The phonology of Iranian-Balochi dialects : description and analysis
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Chapter (3):

Suprasegmental and Prosodic Phonology of Iranian-Balochi Dialects

This chapter deals with the phonological units which extend over more than one sound segment in an utterance (suprasegments). First syllable structure in IBDs will be studied, since the syllable is a major element in describing phonotactic patterns in languages, and it is considered as a phonological unit which supplies a level of prosodic organization between segment and higher-level prosodic units. Then I will focus on the phonological behavior of geminate consonants in IBDs, since the term geminate refers to a long or double consonant, it can be discussed as a suprasegment unit in phonology. Furthermore, word stress patterns in IBDs will be discussed. All suprasegmental and prosodic topics which have been mentioned already will be analyzed by the analytical tools in OT.

I will proceed as follows. In section 3.1, we will become familiar with the syllable-internal structure in IBDs, including onsets, codas, nucleus, internal and final codas asymmetries, and IBDs' syllable weight system. This section will also introduce the OT approaches to analyze the observations on IBDs syllable structure such as obligatory onset, the structure of coda, syllable peak and word-initial onset clusters. In section 3.2, I will present the two types of geminate consonant in IBDs, namely final and intervocalic geminate. First the moraic representation of geminate will be given and then the OT approaches to IBDs geminate will be presented. Finally, section 3.3 will deal with the stress pattern system in IBDs, first the formal representation of stress pattern in metrical phonology will be given, and the relevant OT analysis for the position of primary stress in mono-morphemic words, compound words, and root with an affix will be discussed.

3.1 Syllabe-internal structure in Iranian-Balochi dialectes

3.1.1 Introduction

The syllable is a prosodic category that orders segments in well-formed sequences according to their sonority values, it means that the syllable has a vowel (high sonorant segment) in the nucleus position which generally is preceded or followed by lower sonority segments, normally consonants (see Zec 2007). In the prosodic hierarchy, the syllable is located above segment and bellow word, so it is larger than the segments and smaller than the word (Zec

2007:162). Besides, the syllable is a main part of phonological generalization, and is connected with both segmental and suprasegmental levels (Fery and van de Vijver 2003).

Iranian-Balochi dialects have reasonably complex syllable structures, their syllable structures include open and close syllables and onset clusters and coda clusters as well: CV, CVC, CVVC, CCVC, CVCC and CCVCC. In addition, most words are monosyllabic or disyllabic and rarely trisyllabic. This section is organized as follows: in section 3.1.2. I describe the syllabic constituency in IBDs which includes the consonantal position (i.e. onset and rhyme); then the vowel distribution in the nucleus of the syllable structure, the syllable contact, Final consonants and internal codas asymmetry and finally syllable weight. Section3.1.3. investigates and analyses the IBDs syllable structure in OT.

3.1.2 Syllabic constituency in IBDs

3.1.2.1 Onsets

This constituent seems obligatory in Balochi dialects, whenever the concatenation of morphemes would result in an onsetless syllable, epenthetic [ʔ][2]or [j] are inserted, as the following example demonstrates.

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[2] LOMBARDI (2002:4) assumes that the glottal stop has a pharyngeal place specification and suggests that the hiera

[ʔ] insertion in a word-medial onset position

a.i	*molla-ok*	[mollɑʔok]	‘butterfly’
a.ii	*do-om*	[doʔom]	‘second’
a.iii	*hædidʒæ-ok*	[hædidʒæʔok]	‘ladybird’
a.iv	*dʒolaː-ok*	[dʒolɑː-ʔok]	‘spider’
b.i	*seː-om*	[seː-jõm]	‘third’
b.ii	*waːdʒæ-iː*	[wɑːdʒæ-jiː]	‘a man’
b.iii	*distæ-iː*	[distæ-jiː]	‘(s)he saw’

(1) shows that when a suffix starts with a vowel and the preceding stem ends with a vowel, a consonant [ʔ] or [j] are inserted as vowel hiatus resolution (I will discuss more about this phonological process in the next chapters). These obstruent consonants provide the following syllable with an onset. Moreover, [ʔ] mainly occurs in word-initial position before a vowel, given words like [ʔõmɪ] ‘age’, [ʔækl] ‘wisdom’, [ʔæ̃mb] ‘mango’,[ʔɑːpos] ‘cow in calf’.

