

## Regressive Assimilation of the "t" in Saudi Northern Region Dialect of Arabic (SNRDA): An OT Account

Dr. Khalaf M. J. AlShammiry<sup>1</sup>

### Abstract

Using Prince and Smolensky (1993) optimality theory, the focus of this paper is to provide an OT account for the total regressive assimilation process of the consonant "t" to the following coronal consonant manifested in Saudi Northern Region Dialect of Arabic (SNRDA). Contra Bakovic's (2005), interestingly, total assimilation takes place between two adjacent consonants and geminates are created; according to Bakovic epenthesis should apply to prevent formation of geminates. This assimilation process is also interesting when we know that other dialects of Arabic, Syrian, Libyan, Cairene, and San'ani, among other dialects, resort to voicing assimilation to avoid the formation of geminates. To account for this process, I will use the constraints: *Agree (feature)* (Beckman (1998) and Lombardi (1999) and *No Gem* Bakovic (2005), Hall (2003 and 2006) and Rose (2000)) among other interacting marked-ness and faithfulness constraints..

**Keywords:** Regressive voicing assimilation, prefix "t-", coronal sound "t", Agree (feature), NoGem constraint

### 1. Introduction

Assimilation is a process in which a sound has become more similar or identical to the neighboring or adjacent influencing sound; for example, in English the sound "t" in the word fat is pronounced as "p" when the sound is followed by a word starting with the sound "p" like the word pig, /fæpplɪg/; whereas the sound "n" in the word "in" is pronounced as "m" when the word is followed by a word starting with the sound "p" like the word place, /ɪmplɪes/; in the first example, assimilation is total whereas in the second example, it is partial. Moreover, assimilation can be regressive and it can be progressive; in the former, the following sound influences the preceding sound whereas in later, it is the preceding sound is the influencing sound. In both English examples given above, we have regressive assimilation. However, in the word pigs, the preceding voiced sound "g" influences the following voiceless sound "s"; that is why the sound "s" changes to "z"; thus, this type of assimilation is referred to as progressive assimilation,(Gimson, 1970) and (Roach, 2002)).

Using Prince and Smolensky (1993) optimality theory, this paper aims to provide an optimality theoretical (OT) account of a regressive assimilation process manifested in Saudi Northern Region Dialect of Arabic (henceforth SNBDA); in this dialect, the coronal consonant "t" assimilates to the following coronal non-sonorous consonant. The data interesting for two reasons, first, it shows that it is not only the coronal consonant of the second person or the third person feminine (singular or plural) in the imperfective tense "t-" in Arabic assimilates to the following coronal non-sonorous consonant in voicing Elgadi (1986), Harrama (1993), Abdunnabi (2000), and Elramli (2012) but also the consonant "t" surfacing in all positions including word boundaries assimilates totally to the following coronal non-sonorous consonant in voicing, place and manner.

<sup>1</sup> Associate Professor of Linguistics, King Saud University, College of Languages and Translation (COLT), Riyadh, KSA, and Vice President for Quality, Development and Community Services at Northern Border University (NBU), Arar, KSA. PO Box 1321.

More interestingly, the data presented here is counterevidence against Bakovic's (2005) claim in which Bakovic proposes that adjacent consonants with a small subset of specific features could result in assimilation and that assimilation between the two adjacent consonants is blocked and epenthesis applies when assimilation leads to the formation of geminates. In this data, although assimilation of the adjacent consonants leads to the formation of geminates, it is not blocked. Using the constraints *Agree (feature)* Beckman (1998) and Lombardi (1999) and *No Gem* Bakovic (2005), Hall (2003, 2006), Rose (2000) among other interacting marked-ness and faithfulness constraints, in this paper, I will provide an OT account of this language specific assimilation phenomenon.

This paper is structured as follows. Section 2 discusses Bakovic's (2005) analysis of sufficiently similar adjacent consonants avoidance. In section 3, I discuss the data under investigation (total regressive assimilation of the coronal consonant "t"); where it will be shown that assimilation of adjacent consonants results in geminate creation. In section 4, I will review the literature on works done on regressive assimilation of the coronal consonant "t" in other dialects of Arabic. In section 5, I provide an OT account of the Saudi data. Conclusion will be in section 6.

