*	*
Cand.2		*	
Cand.3			*
Cand.4			

ii) **BOB**

ii)	C1&C2	C1	C2
Cand.1	*	*	*
Cand.2	*	*	
Cand.3	*		*
Cand.4			

In this paper, the **WOW** definition of local conjunction is used when assigning violation marks. The **BOB** conception will be shown to be inadequate to handle the data under investigation.

The rest of this paper considers voice, emphasis, and continuance assimilation under local conjunction of faithfulness constraints with AGREE in sections (5-7) respectively. Concluding remarks are provided in section 8.

5. Voice Assimilation and Local Conjunction

The phonemic consonant inventory of IUA in (1) shows that there are six possible pairs of sounds that differ only in voice; three coronal pairs (8), two velar pairs (9), and one pharyngeal pair (10). This brings the total number of possible clusters to twelve as exemplified in (8-10).

(8) Coronal clusters

a. /faat dukkaaneh/	[faad daukkaaneh]	‘he entered a store’
b. /bariid taariixi/	[barrit taariixi]	‘historical mail’
c. /muθallaθ ðahabi/	[muθallað ðahabi]	‘a golden triangle’
d. /fuulaað θamiin/	[fuulaaθ θamiin]	‘expensive steel’
e. /kiis zatuun/	[kiiz zatuun]	‘a sack of olives’
f. /muuz suuri/	[muus suuri]	‘Syrian bananas’

(9) Velar clusters

a. /sˁuraax ɣaamir/	[sˁuraaɣ ɣaamir]	‘overwhelming scream’
b. /farraɣ xeemtu/	[farrax xeemtu]	‘he emptied his tent
c. /malik gawi/	[malig gawi]	‘a strong king’
d. /sarag kursi/	[sarak kursi]	‘he stole a chair’

(10) Pharyngeal clusters

a. / miliħ ʔaadi/	[miliʔ ʔaadi]	‘regular salt’
b. /balaʔ ħabbe/	[balaħ ħabbe]	‘he swallowed a pill’

The three coronal emphatics in the language also undergo voice assimilation when place of articulation is identical and the first member of the cluster is the plain consonant. Conversely, voice assimilation is denied since the cluster differs in features other than voice, i.e. emphasis and voice. A detailed account is left for section 6.

Voice assimilation is suspended if the cluster differs in any other feature(s) as shown in (11).

(11) Voice assimilation suspended

a. /walad saʔiid/	[walad saʔiid]	‘a happy boy’
b. /malik daahje/	[malik daahje]	‘a cunning king’
c. /faras gawi/	[faras gawi]	‘a strong horse’

Data (8-11) represents an interesting scenario in IUA. Voice assimilation takes place only when adjacent segments agree in all other feature specifications (8-10), while voice specifications are preserved if the cluster disagrees in any other feature(s) (11). The constraints in (12) and the constraint hierarchy in (13) account for most assimilation patterns in IUA

(12) Active constraints in IUA

a. (ID)ENT{KP}: An input dorsal (K) or labial (P) is identical to its output correspondent.
b. (ID)ENT-(ONS)ET: Input onset segments are identical to their output correspondents.
c. (ID)ENT–OBS {KPT}: Input obstruents must retain their major place of articulation in the output.
d. (ID)ENT (SON): Input segments must preserve their value of sonorancy in their output correspondents.
e. (ID)ENT-OBS(NON-CONT.): Input obstruents must retain the feature non-continuant in their output correspondents.
f. (ID)ENT- CONT.(PLACE): Input continuants must retain their place of articulation in the output.
g. (ID)ENT (CONT.): The feature 'continuant' of an input segment must be retained in the output.
h. (ID)ENT (EMPH.): The feature 'RTR' in the input is preserved in the output.
i. AGREE: Consonant clusters agree in feature specifications across a word boundary.
j. (ID)ENT-IO: Input segments are identical to their output correspondents.

(13) Hierarchy for assimilation in IUA

ID{KP}, ID-ON, ID–OBS{KPT}, ID(SON), ID-OBS(NON-CONT.), ID-CONT.(PL), ID (CONT.), ID (RTR) >> AGREE >> ID-IO

This hierarchy will optimize the correct output for the data in (8-10) since all clusters satisfy all constraints ranked higher than AGREE and then to satisfy AGREE, voice assimilation would take place. Tableaux (14-16) exemplify for (8a), (9a), and (10a) respectively.