Simple onsets can be filled by any consonant, with notable exceptions: the [ŋ] and [ɻ] can occur at the end of the word respectively like in zeng ‘bell’, klieɽ ‘lizard’, but not at the beginning *ngez or *ɻerkæbs.

Furthermore, word-initial consonant clusters are also allowed in IBDs, consider the following examples:

(2) Word-initial consonant clusters

a.i	*tʃlimp*	[tʃ^{h}ĩmp] ‘bubble-bubble’	
a.ii	*pliːʃtok*	[p^{h}liʃt^{h}ok]	‘martin’
a.iii	*klieɻ*	[k^{h}lieɻ]	‘lizard’
a.iv	*blek*	[blek]	‘write!’
a.v	*glaːbi*	[glɑːbi]	‘pink’
b.i	*tʃraːg*	[tʃ^{h}rɑːg]	‘light’
b.ii	*braːs*	[brɑːs]	‘brother’
b.iii	*kruːtʃ*	[k^{h}ruːtʃ]	‘a kind of date’
b.iv	*gruːg*	[gruːg]	‘storm’
b.v	*trond*	[t^{h}rõnd]	‘rough’
b.vi	*drueg*	[drueg]	‘lie’
b.vii	*praːh*	[p^{h}rɑːh]	‘wide’

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rchy of ranked markedness constraints according to the place of articulation as proposed by PRINCE / SMOLENSKY (1993) should be modified to include *Phar in the rightmost position. This hierarchy is reproduced in as below.

*Lab, *Dor >> *Cor >> *Phar

With this hierarchy "/ʔ/ will be [the] optimal epenthetic consonant [and] its place markedness violation is even lower than that of the relatively unmarked /t/" (Naderi, van Oostendorp 2011:154).

c.i	*ʃwaːnæk*	[ʃwɑ̃ːnæk]	‘shepherd’
c.ii	*bwaːn*	[bwɑ̃ːn]	‘read!’
c.iii	*gwær*	[gwær]	‘chest’
c.iv	*dwaːzdæh*	[dwɑːzdæh]	‘tilve’
c.v	*dʒwaːn*	[dʒwɑ̃ːn]	‘young’
c.vi	*swaːr*	[swɑːr]	‘rider’

Based on (2), I can draw the following table (+ denotes that a combination exists, - that it does not or is very marginal).

Table (3)

C_2 C_1	l	r	w
P	+	+	–
b	+	+	–
d	–	+	+
t	–	+	+
k	+	+	–
g	–	+	+
dʒ	–	–	+
tʃ	+	–	–
s	–	–	+
ʃ	–	–	+

Table (3) demonstrates that the first segment of a cluster is always a non-retroflex obstruent and the second consonant in a cluster is either one of the liquids [l, r] or the glide [w]. You can see that all cells are not filled in the table (3). In particular, the combinations [tl, dl,] and [pw, bw] are missing. Since [tl, dl] involve a coronal obstruent followed by a coronal liquid, and [pw, bw] involve a labial obstruent followed by a labial glide. In other words, Balochi onsets satisfy the following rule:

The two segments in the onset cannot have the same place of articulation with the exception of the [tr] combination.

Balochi onset clusters fit the theory of Sonority Sequencing Generalization (SSG). “SSG states the relative sonority within complex onsets: in a biconsonantal onset cluster, the second consonant should be more sonorant than the first.” (Zec 2007:189). So within the onset, less sonorant consonants precede more sonorant consonant. In order to provide better explanations, consider the sonority scale (the early works of Sievers 1881):

(4) Sonority scale

obstruents < nasals < liquids < glides < vowels

1 2 3 4 5

If I use the number in (4) and transfer them into columns of asterisk, the syllable structure of the word *grãːn* ‘heavy, expensive’ can be represented as:

(5)

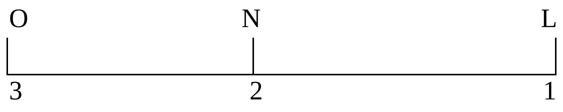
		*	
		*	
	*	*	
	*	*	*
*	*	*	*
g	r	ɑː	N
1	3	5	2

This structure shows that the segments before the nucleus (the highest element) gradually rise in sonority, whereas those following the nucleus (peak) fall.

In IBDs, [gr], [kr] are fine clusters, rising from the 1 of [g], [k] to the 3 of [r], but [gn] is not, and neither is any other cluster of obstruent and a following nasal.