### 3. Bakovic's (2005) Analysis

The crux of Bakovic's (2005) article titled "Anti-gemination, Assimilation and the Determination of Identity" is the dependence of anti-gemination on independent assimilation processes; that is to say, the assimilation process is blocked just in case the result of assimilation would be the creation of a geminate. To support his point, Bakovic gives two examples from English and Lithuanian. In English, the past tense form of the verb is one of three phonological conditioned alternations; voiceless alternate "t", a voiced alternant "d" and a schwa and voiced alternate "əd"; all depends on the sound adjacent. (the examples given below are taken from Bakovic's ((2005))

#### Past-tense suffix alternations in English:

1. a. [t]following voiceless consonants other than /t/      tapped [pt]/ ceased [pt]
- b. [d]following vowels and voiced consonants other than /d/      tabbed [d]/ seized [zd]
- c. [əd]following /t/ and /d/      seated [təd] / ceded [dəd]

in (1a) and (1b), the [t] and [d] alternations are due to the a voicing assimilation process motivated by Agree [voi], which penalizes tauto-syllabic sequences of obstruent's that disagree in [+/-voice]. In (1c), voicing assimilation process is blocked; instead, aschwa is inserted, epenthesis takes place. Using Bakovic's (2005) words, epenthesis applies to /t+d/ because the crucial alternatives to the epenthetic candidate [əd] are each ruled out by independently active constraints: NoGem, penalizing the voice-assimilated candidate \*[tt], and Agree [voi], penalizing the faithful but unassimilated candidate \*[td]. That is to say, the two constraints Agree [voi] and NoGem thus jointly ensure the optimality of the epenthetic candidate [təd], which violates the lower ranked faithfulness constraint Dep (V). in Lithuanian, The verbal prefix /at/ and /ap/ are realized as [atii] and [apii] respectively when the stem to which the prefixes prefixed to begin with a consonant that is identical to the consonant of the verbal prefix or differs from it only in terms of voicing or palatalization or both.

#### Avoidance of sufficiently identical adjacent consonants in Lithuanian

- |                    |                 |              |                     |
|--------------------|-----------------|--------------|---------------------|
| 2. a. atii-teisiti | "to adjudicate" | apii-putii   | "to grow rotten"    |
| b. atii-douti      | "to give back"  | apii-bieriti | "to strew all over" |
| c. atii-dietii     | "to delay"      | apii-biekiti | "to run around"     |

However, when the stem to which the prefixes prefixed to begin with a consonant that is not identical to the consonant of the prefix, the first of the two consonant assimilates to the second in terms of voicing and palatalization.

**Voicing/palatalization Assimilation in Lithuanian**

**Voiceless non palatalized**

3. at-ko:piti "to rise" ap-kalibietii "to slaner"

**Voiced non palatalized**

4. ad-gautii "to get back" ab-gautii "to deceive"

**Voiceless palatalized**

5. ati-pijautii "to cut off" api-tiemidii:tii "to obscure"

**Voiceless palatalized**

6. adi-biekitii "to run up" abi-gii:dii:tii "to heal"

That is to say, in Lithuanian, epenthesis takes place to avoid adjacent identical consonants or adjacent consonants unassimilated for voicing or palatalization. To get adjacent assimilated consonants for voicing or palatalization results in regressive assimilation except when the result of applying regressive assimilation would jeopardize the avoidance of adjacent identical consonants by creating adjacent identical consonants; in such a case, assimilation is blocked and vowel epenthesis is triggered instead. Again, as for English past tense alternates, the two constraints Agree [voi] and NoGem thus jointly ensure the optimality of the epenthetic candidate [atii], which violates the lower ranked faithfulness constraint Dep (V). Next, I will present the data under discussion; contra to Backovic's, interestingly, in this dialect, total assimilation takes place between two adjacent consonants and geminates are created; according to Bakovic's analysis, epenthesis should apply to prevent formation of geminates. But before doing so, I include the following two tables of the vowels and consonants inventories found in the dialect.

**Phonemes inventories**

**Table 1: Consonant inventory:**

Manner ↓	Place →	Labial	Labio dental	interdental	Dental		Post-alveolar	Palatal	Velar	Uvular	Pharyngeal	Glottal
					Plain	Emphatic						
Plosive		b			t d	ط D ظ			k <sup>2</sup> g	q <sup>3</sup>		ʔ
Fricative		f		θ ð	s z	ص Z ض	f <sup>4</sup> dʒ		x ɣ		ħ ʕ	h
(Central) approximant		w					r	j				
(Lateral) approximant					l							
Nasal		m					n					

**Table 2: Vowel Inventory**

	Front		Central		Back			
	Tense	ax	Tense	ax	Rounded		Unrounded	
					Tense	ax	Tense	ax
High	ii	i			uu	u		
Mid								
Low			aa	a				

<sup>2</sup> The consonant "k" in certain phonological environments is fronted and affricated as "ts".

<sup>3</sup> The consonant "q" is phonetically released as the voiced velar stop variant [g], however, in certain phonological environments the "q" is fronted and affricated as voiced alveolar affricated variant [dʒ].

<sup>4</sup> The consonant "f" in certain phonological environments is fronted and affricated as "ts".

Now, let us turn to the data under investigation. In SNRDA, the consonant "t" in all positions including word boundaries totally assimilates to the following coronal non-sonorous sounds in voicing, place and manner. See the following tables.