(14)

/faat dukkaaneh/	ID{KP}	ID -ONS	ID–OBS{KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. faat dukkaneh									*!	
b.☞ faad dukkaneh										*
c. faat tukkaneh		*!								*

Although candidate (14b) violates IDENT-IO, it is still optimal since it satisfies the higher ranked AGREE while (14a) violates it. Candidate (14c) is ruled out for a fatal violation of the higher ranked IDENT –ONSET.

(15) Violating IDENT-IO and satisfying AGREE

/sʔuraax ɣaamir/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. sʔuraax ɣaamir									*!	
b.☞ sʔuraaɣ ɣaamir										*
c.sʔuraax xaamir		*!								*

Candidate (15b) is optimal for the same reasoning provided for (14b) above.

(16) Violation of the higher ranked IDENT- CONT.(PLACE).

/miliħ ʔaadi/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. miliħ ʔaadi									*!	
b. ☞ miliʔ ʔaadi										*
c. miliz ʔaadi						*!				*

Candidate (16b) is optimal for the same reasoning above except that (16c) is ruled out for violation of the higher ranked IDENT- CONT.(PLACE).
Data in (11) pauses a problem to the constraint hierarchy in (13) as exemplified by (17) for (11a) where (17a) is the optimal output but it is ruled out for a double violation of AGREE. The cluster disagrees in voicing and continuance. According to the hierarchy above, candidate (17b) should be optimal since it fares better than (17a) as to the demands of AGREE; the cluster differs only in continuance. Candidate (17c) is ruled out by a higher ranked IDENT-OBS (NON-CONT.) which requires obstruents to preserve the feature non-continuant.

(17) Cluster disagrees in voicing and continuance

/walad saʔiid/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. ☹ walad saʔiid									**!	
b. ☞ walat saʔiid									*	*
c. walas saʔiid					*!					*

The major difference between tableaux (14-16) on the one hand and tableau (17) on the other is the fact that in (14-16) the optimal candidate does not violate AGREE, while in (17) both the optimized and the failing optimal candidates violate AGREE. The difference being the number of violation marks.

Although (17a) violates AGREE twice, it still preserves the voice specification of the input, while (17b) violates AGREE and at the same time violates a constraint that would demand preservation of the voice specifications of the input. To rule out (17b), it is necessary to introduce a constraint that would be violated if both AGREE and IDENT (voice) are violated. Ranking such a constraint higher than AGREE would rule out a candidate like (17b) but not (17a). This is the ideal scenario for the locally conjoined constraint introduced in (18).

(18) [AGREE & IDENT (VOICE)] stem-stem

This constraint is violated iff both conjuncts are violated in a cluster across a word boundary.

In effect, IDENT (VOICE) may be violated only if its violation would guarantee satisfaction of AGREE. This locally conjoined constraint (LCC) is ranked higher than AGREE by definition and AGREE is ranked higher than IDENT (VOICE) to guarantee the correct output for the data (8-11). Tableaux (19-22) exemplify for (8a), (9a), (10a), and (11a) respectively:

(19) Candidates do not incur a violation of the LCC

/faat dukkaane/	[AGREE & IDENT (VOICE)]	AGREE	IDENT (VOICE)
a. faat dukkaneh		*!	
b.☞ faad dukkaneh			*

Both candidates do not incur a violation of the LCC since each candidate only violates one member of the LCC. Candidate (19b) violates IDENT (VOICE) but it is still optimal since it satisfies the higher ranked AGREE while (19a) violates it.

(20) Violating IDENT (VOICE) but satisfying AGREE

/sʔuraax ɣaamir/	[AGREE & IDENT (VOICE)]	AGREE	IDENT (VOICE)
a. sʔuraax ɣaamir		*!	
b.☞ sʔuraaɣ ɣaamir			*

Candidate (20b) is optimal for the same reasoning provided for (19b) above.

(21) Violating AGREE but satisfying IDENT (VOICE)

/miliħ ʔaadi/	[AGREE & IDENT (VOICE)]	AGREE	IDENT (VOICE)
a. miliħ ʔaadi		*!	
b.☞ miliʔ ʔaadi			*

Candidate (21b) is optimal for the same reasoning above.