The reason for this is that the dispersion between an obstruent and a nasal is not large enough, which can be explained by Minimal Sonority Distance (MSD) imposed on a pair of onset segments (Steriade 1982, Selkirk 1984a, Levins 1985, Baertsch 2002 among others). Based on the scale in (6), [g] is separated from [r] by two intervals, while only one interval separate [g] from [n]. The minimal sonority distance in the Balochi is at least two intervals. In sum, any two consonants that are at least two intervals apart can form a complex onset in Balochi.

(6) Sonority Distance



Zec (2007:189) gives the range of values for MSD, based on the scale in (6) as follows (O= obstruent, N= nasal, L= liquid):

a)	MSD0	OO, NN, LL
b)	MSD1	ON, NL

c) MSD2 OL

Sequences with flat sonority have the value MSD0, those with the steepest rise, MSD2, and the sequences with a less steep rise are given the value MSD1.

Balochi, which allows OL onset clusters, provides an example of a language with minimal sonority distance MSD2.

Thus, in Balochi both simple onsets and complex onsets are allowed. Moreover, in the onset cluster the less sonorant consonant precedes the more sonorant segment.

However, IBDs have number of word-initial clusters which violate the sonority sequencing generalization. These are words such as in (7).

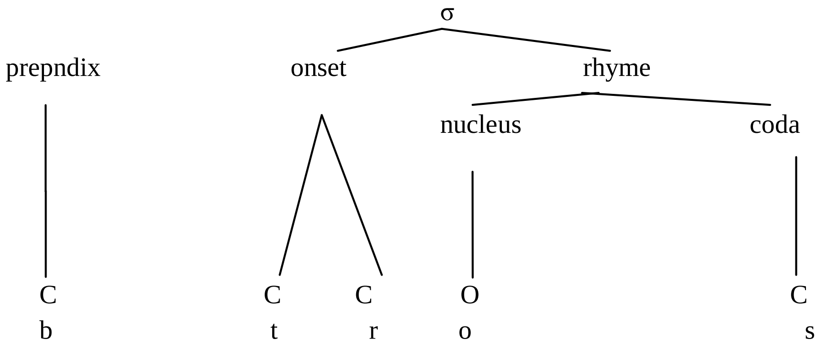
(7) word-initial consonant clusters against (SSG)

a.i.	*spiːt*	[sp^{h}iːt]	‘white’
a.ii	*spiʈʈ*	[sp^{h}iʈʈ]	‘speed’
a.iii	*spænk*	[sp^{h}æ̃nk]	‘story’
a.iv	*spæntaːn*	[sp^{h}æ̃nt^{h}ɑ̃ːn]	‘wild rue’
b.i	*pkæp*	[pk^{h}æp]	‘fall down!’
b.ii	*pkoʈʈ*	[pk^{h}oʈʈ]	‘beat!’
b.iii	*psuːtʃ*	[psuːtʃ]	‘burn!’
b.iv	*bzuːr*	[bzuːr]	‘take!’
b.v	*bguː*	[bguː]	‘say!’

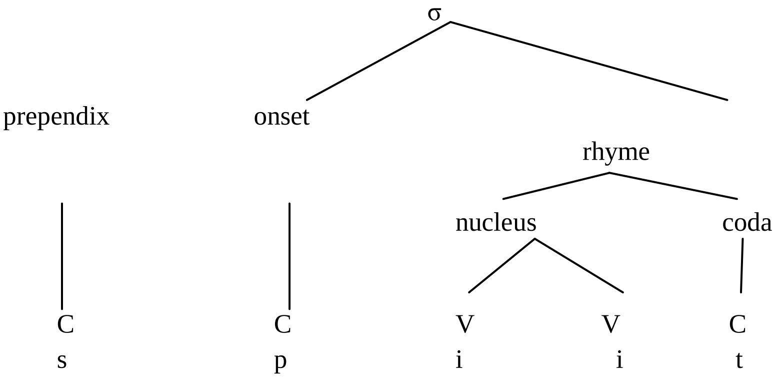
In examples 7(a.i- a.iv), coronal /s/ is followed by a plosive /t, p/. In addition in the imperative forms the prefix *b*- or *p*- adds to the present stem like in 7(b.i-b.v). Not only do these words all start with two obstruents, in spite of the demands on dispersion which Balochi data otherwise shows, but words like bgwæp ’knit!’ and ptrændʒ ‘hang!’ even start with three consonants.