**Table 3: Assimilation of the "t" in the Pro-clitic Imperfective Tense to Coronal Non-sonorous Sounds**

The sound	Input	Output	The meaning
t	?it- tarrix	?it- tarrix	To record
θ	?it- θaaḥir	?iθ- θaaḥir	To talk much
dʒ	?it- dʒariḥ	?idʒ- dʒariḥ	To hurt
d	?it- daafiṣ	?id- daafiṣ	To defend
ð	?it- ðawwib	?ið- ðawwib	To melt
z	?it- zuur	?iz- zuur	To visit
s	?it- sallim	?is- sallim	To salute
ʃ	?it- ʃammis	?iʃ- ʃammis	To sunshine
S	?it- SaTir	?iS- SaTir	To slap
Z	?it- ZarriT	?iZ- ZarriT	To defecate
T	?it- Taalib	?iT- Taalib	To complain
D	?it- Daahir	?iD- Daahir	To demonstrate

We could see from table (3) that there is total regressive assimilation of the "t" to the following coronal non-sonorant consonants; it is clear, contra to Bakovic (2005), that total assimilation takes place between two adjacent consonants and geminates are created although according to Bakovic's epenthesis should apply. However, this total assimilation is not attested when the consonant "t" is followed by sonorant and non-coronal consonants.

**Table 4: No Assimilation of the "t" in the Pro-clitic Imperfective Tense to Sonorant and Non-coronal Sounds.**

The sound	Input	Output	The meaning
?	?it- ?amil	?it- ?amil	To hope
b	?it- ballil	?it- ballil	To wet
ħ	?it- ħamil	?it- ħamil	To carry
x	?it- xarrim	?it- xarrim	To punch
r	?it- raDiṣ	?it- raDiṣ	To nurse
ʕ	?it- ʕammir	?it- ʕammir	To build
χ	?it- χaazil	?it- χaazil	To wink
f	?it- fassir	?it- fassir	To explain
q	?it- qaatil	?it- qaatil	To fight
k	?it- kallim	?it- kallim	To speak
l	?it- laʕin	?it- laʕin	To curse
m	?it- mahiṭ	?it- mahiṭ	To whip
n	?it- nammi	?it- nammi	To raise
h	?it- hannī	?it- hannī	To congratulate
w	?it- walwil	?it- walwil	To yell
j	?it- jassir	?it- jassir	To ease

We could see from table (4) that regressive assimilation of the "t" to the following sonorant and non-coronal consonants does not take place.

In the same dialect, the coronal consonant "t" also totally assimilates to the following coronal non-sonorant sounds in other pro-clitics, the "t" in the pro-clitic used in passivizing verbs and the "t" in the pro-clitic "mit" used in deriving past participial adjectives. However, regressive assimilation is not attested when the coronal "t" in both pro-clitics is followed by sonorant and non-coronal sounds. See tables (5), (6), (7) and (8) below.

**Table 5: Assimilation of the "t-" in the Pro-clitic Used in Passivizing Verbs to Coronal Non-sonorous Sounds.**

The sound	Input	Output	The meaning
t	?it- taaxaθ	?it- taaxaθ	was taken
θ	?it- θalladɟ	?iθ- θalladɟ	was frozen
ɟ	?it- ɟallax	?iɟ- ɟallax	was scratched
d	?it- dibaxɣ	?id- dibaxɣ	was hit
ð	?it- ðawwab	?ið- ðawwab	was melt
z	?it- zinaq	?iz- zinaq	was surrounded with
s	?it- sadd	?is- sadd	was stopped
ʃ	?it- ʃam	?iʃ- ʃam	was smelled
S	?it- Sab	?iS- Sab	was poured
Z	?it- Zab	?iZ- Zab	was hidden
T	?it- Tallaq	?iT- Tallaq	was divorced
D	?it- Dahhar	?iD- Dahhar	was demonstrated

**Table 6: No Assimilation of the "t-" in the Pro-clitic Used in Passivizing Verbs to Sonorant and Non-coronal Sounds.**

The sound	Input	Output	The meaning
?	?it- ?assis	?it- ?assis	was established
b	?it- ballal	?it- ballal	was wet with water
h	?it- haffaz	?it- haffaz	was given incentives
x	?it- xarram	?it- xarram	was punched
r	?it- raDaʃ	?it- raDaʃ	was nursed
ʕ	?it- ʕammar	?it- ʕammar	was built
χ	?it- χaffaS	?it- χaffaS	was crashed
f	?it- fassar	?it- fassar	was explained
q	?it- qattal	?it- qattal	was killed
k	?it- kammam	?it- kammam	was masked
l	?it- laʃan	?it- laʃan	was cursed
m	?it- maħaT	?it- maħaT	was whipped
n	?it- namma	?it- namma	was raised
h	?it- hanna	?it- hanna	was congratulated
w	?it- wallaʃ	?it- wallaʃ	was lighted
j	?it- jassar	?it- jassar	was made easy