(22) LCC blocks voice assimilation

/walad saʔiid/	[AGREE & IDENT (VOICE)]	AGREE	IDENT (VOICE)
a. ☞ walad saʔiid		**	
b. walat saʔiid	*!	*	*

The LCC blocks voice assimilation since the adjacent consonants differ in voice and continuance guaranteeing (22a) as the optimal candidate despite two violations of AGREE compared to a single violation of the constraint by (22b).

6. Emphasis Assimilation and Local Conjunction

There are three emphatic consonants in IUA as shown in table (1). All three are coronals. Data in (23) and (24) shows that there is a tendency in the language to preserve emphatic segments (23) while plain consonants surface identical to a following emphatic when the two sounds in the cluster differ only in terms of the feature emphatic (24a) discussed in section (6.1) or when they also differ in their voice specifications (24b) discussed in section (6.2).

(23) Emphatic + Plain clusters: assimilation is blocked

1. /ʔartˁ dawli/	[ʔartˁ dawli]	'an international limit'
2. /gamiisˁ zahri/	[gamiisˁ zahri]	'a pink shirt'
3. /mariiðˁ θaani/	[mariiðˁ θaani]	'a second patient'

(24) Plain + Emphatic clusters: total assimilation.

a.		
1. /banaat tˁaahraat/	[banaatˁ tˁaahraat]	'pure girls'
2. /fulaað ðˁaʔiif/	[fulaaðˁ ðˁaʕiif]	'weak steel'
3. /ħamaas sˁariiħ/	[ħamaasˁ sˁariiħ]	'clear enthusiasm'
b.		
1. /bariid tˁibbi/	[bariitˁ tˁibbi]	'medical mail'
2. /muθallaθ ðˁaahir/	[muθallaðˁ ðˁaahir]	'a clear triangle'
3. /fuuz sˁariiħ/	[fuusˁ sˁariiħ]	'a clear victory'

Data in (23) is readily accounted for by a constraint in the language that demands preservation of tongue root retraction (RTR) (25).

(25) IDENT(RTR): The feature RTR of an input segment is preserved in the output

It might be important here to note that this rule preserves the feature (emphatic) but not the general specification of emphasis. This in effect allows a plain consonant to acquire tongue root retraction from a neighboring sound but not vice versa. Accordingly, the demands of a constraint like IDENT(RTR) are different from the demands of a constraint like IDENT (emphasis). The first preserves the feature itself while the latter requires a segment to preserve the specification of emphasis be it (+ RTR) or (-RTR).

In IUA, IDENT(RTR) is the active constraint that accounts for the data in (23) since it is ranked higher than AGREE and IDENT-IO as shown in the hierarchy in (13) repeated in (26) for convenience.

(26) Hierarchy for assimilation in IUA
ID{KP}, ID-ON, ID–OBS{KPT}, ID(SON), ID-OBS(NON-CONT.), ID-CONT.(PL), ID (CONT.), ID (RTR) >> AGREE >> ID-IO

6.1 *Plain + Emphatic Clusters I:*

In (24a), a plain consonant at the end of a word is followed by an identical consonant except for the specifications for emphasis. The cluster surfaces identical with regressive spread of RTR. No constraint ranked higher than AGREE can hinder its satisfaction. Accordingly the cluster surfaces identical. The constraint hierarchy in (26) shows that all the constraints ranked higher than AGREE are equally satisfied by the three plain consonants /t/, /ð/, and /s/ and their emphatic counterparts /tˁ/, /ðˁ/, and /sˁ/. This leaves the choice of the most harmonic candidates to AGREE which produces the correct candidate with total assimilation as shown in (27) for (24a1).

(27)

/banaat tˁaahraat/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL.)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. banaat tˁaahraat									*!	
b.☞banaatˁ tˁaahraat										*

The question now is where exactly we need local conjunction in accounting for emphasis assimilation in the language. The need for local conjunction becomes evident when accounting for clusters of a plain consonant followed by an emphatic where the two consonants are not otherwise identical. To put it differently, data in (28) provides selected examples of such clusters:

(28) Plain + Emphatic clusters: no assimilation.

a. /banaat ðˁaˁiifaat/ [banaaṭ ðˁaˁiifaat] 'weak girls'
b. /xilaaf tˁibbi/ [xilaaf tˁibbi] 'medical disagreement'
c. /salaam ðˁaˁiif/ [salaam ðˁaˁiif] 'fragile peace'