One common strategy to explain such cases as in other languages such as English, Dutch and Greek is to consider the initial consonant of onset clusters (here in Balochi dialects s, p and b) not to be part of the core syllable, but to form a prependix which is considered to be outside the domain of normal syllabification process. This extra consonant has an extrasyllabicity property, i.e. not belonging to the syllable structure (Ein and van der Hulst**,** 2001:138,148). Thus words like *btros* ‘fear!’ and spiːt ‘white’ might have the following structures:

(8) I. *btros* [btʰros] ‘fear!’



II. spiːt [spiːt] ‘white’



Although medial sC can occur, *s* is in the coda and *c* in the onset of the second syllable and hence not a violation of the sonority hierarchy within one onset, as shown in (9).

(9) Medial sC in IBDs

a.i	*daːstaːn*	[dɑːs]$_\sigma$ [tʰɑ̃ːn]$_\sigma$	‘story’
a.ii	*bæstæ*	[bæs]$_\sigma$ [tʰæ]$_\sigma$	‘box’
a.iii	*ræstæg*	[ræs]$_\sigma$ [tʰæg]$_\sigma$	‘ripe’

The initial consonant of the medial cluster must be syllabified as a rhyme of the preceding syllable and the final consonant of the medial cluster belongs to the onset in the following syllable. In fact the medial clusters in (9) are heterosyllabic.

3.1.2. 2 Coda

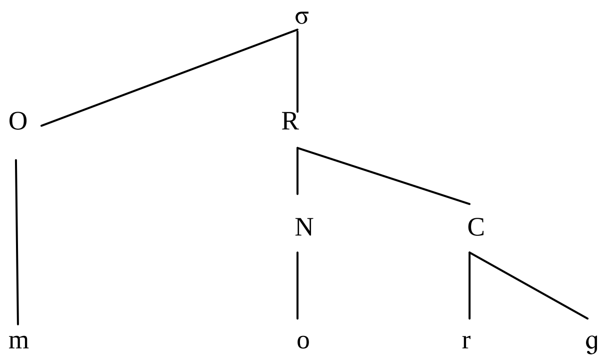
Now I turn to the coda position in IBDs. The data illustrate that every consonant can occur in this position, except [w] and [ʔ]: *ʃæh* ‘king’, *miːr* ‘sir’, *bɪl* ‘dog’, *taːs* ‘bowl’, *paːn* ‘drug’, *paːʈ* ‘trick’, *daːr* ‘wood’ etc. Furthermore, there are also final consonant clusters as in (10).

(10) word-final consonant clusters

a.i	*lonɖ*	[lõnɖ]	‘fellow’
a.ii	*bænd*	[bæ̃nd]	‘rope’
a.iii	*ʈueng*	[ʈ^{h}eng]	‘knee’
a.iv	*kelent*	[k^{h}elẽnt]	‘shovel’
a.v	*neginz*	[neɡ̃inz]	‘lentil’
a.vi	*næmb*	[næ̃mb]	‘dew’
b.i	*kælb*	[k^{h}ælb]	‘heart’
b.ii	*haːlg*	[hɑːlg]	‘peach’
b.iii	*hæjk*	[hæjk]	‘eyeball’
b.iv	*hord*	[hord]	‘small’
b.v	*morg*	[morg]	‘bird’
b.vi	*bærp*	[bærp]	‘snow’

Examples in (10) and geminates in the word-final position are an evidence for Balochi having a complex coda. Consider following structure (O: onset, R: rhyme, N: nucleus and C: coda):

(11) *morg* [morg] ‘bird, hen’



The sonority profile of the codas in (10) is always the same: a liquid or nasal followed by an obstruent. A coda cluster therefore is the mirror image of onset cluster. All final clusters in (10) support the sonority sequencing generalization in word-final position: within the coda, more sonorant consonants precede less sonorant consonants, excluding geminate here. (Ein and van der Hulst, 2001).