**Table 7: Assimilation of the "t-" in the Pro-clitic "mit" Used in Deriving Past Participial Adjectives to Coronal Non-sonorous Sounds.**

The sound	Input	Output	The meaning
t	mit- tarrix	mit- tarrix	is recorded
θ	mit- θawwir	miθ- θawwir	is fired
ɟ	mit- ɟarriħ	miɟ- ɟarriħ	is wounded
d	mit- darriʃ	mid- darriʃ	is shielded
ð	mit- ðammin	mið- ðammin	is priced
z	mit- zahhil	miz- zahhil	is gotten ready
s	mit- sabbik	mis- sabbik	is fixed
ʃ	mit- ʃammis	miʃ- ʃammis	is sun shined
S	mit- SaTar	miS- SaTar	is slapped
Z	mit- Zabbir	miZ- Zabbir	is piled up
T	mit- Tawwi	miT- Tawwi	is twisted
D	mit- Dahhir	miD- Dahhir	is demonstrated

**Table 8: No Assimilation of the “t-” in the Pro-clitic “mit” Used in Deriving Past Participial Adjectives to Sonorant and Non-coronal Sounds.**

The sound	Input	Output	The meaning
ʔ	mit- ʔamil	mit- ʔamil	is hoped
b	mit- ballil	mit- ballil	is wet
ħ	mit- ħamil	mit- ħamil	is tolerated
x	mit- xarrim	mit- xarrim	is punched
r	mit- raDiʕ	mit- raDiʕ	is nursed
ʕ	mit- ʕammir	mit- ʕammir	is built
χ	mit- χayyir	mit- χayyir	is changed
f	mit- fasir	mit- fasir	is uncovered
q	mit- qaatil	mit- qaatil	is fought
k	mit- kammil	mit- kammil	is finished
l	mit- laʕan	mit- laʕan	is cursed
m	mit- maħiʔ	mit- maħiʔ	is whipped
n	mit- nammi	mit- nammi	is raised
h	mit- handdim	mit- handdim	is tidied up
w	mit- wayyil	mit- wayyil	Yelled
j	mit- jassir	mit- jassir	is available

Moreover, total assimilation of the “t” to the following coronal non-sonorant sounds also applies acrossword boundaries. See the following table.

**Table 9: Assimilation of the Coronal Sound “t” to Coronal Non-sonorous Sounds across Word Boundaries**

The sound	Input	Output	The meaning
t	lait- taxaraɗʒ	lait- taxaraɗʒ	I hope you graduate.
θ	ʃarait- θyaab	ʃaraiθ-θyaab	I bought clothes.
ɗʒ	ʃift- ɗʒaditi	ʃiftɗʒ- ɗʒaditi	I saw my grandma.
d	mut- duunaha	mud- duunaha	Die because of it.
ð	baχait- ðminih	baχaið- ðminih	I want its price.
z	riħt- zahran	riħz- zahran	I went to Zahran.
s	bait- sabbaak	bais- sabbaak	A plumber’s house
ʃ	bait- ʃams	baiʃ- ʃams	A sun house
S	faat- SaTar	faaS- SaTar	He entered slapping.
Z	walʕaadiat- Zabha	walʕaadiaZabha	By the steeds that run.
T	maat- Taahir	maaT- Taahir	Taahir died.
D	kaanat- Dalimah	kaanaD- Dalimah	It was unjust.

We could see from table (9) that total regressive assimilation of the “t” applies across word boundaries.

However, total regressive assimilation of the “t” is not attested word internally. See the two examples in table 10 below.

**Table 10: No Assimilation of the “t-”Word-Internally.**

The sound	Input	Output	The meaning
ʃ	fatʃuu	fatʃuu	Do search.
ɗʒ	matɗʒar	matɗʒar	Shop.

We could see from table (10) that the coronal sound “t” does not assimilate to the following non-sonorant coronal sounds word internally.

From the tables, one can conclude that the coronal sound "t" always fully assimilates to the following coronal non-sonorous sounds in all positions except word-internally. Before providing an OT account of the data here, next, I review the literature on the regressive "t" assimilation in other dialects of Arabic.

#### 4. Assimilation of the Coronal Non-sonorous Sound "t" in Other Dialects of Arabic

The imperfective prefix "t-" has been investigated by a number of ancient Arab grammarians; the two well know Arabic linguists, Sibawayh (1975) and Ibn Jinni (1954), state that when this imperfective prefix is attached to a consonant-initial verb a vowel is inserted; this is because in classical Arabic the complex onset is not tolerated.