In (28a), a potential candidate like [banaaðˁ ðˁaˁiifaat] although in perfect harmony with the requirements of AGREE, is nevertheless ruled out by a higher ranked IDENT-OBS (NON-CONT.) which requires obstruents to retain the feature non-continuant. In (28a), the alveolar obstruent /t/ cannot acquire the feature continuant associated with the following /ðˤ/ and thus a potential candidate like [banaaðˁ ðˁaˁiifaat] is ruled out. However, there are no constraints in the

hierarchy in (26) that would prevent /t/ from acquiring the feature emphatic from the following sound and thus become more harmonic as to the dictates of AGREE as shown in (29):

(29) Hierarchy fails as a result of double violation of AGREE

/banaat ðˁaˁiifaat/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a.☹ banaaṭ̪ ðˁaˁiifaat									**!	
b.☞banaaṭ̪ˁðˁaˁiifaat									*	*
c. banaaðˁ ðˁaˁiifaat					*!					**

The hierarchy fails to optimize the actual output (29a) because of a double violation of AGREE. The cluster disagrees in the specifications of continuance and emphasis. Candidate (29b) better satisfies and incurs a single violation for disagreement in continuance. Candidate (29c) is ruled out for a fatal violation of a higher ranked constraint.

What is required here is a constraint that demands segments to retain their specification for emphasis except when AGREE would otherwise be satisfied. In other words, a segment will acquire emphasis from a following emphatic only if this would result in two sounds becoming identical. This is achieved through the local conjunction of AGREE and IDENT (emphasis). This locally conjoined constraint is introduced in (30):

(30) [AGREE & IDENT (emphasis)] stem-stem
This constraint is violated iff both conjuncts are violated in a cluster across a word boundary.

This locally conjoined constraint (LCC) is ranked higher than AGREE by definition and AGREE is ranked higher than IDENT (emphasis) to guarantee the correct outputs as tableaux (31) and (32) exemplify for (24a1) and (28a) respectively:

(31) Satisfying LCC

/banaat tˁaahraat/	[AGREE & IDENT(emphasis)]	AGREE	IDENT(emphasis)
a. banaat tˁaahraat		*!	
b.☞ banaatˁ tˁaahraat			*

Neither candidate violates the LCC since each satisfies one member of the LCC. Although candidate (31b) violates IDENT (emphasis), it is optimal since it does not violate the higher ranked AGREE.

(32) Violating both conjuncts

/banaat ðˁaˁiifaat/	[AGREE & IDENT(emphasis)]	AGREE	IDENT(emphasis)
a.☞banaat ðˁaˁiifaat		**	
b. banaatˁ ðˁaˁiifaat	*!	*	*

Candidate (32a) is optimal since it satisfies the higher ranked LCC. Although the two adjacent consonants do not agree, they still preserve their specification for emphasis. Candidate (32b) on the other hand violates the LCC since it violates both conjuncts.

This example solidifies our 'worst of the worst' (**WOW**) conception of local conjunction (Smolensky 1993, Moreton and Smolensky 2002) where a candidate satisfies a conjunction if it satisfies any of the conjuncts. On the other hand, a 'best of the best' (**BOB**) analysis, where a candidate satisfies a conjunction iff it passes every conjunct (Crowhurst and Hewitt 1997) will not account for the data above since according to a (**BOB)** analysis of (32), both candidates violate the LCC leaving optimization of a candidate to AGREE which would favor the sub-optimal (32b) as shown in (32) above.

6.2 *Plain + Emphatic Clusters II:*

In (24b) repeated in (33) for convenience, a plain consonant at the end of a word is followed by an emphatic consonant at the beginning of a following word. The two consonants have different voice values but nevertheless surface identical.

(33) Plain + Emphatic clusters with different voice values: total assimilation.

a. /bariid tˁibbi/	[bariitˁ tˁibbi]	'medical mail'
b. /muθallaθ ðˁaahir/	[muθallaðˁ ðˁaahir]	'a clear triangle'
c. /fooz sˁariiħ/	[foosˁ sˁariih]	'a clear victory'

The facts presented in the data are readily accounted for by the constraints introduced so far. The local conjunction of AGREE with IDENT (VOICE) in (18) and with IDENT (emphasis) in (30) together account for the data in (33) as shown in (34) for (33a). Both [AGREE & IDENT (VOICE)] and [AGREE & IDENT (emphasis)] are ranked higher than their members by definition and no crucial domination holds between the two constraints themselves. Selecting the optimal candidate is a function of AGREE and thus no crucial dominance holds between IDENT (VOICE) and IDENT (emphasis).