On the other hand, there are number of examples in IBDs that complex codas violate the sonority sequencing generalization in the coda position. Consider the following examples:

(12) word-final consonant clusters against (SSG)

a.i	*dohl*	[dohl]	‘kettledrum’
a.ii	*pohl*	[pohl]	‘bridge’
a.iii	*tæhl*	[t^{h}æhl]	‘bitter’
a.iv	*ketl*	[k^{h}etl]	‘kettle’
a.v	*kosl*	[k^{h}osl]	‘ablution’
a.vi	*nogl*	[nogl]	‘candy’
a.vii	*ʔækl*	[ʔæk^{h}l]	‘wisdom’
a.ix	*ɣopl,kobl*	[ɣopl], [k^{h}obl]	‘lock’
b.i	*zæhr*	[zæhr]	‘bitter’
b.ii	*sohr*	[sohr]	‘red’
b.iii	*mohr*	[mohr]	‘tight’
b.iv	*pekr*	[p^{h}ekr]	‘thought’
b.v	*kæbr*	[k^{h}æbr]	‘grave’
b.vi	ʔæsr	[ʔæsr]	‘afternoon’
c.i	*kæhn*	[k^{h}æhn]	‘kanat’
c.ii	*læhm*	[læhm]	‘slow, soft’
d.i	*kæbg*	[k^{h}æbg]	‘partridge’
d.ii	*hæpt*	[hæpt]	‘seven’
d.iii	*zatk*	[zɑtk]	‘born’
d.iv	*pæʈk*	[p^{h}æʈk]	‘the sound of bullets’
d.v	*zatk*	[zɑtk]	born’
d.vi	pætk	[p^{h}ætk]	‘cooked’

Based on examples in 12 (a-c), consider table (13):

(13)

C2 C1	l	r	n	m
h	+	+	+	+
t	+	-	-	-
s	+	+	-	-
g	+	-	-	-
k	+	+	-	-
b	+	+	-	-
p	+	-	-	-

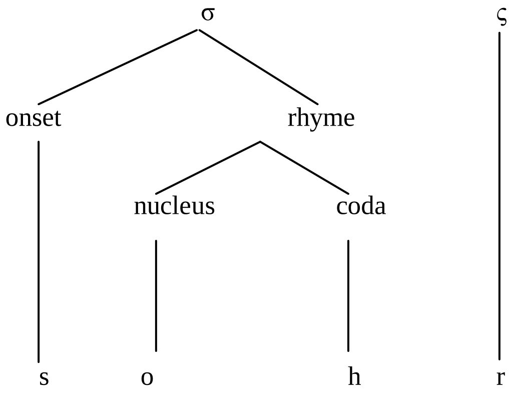
Table (13) shows that the first segment of the final clusters is a non-retroflex obstruent, and the second consonant in a cluster is either one of the liquids [l, r] or the nasals [n, m]. So, there is a sequence of obstruent/ sonorant which is an example of rising sonority with MSD2 values which is against the SSP.

For dealing with SSP violations, there are number of proposals such as the core and affix, syllable appendix. (Yu Cho and Holloway King 2003). The present proposal in which I analyze the data in (12) relies on the notion of semisyllables. Semisyllables are syllables that have no mora. Semisyllables are known as degenerate syllable, minor syllables, headless syllables, and consonantal syllables. Properties of semisyllables are as follow (Yu Cho & Holloway king, 2003: 187):

(14) Properties of semisyllables
“a. No nucleus
b. No codas
c. No stress/accent/tone
d. Prosodically invisible
e. Well-formed onset clusters
f. Restricted to morpheme peripheral positions”

Semisyllables are defined as syllables that contain no mora. Sonority sequencing principle applies to consonant clusters including semisyllables, because they form a syllable which has an onset but no nucleus. Since there is no syllable peak, there is only rising sonority in semisyllables. While moraic full syllables are represented with regular sigma (σ), semisyllables represented with a final-position sigma (ς). The semisyllables in Balochi are restricted to the right edge of the word. The representation of the word *sohr* is as given in (15):

(15) *sohr* [sohr] ‘hot, red’



Moreover, in 12 (d) there are number of examples with the sequences of two obstruents

(stop+ stop) at coda position, they show flat sonority which has MSD0 values based on Zec (2007). Table (16) shows the plateau clusters in data12 (d).

(16)

C2 C1	g	k	t
b	+	-	-
p	-	-	+
t	-	+	-
ʈ	-	+	-

Indeed, table (16) displays examples of harmonic clusters like [bg, tk, ʈk] which are formed by a sequence of [-dorsal][+ dorsal] stop (Yu Cho & Holloway King 2003). The harmonic clusters involve homogeneity of laryngeal features, non-homogeneous clusters of [-dorsal][+dorsal] are found in Balochi data as in *pg *bk *tg *ʈg just like in Georgian harmonic clusters (Yu Cho & Holloway King 2003).