**Table 11: The Imperfective Prefix "t" and Vowel Insertion**

Input	Output	The meaning
t-drus-u	tadrusu	"You (mas. sing.) learn."
t-darris-u	tudarrisu	"You (mas. sing.) teach."
t-drus-e	enatadruseena	"You (fem.sing.) learn."
t-darris-e	enatudarriseena	"You (fem.sing.) teach."
t-drus-a	anitadrusaani	"You (two persons) learn"
t-darris-a	anitudarrisaani	"You (two persons) teach"
t-drus-u	unatadrusuuna	"You (mas.pl.) learn"
t-darris-u	unatudarrisuuna	"You (mas.pl.) teach"
t-drus-n	atadrusna	"You (fem.pl.) learn"
t-darris-n	atudarrisna	"You (fem.pl.) teach"
t-drus-u	tadrusu	"She teaches."
t-darris-u	tudarrisu	"She teaches."

We could see from table (11) that in the vowel "a" or "u" is epenthesized between the imperfective prefix "t-" and the first consonant in the following verb. The vowel "a" or the vowel "u" is used depending on the verb used.

Anees (1975) shows that the consonant "t" in Arabic verbs changes into one of the velarized consonants /S, Z, T, and D/ depending on the neighboring influencing sound; (See al-Saygh (1998) for the same phonological change).

Barry and Teifour (1999) and Teifour (1997) studying obstruent clusters voicing assimilation in informal Syrian Arabic give the following example for regressive voicing assimilation of the "t" to the following sound; (see also Cowell (2005) who argued for the same regressive assimilation in Syrian Arabic):

7. /ʃare:tda:r/ → [ʃare:dda:r] (Barry and Teifour, 1999)

7. shows that regressive voicing assimilation takes place across word boundaries in Syrian Arabic.

Watson (2002) investigating Cairene and San'ani dialects of Arabic states that "plain coronal stop assimilates the feature of a following marked coronal obstruent" a process that is attested in both dialects of Arabic; for example, in Cairene, an underlying voiceless obstruent assimilates voice from a following voiced obstruent with the phonological words. ....voicing assimilation may also occur across phonological words. However, assimilation does not take place before sonorants.

8. a. yitsabbanyissabban "he soaps h.s." (Watson, 2002)  
 b. k+d > gd /yikdib/ yigdib "he lies."  
 c. s+z > χz /maxzan/ maxzan "store"

We could see from (8a,b and c) that there is regressive voicing assimilation of the voiceless obstruent sounds including the sound "t" to the following voiced sounds. (I will not say anything about this regressive voicing assimilation of other voiceless sounds since it is not attested in the dialect under investigation).

Elramli (2012) studying the prefix "t-" in Misrata Libyan Arabic, shows that the prefix acquires its voicing from an initial voiced consonant of the verb stem to which it is prefixed to.

9. a. t-zuurdzuur "You/she visit(s)." (Elramli, 2012)  
 b. t-zakkidzakki "You/she give(s) sakat."  
 c. t-gaabildgaabil "You/she meet(s)."

To support his point, Elramli cites a number of works done in different dialects of Arabic where the same regressive voicing assimilation process takes place, Elgadi (1986), Harrama (1993) and Abdunnabi (2000).

Harrama (1993) investigating the al-Jabal al-Garbi dialect of Libyan Arabic, assumes that there is a process of syncopization. For him, underlyingly, there is a vowel right after the imperfective prefix "ti-"; when this vowel is syncopated, the voicing assimilation between the prefix and the first consonant takes place.

10. a. ti-diff t-diff ddiff "You (m.s.) push." (Elramli 2012 p. 39)  
 b. ti-ziid t-ziiddziid "She adds."

in (10a and b), we could see that the vowel is present in the underlying representation; and when it is syncopated, voicing assimilation between the prefix "t" and the following sound takes place. However, when the prefix is followed by a verb with a consonant cluster, the vowel is not deleted just to prevent CCC clusters.

11. a. ti-dristidris "You study."  
 b. ti-gdirtigdir "You are capable of."

We could see that in (11a and b) the vowel "i" is not syncopated.

The same process is attested in Jabal "mountain" Libyan Arabic, Abdunnabi (2000); in this dialect, the prefix "t-" assimilates to the first consonant of the following verb; the same process is also attested in Tripolitanian Arabic, Elgadi (1986) and in Moroccan Arabic, Almakhmakh (1997).

12. a. t-guuldguul "You say."  
 b. t-ziidziid "You add." (Elramli 2012 p. 40)

In (12a and b), the prefix "t" assimilates to the following voiced sound. Both Elgadi (1986) and Abdunnabi (2000) agree that the prefix "t" does not assimilate to sonorous sounds, n, l, r, w, or j.