(34) Assimilation of voice and emphasis

/bariid tˁibbi/	[AGREE & IDENT (emphasis)]	[AGREE & IDENT (VOICE)]	AGREE
a.☞bariitˁ tˁibbi			
b. bariid tˁibbi			*!*
c. bariidˁ tˁibbi	*!		*
d. barrit tˁibbi		*!	*

Candidates (34a) and (34b) satisfy the two conjunction constraints. Candidate (34a) however satisfies AGREE while (34b) incurs two violations of the constraint. Candidates (34c) and (34d) incur a fatal violation of [AGREE & IDENT (emphasis)] and [AGREE & IDENT (VOICE)] respectively. All other potential candidates are rules out by the demands of the higher ranked constraints in (26). Assimilation is blocked if the two adjacent consonants differ in any other features as was shown in (28) earlier.

7. Continuance Assimilation and Local Conjunction

In IUA, /n/ and /l/ assimilate to a following /r/ as shown in (35a, b) but not vice versa (35c, d) and they do not assimilate to any other continuant (36).

(35) Assimilation of /n/ and /l/ to a following /r/ but not vice versa:

a. /fannaan raaʔiʔ/	[fannaar raaʔiʔ]	'a great actor'
b. /suʔaal raaʔiʔ/	[suʔaar raaʔiʔ]	'a great question'
c. / ħiwaar naafiʔ/	[ħiwaar naafiʔ]	'a useful dialogue'
d. /ʔaar laʔiim/	[ʔaar laʔiim]	'a mean neighbor'

(36) /n/ and /l/ do not assimilate to obstruent continuants:

a. /fannaan ɣani/	[fannaan ɣani]	'a rich artist'
b. /fannaan suuri/	[fannaan suuri]	'a Syrian artist'
c. /suʔaal ðaki/	[suʔaal ðaki]	'a clever question'
d. / suʔaal ɣabi/	[suʔaal ɣabi]	'a stupid question'

Data in (35) is readily accounted for by the constraint hierarchy in (26). No high ranked constraint would hinder total assimilation in satisfaction of AGREE in (35a, b) as shown in (37) for (35a). On the other hand, assimilation is blocked in (35c, d) due to the demands of a higher ranked constraint that requires segments to preserve the feature 'continuant', i.e., IDENT(CONT) and a constraint that requires sonorants to surface without a decrease in sonorancy, i.e., IDENT(SON) as shown in (38) for (35c).

(37)

/fannaan raa?i?/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. fannaan raa?i?									*!*	
b. ☞ fannaar raa?i?										*

Candidate (37a) violates AGREE while (37b) satisfies it. Both candidates satisfy all other higher ranked constraints and thus (37b) surfaces as the optimal candidate.

(38)

/ħiwaar naafi?/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO
a. ħiwaan naafi?				*!			*			*
b. ☞ ħiwaar naafi?									*	

Although (38a) satisfies AGREE, it is sub-optimal compared to (38b) which violates AGREE but satisfies all other higher ranked constraints. Although a potential candidate like /ħiwaam naafiʕ/ satisfies all higher ranked constraints and fails as well as (38b) as to the demands of AGREE, it is still sub-optimal due to the demands of lower ranked IDENT-IO which is satisfied by (38b).

In (36), although total assimilation is blocked due to the demands of IDENT (SON), no constraint in (26) would prevent /n/ and /l/ in from acquiring the feature continuant from the following sound and surface as /r/ as shown in (39) for (36a).

(39) Fatal violation of IDENT (SON)

/fannaan ɣani/	ID{KP}	ID -ONS	ID–OBS {KPT}	ID (SON)	ID-OBS (NON-CONT.)	ID-CONT.(PL)	ID (CONT.)	ID (RTR)	AGREE	ID-IO

a. ☹ fannaan ɣani									**!*	
b. ☞ fannaar ɣani									*	*
c. fannaaɣ ɣani				*!						