13. a. t-nuggtnugg "You nag."  
 b. t-laagitlaagi "You meet."  
 c. t-rattibrattib "You moisture."  
 d. t-wazzaṭwazzaṭ "You/she distribute(s)."  
 e. t-jassirtjassir "You/she make(s) something easy."

In (13a, b, c, d, and e), the "t" does not assimilate to sonorous sounds. Accounting for the t-assimilation in the above dialects and the Misrata Libyan Arabic, Elramli (2012), using Optimality framework of Prince and Smolensky (1993, 2004), proposes the following marked-ness and faithful constraints:

To account for voicing assimilation of the prefix "t-" to the following sound, Elramli uses the following two constraints.



Share (F) > IDENT-IO

Since the dialects he presents do not insert a vowel as a repair strategy to break the prefix "t-" and the following sound and to prevent voicing assimilation, he uses the following two constraints:

DEP-IO > IDENT-IO

To preserve the prefix "t-" and the following sound to which the prefix assimilates from being deleted, he uses the constraints:

MAX-IO > IDENT-IO

To prevent progressive voicing where the first consonant of the stem assimilates to the prefix "t-", he uses the constraints:

IDENT-IO (stem-initial) > IDENT-IO (prefix)

Since the prefix "t-" does not assimilate to the following sonorous sounds, he uses the constraint:

ID PRESONORANT VOICE (IDPRESON VOI)

Therefore, to yield the optimal candidate in Misrata and other dialects he discusses, Elramli comes up with the following ranking.

**IDPRESON VOI > Share (F), MAX-IO, DEP (IO), IDENT-(S-I) > IDENT (prefix)**

Recall the Saudi data under investigation; although Elramli's (2012) constraints work best to account for voicing assimilation of the imperfective tense "t-" he discusses, the constraints he uses do not work for the data investigated in this paper; for a simple reason; the Saudi data shows total assimilation of the "t" to the following consonant in voicing, place and manner, and it is not only the "t-" used in the imperfective prefix "t-" that assimilates to the following consonant; but it is actually the "t" found in all positions even in word boundaries; this total assimilation of the "t" is only not attested word-internally.

To recap, we can say that the sound "t" assimilates either partially or totally to the following sound; partially, it assimilates in voicing; whereas, totally, it assimilates in voicing, place and manner. Now, in the following section, I provide an OT account for the total regressive assimilation of the "t" in SNBDA; and see if the same ranking could be used to account for the voicing assimilation of the "t" manifested in other dialects of Arabic.

## 5. OT Constraints and the "t" assimilation

Since the adjacent obstruent in this dialect agree in voice, place, and manner, I assume, following Prince and Smolensky (1993, 2004), that we need the markedness constraint AGREE; however, I will depart from Prince and Smolensky in assuming that this markedness constraint is divided into three AGREE markedness constraints.

AGREE (voi.)

(Lombardi, (1999) and Flemming, (2008))

Adjacent Obstruent must agree in voicing.

AGREE (pl.) (Flemming (2008))

Adjacent Obstruent must agree in place.

AGREE (man.)

Adjacent Obstruent must agree in manner.

Full agreement of the two obstruent form geminates which are universally disfavored; thus, we need the constraint No Gem:

No Gem (Hall (2003) and Rose (2000))  
 Gemimates are not allowed.

In addition, the following faithful constraints are needed:  
 IDENT (voi.)

The specification for the feature voice of the input must be preserved in the output.

IDENT (pl.)  
 The specification for the feature place of the input must be preserved in the output.

IDENT (man.)  
 The specification for the feature manner of the input must be preserved in the output.

**Tableau1**

?it- 0uur	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
?i0- 0uur				*	*	*	*
?it- 0uur	*	*	*				

In tableau (1), the faithful candidate? *it-0uur* loses out to the assimilated form *?i0-0uur* because the former candidate does not satisfy the highly ranked constraints Agree (voic), Agree (pl.) and Agree (man.).

Since epenthesis is not allowed in this dialect, we need the DEP (V) constraint:  
 DEP (V)

Output segments must have input correspondents. (Kager (1999))

**Tableau 2**

?it- 0uur	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
?i0- 0uur					*	*	*	*
?iti0uur	*							

In tableau (2), the candidate *?i0-0uur* wins because it does not violate any of the highly ranked constraints DEP V, Agree (voic), Agree (pl.) and Agree (man.). The candidate *?iti0uur* loses out because it violates the constraint DEP V.

To prevent deleting any of the obstruents, we need the constraint MAX (C):  
 MAX (C)  
 Input segments must have output correspondents. (Kager (1999))

**Tableau 3**

?it- 0uur	MAX C	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
?i0- 0uur						*	*	*	*
?i- suur	*					*	*	*	

In tableau (3), the winner *ʔit-θuur* is selected over *ʔi-θuur* because the latter form does not satisfy the constraint MAX C.

Since the assimilation in this dialect is regressive in which the “*t*” assimilates to the following sound, we need a constraint to prevent the following coronal sound to assimilate to the “*t*”; the constraint needed is IDENTstem initial (voice, place, and manner):

IDENT stem initial (voice, place, manner) (see Grijzenhout’s (2000) with some modification)  
 Voicing, place, and manner specification of segments of the stem must not change.

**Tableau 4**

<i>ʔit-θuur</i>	IDENT initial stem voi.pl.man.	MAX C	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
<i>ʔiθ-θuur</i>							*	*	*	*
<i>ʔit-tuur</i>	*						*	*	*	

The candidate *ʔit-tuur* loses out to the assimilated form *ʔiθ-θuur* in tableau (4) because the former violates the highly ranked constraint IDENT stem initial voic.pl.man.

Recall that I have given some examples where the coronal non-sonorous consonant “*t*” does not assimilate to the following consonant word internally; thus, we need the constraint IDENT word-inter.: IDENT word-inter.

Voicing, place, and manner specification of segments word internally must not change.

This proposed IDENT word-inter. constraint is to insure that obstruent’s sequence inside the word not at the edges is kept intact.

**Tableau 5**

matɖʒar	IDENT word- inter.	IDENT stem initial voi.pl.man.	MAX C	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT pl.	IDEN T voi.	IDENT man.	NoGem
matɖʒar					*	*	*	*			
maɖʒɖʒar	*							*	*	*	*

In tableau (5), although the candidate *matɖʒar* does not satisfy any of three Agree constraints, it still wins; that is because it does satisfy the highly ranked constraint IDENT word-inter, a constraint which the second candidate *maɖʒɖʒar* does not satisfy.

Now, recall that I have shown that the “*t*” before the coronal sonorous sounds is persevered; in other words, no assimilation takes place; thus, we need the following constraint.

IDENT (obs-son.)  
 An obstruent sonorous sound sequence in the input must be persevered in the output.

**Tableau 6**

<i>ʔit-rafis</i>	IDENT obs.son	IDENT wor- inter.	IDENT stem initial voi.pl.man.	MAX C	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
<i>ʔit-rafis</i>						*	*	*				
<i>ʔir-rafis</i>	*								*	*	*	*

Although the candidate *ʔir-rafis* tableau (6) satisfies the three Agree constraints, it still loses out over the faithful candidate *ʔit-rafis*, that is because the former violates the highly ranked constraint IDENT obs.son. which the latter candidate satisfies.

Let us see if the same raking could take care of the “t” assimilation across the word boundaries.

**Tableau 7**

maat- 0uuri	IDENT obs.son	IDENT wor.-inter.	IDENT stem initial voi.pl.man.	MAX C	DEP V	Agree voi.	Agree pl.	Agree man.	IDENT voi.	IDENT pl.	IDENT man.	NoGem
maat- 0uuri									*	*	*	*
maati- 0uuri				*	*				*	*	*	
maa- 0uuri									*	*	*	
maat- tuuri			*						*	*	*	*

Tableau (7) shows that even across word boundaries and compared to other rival candidates only the candidate *maat-0uuri* wins; that is because it satisfies all the highly ranked constraints.

To recap, the following constraints ranking accounts for the total regressive assimilation of the “t” to the following coronal non-sonorous sounds in SNBDA:

IDENT obs.son, IDENT wor.-inter, IDENT stem initial, MAX C, DEP V > Agree voi., Agree pl., Agree man. > IDENT voi., IDENT pl, IDENT man., NoGem

The same constraints could be re-ranked to account for dialects where voicing assimilation of the obstruent “t” is attested.

Ranking for voicing of the obstruent “t”:

IDENT obs.son, IDENT wor.-inter, IDENT stem initial, MAX C, DEP V, NoGem > Agree voi. > Agree pl., Agree man., IDENT voi., IDENT pl, IDENT man.,

## 6. Conclusion

Using Prince and Smolensky (1993) optimality theory, in this paper, I have provided an optimality theoretical (OT) account for the regressive assimilation process manifested in Saudi Northern Region Dialect of Arabic (SNBDA); in this dialect, the coronal consonant “t” assimilates to the following coronal non-sonorous consonant. The data interesting for two reasons, first, it shows that it is not only the coronal consonant of the second person or the third person feminine (singular or plural) in the imperfective tense “t-” assimilates to the following coronal non-sonorous consonant in voicing, Elgadi (1986), Harrama (1993), Abdunnabi (2000), and Elramli (2012) but also the consonant “t” surfacing in all positions including word boundaries assimilates totally to the following coronal non-sonorous consonant in voicing, place and manner.