Based on the constraint hierarchy in (26), candidate (39b) is optimal. In (39a), the adjacent consonants disagree in nasality, continuance, and place of articulation while in (39b) the two consonants agree in nasality and continuance. Candidate (39c) is ruled out for a fatal violation of a higher ranked IDENT (SON).

The local conjunction of AGREE with IDENT(CONT) will allow non-continuants to lose this feature only when that would lead to total assimilation as defined in (40) and exemplified in (41) for (36a).

(40) [AGREE & IDENT(CONT)] stem-stem

This constraint is violated iff both conjuncts are violated in a cluster across a word boundary.

(41) Output segments are identical to their correspondents in the input:

/fannaan ɣani/	[AGREE & IDENT(CONT)]	AGREE	IDENT(CONT)
a.☞ fannaan ɣani		***	
b. fannaar ɣani	*!	*	*

Candidate (41b) violates the LCC because it violates both conjuncts. In other words, assimilation in continuance did not lead to total assimilation. Another potential candidate is / fannaal ɣani/ which satisfies the LCC and incurs as many violations of AGREE as does the optimal candidate. Selection of the optimal candidate in this case is left to a lower ranked constraint which demands output segments to be identical to their correspondents in the input as shown in (42).

(42)

/fannaan ɣani/	[AGREE & IDENT(CONT)]	AGREE	IDENT(cont)	IDENT-IO
a.☞ fannaan ɣani		***		
b. fannaar ɣani	*!	*	*	*
c. fannaal ɣani		***		*!

Since both /n/ and /l/ are sonorants, total assimilation to a following obstruent is blocked by the demands of a higher ranked IDENT (SON). These two sounds may, however, be followed by a sonorant continuant like the glides /w/ or /j/. Assimilation is still blocked as shown in (43).

(43) /n/ and /l/ do not assimilate to sonorant continuants

a. /fannaan waħad/ [fannaan waħad] ‘one artist’

b. /fannaan jamani/ [fannaan jamani] ‘aYemeni artist’
c. /su?aal waħad / [su?aal waħad] ‘one question’
d. /su?aal jasiir / [su?aal jasiir] ‘an easy question’

None of the higher ranked constraints in (26) prevents /n/ and /l/ from totally assimilating to a following glide. The LCC introduced in (41) cannot prevent assimilation either as shown in (44) for (43a).

(44) Multiple violations of AGREE

/fannaan waħad/	[AGREE& IDENT(CONT)]	AGREE	IDENT(CONT)	IDENT-IO
a.☹ fannaan waħad		*!**		
b.☞fannaaw waħad			*	*

Both candidates satisfy the LCC since none violates both conjuncts. The sub-optimal candidate (44a) fails due to multiple violations of AGREE.

8. Conclusions

Extending the linguistic phenomena which can be accounted for by the notion of local conjunction provides empirical viability to the notion itself. In this paper, local conjunction of faithfulness and a markedness constraint was found to be important and sufficient for an adequate evaluation and account of voice, emphasis, and continuance assimilation in IUA. The arguments presented show that these three features undergo assimilation to a following sound only when this would lead to total assimilation. Voice assimilation in Arabic takes place only when adjacent segments agree in all other feature specifications.

The ranking of a constraint that requires adjacent segments to agree in all features relative to other constraints that demand faithfulness to the feature ‘voice’ (when the adjacent segments differ in any other feature or features) is contradictory. The local conjunction of [AGREE & IDENT (VOICE)] guarantees that the requirement to retain the voice value of a segment may be violated only if this violation would lead to total assimilation between the two adjacent segments. This locally conjoined constraint (LCC) is ranked higher than AGREE by definition and AGREE is ranked higher than IDENT (VOICE) to guarantee the correct optimization of the correct candidate. The same is true when it comes to the feature [RTR] where the local conjunction of [AGREE & IDENT (RTR)] guarantees that the requirement to retain the RTR value of a segment may be violated only if this violation would lead to total assimilation between the two adjacent segments. In the language as well, coronal sonorants /n/ and /l/ undergo total assimilation to a following /r/ but not to any other continuant. The local conjunction of [AGREE & IDENT(CONT)] is responsible for the optimization of the correct candidate. In brief, the ultimate aim of this paper has been to propose local conjunction as an appropriate tool for handling voice, emphasis, and continuance assimilation in stem-stem clusters in Arabic.

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