More interestingly, the data presented here is counterevidence against Bakovic’s (2005) claim in which bokovic proposes that adjacent consonants with a small subset of specific features could result in assimilation and that assimilation between the two adjacent consonants is blocked and epenthesis applies when assimilation leads to the formation of geminates. In this data, although assimilation of the adjacent consonants leads to the formation of geminates, it is not blocked. In this paper, using the constraints: *Agree (feature)* Beckman (1998) and Lombardi (1999) and *NoGem* Bakovic (2005), Hall (2003 and 2006) and Rose (2000)) among other interacting marked-ness and faithfulness constraints, I have come up with a constraints ranking that accounts for this total regressive assimilation and used the same ranking to account for the voicing assimilation of the same sound manifested in other dialects of Arabic.

## References

- Abdunnabi, A. (2000). *A Descriptive Grammar of Libyan Arabic: A structural Approach*. PhD Dissertation. University of Exeter.
- Amakhmakh, N. (1997). *Nonlinear Phonology of a Moroccan Arabic Dialect*. PhD Dissertation, University of Wisconsin-Madison.
- Anees, I. (1975). *?al-?aSwaat ?al-laqhawiyyah*. Maktabat ?al-?injju Al-Masriyyah, Egypt.
- Al-Sayiqh, A. (2007). *?al-Mustalah ?al-Sawti fi ?al-dirasaat ?al-Arabiyah*. Dar ?al-Fikr for Publishing, Beirut.
- Barry, M. and Teifour R. (1999). Temporal Patterns in Syrian Arabic Voicing Assimilation. *International Congress of Phonetic Sciences 14*: San Francisco.
- Beckman, J. (1998). *Positional Faithfulness*. PhD Dissertation, University of Massachusetts, Amherst.
- Bokovic, E. (2005). Antigemination, Assimilation, and the Determination of Identity. *Phonology* 22: 279-315.
- Cowell, M. (2005). *A Reference Grammar of Syrian Arabic (Based on the Dialect of Damascus)*. Washington: Georgetown University Press.
- Elqadi, A. (1986). *Tripolitanain Arabic Phonology and Morphology: A Generative Approach*. PhD dissertation, Georgetown University.
- Elramli, Y. (2012). Phonological Assimilation of the Reflex /t-/ in Misrata Libyan Arabic. *Newcastle Working Papers in Linguistics*: 18.
- Flemming, E. (2008). Asymmetries Between Assimilation and Epenthesis. *A paper Presented at the 82<sup>nd</sup> Annual Meeting of the Linguistic Society of America*. Chicago, January 3-6.
- Gimson, A. (1970). *An Introduction to the Pronunciation of English*. London: Edward Arnold Ltd.
- Grijzenhout, J. (2000). Voicing and Devoicing in English, German, and Dutch; Evidence for Doman-Specific Identity Constraints. *Working Papers Theorie des Lexikons* 16, Heinrich-Heine-Universität Düsseldorf.
- Hall, T. (2003). On The none-gemination of /r/ in West Germanic Twenty Years Later. *A Paper Presented at the Old World Conference in Phonology I*, Leiden.
- Hall, T. (2006). *Comparative Markedness vs. Standard Faithfulness Theory: A Typological Comparison*. Online PDF article; under <http://roa.rutgers.edu>.
- Harrama, A. (1993). *Libyan Arabic Morphology: Al-Jabal Dialect*. PhD Dissertation, University of Arizona.
- Ibn Jinni, U. (1954). *SirrSina?at?al-?arab*, MaTba?at?al-baabi?al-Halabi; Cairo.
- Kager, R. (1999). *Optimality Theory*. Cambridge University Press.
- Limbardi, Linda. (1999). Positional Faithfulness and Voicing Assimilation in Optimality Theory. *Natural Language and Linguistic Theory* 17: 297-302.
- Teifour, R. (1997). *Some Phonetic and Phonological Aspects of Connected Speech Processes in Syrian Arabic*. PhD Dissertation, University of Manchester.
- Pajak, B. (2009). Contextual Constraints on Geminate: the Case of Polish. *A Paper Presented at the 35<sup>th</sup> BLS Annual Meeting*, Berkeley.
- Prince, A. and Smolensky, P. (1993). *Optimality Theory: Constraint Interaction in Generative Grammar*. Malden, MA, and Oxford: Blackwell.
- Roach, P. (2002). *Phonetics and Phonology*. Cambridge: Cambridge University Press.
- Rose, S. (2000). Rethinking Geminate, Long-Distance Geminate and the OCP. *LJ* 31: 85-122.
- Sibawayh, A. (1975). *?amr?al-kitaab*. Daar?al-Qalam. Cairo.
- Watson, J. (2002) *The Phonology and Morphology of Arabic*. New York: Oxford University Press