Whereas coda clusters in data (12) show the falling sonority in coda clusters, the data (12d) are types of coda clusters with flat sonority.

3.1.2. 3 Nucleus

Considering rhymes to consist of two constituents, the nucleus and coda, in this subsection the distribution of vowels in the nucleus position in the syllable structure of IBDs is presented. Certain restrictions may exist in this distribution, something which needs to be described. The vowel distribution of IBDs is as follows:

(17) The distribution of vowels in IBDs

- i. In all three dialects, an open syllable with a consonant, i.e. CV, both front and back monophthongs and diphthongs are observed.
- ii. All vowels i.e. front, back and diphthongs can occur in the nucleus position of CVC syllable structure.
- iii. In CCVC structure, all front and back vowels except /ɪ/ and /ʊ/can occur, and among diphthongs only /ou/ cannot occur in the nucleus position.
- iv. All short front, back and diphthong except /ou/ can occur in the nucleus position of CVCC syllable.

In sum, Iranian-Balochi dialects are ones in which onset is obligatory and does not allow onsetless syllables, and all consonants except [ŋ,ɻ] can occur in an onset position. Moreover, codas are permitted, i.e. syllables maybe closed, all consonants except [w] can occur as coda. Furthermore, it allows complex onset and codas. In word-initial clusters, the first segment is generally an obstruent which is followed by a liquid or a glide. The second segment in the word-final clusters is normally an obstruent which is preceded by a liquid or a nasal. However, there are clusters in both word-initial and word-final positions which violate sonority sequencing generalization. I consider the first consonant of violated onset cluster as prependix and the final offending consonant of coda cluster as the semisyllable. They have extra-syllabicity property: not belonging to the syllable structure. Finally, only vowels are syllabic in IBDs.

3.1.3 Syllable contact (SC) in IBDs

Syllable contact laws favor a preceding coda be lower in sonority than the following onset (Davis1998, Gouskova 2004, among others). In other words, the hetero-syllabic cluster must have descending sonority. In this subsection the structure of the syllable contact (word-medial consonant clusters) in IBDs will be evaluated based on the syllable contact scale proposed by Zec (2007: 190). In scale (18) the sequences of flat sonority has SC0 value, sequences of rising sonority are given the value SC+1/+2, and those sequences with falling sonority have SC-1/-2 value. (O stand for obstruent, N stands for nasal and L stands for liquid)

(18) Syllabe Contact (SC)

SC+2	OL
SC+1	ON, NL
SC0	OO, NN, LL

SC-1	LN, NO
SC-2	LO

As (18) shows the sequences of OL, ON and NL have positive values, so they are not preferred in word-medial cluster, while the syllable contact with negative values are highly preferred. Besides the sequences of OO, NN and LL have flat sonority.

Now consider the data in (19) which illustrate the syllable contact in IBDs. 19(a) is the sequence of N.O and L.O, 19(b) gives the sequence of L.O, and 19(c) presents the sequence of O.O.

(19) Syllable contact in IBDs

(a) Falling sonority N.O/ L.O

a.i	*kaːmpæg*	[kʰɑ̃ːm.pʰæg]	‘head’
a.ii	*dombiːtʃk*	[dõm.biːtʃk]	‘tail’
a.iii	*kuːnzæk*	[kʰũːn.zæk]	‘heel’
a.iv	*tʃiːntʃok*	[tʃʰĩːn.tʃʰok]	‘pinky’
a.v	*hærgoʃk*	[hær.goʃk]	‘rabbit’
a.vi	*kaːrtʃok*	[kʰɑːr.tʃʰok]	‘knife’
a.vii	*pelpel*	[pʰelpʰel]	‘pepper’
a.viii	*ʃælgom*	[ʃælgõm]	‘turnip’

(b) Rising sonority O.N/ O.L

b.i	*ʔasmaːn*	[ʔɑs.mɑ̃ːn]	‘sky’
b.i	*dokmæ*	[dokʰ.mæ]	‘button’
b.iii	*kohnæg*	[kʰoh.næg]	‘old’
b.iv	*gehniːtʃ*	[geh.niːtʃ]	‘coriandre’
b.v	*pæhluːnk*	[pʰæh.lũːnk]	‘ the side’
b.vi	*bæːdræng*	[bæːd.ræ̃ng]	‘cucumber’
b.vii	*sobræ*	[sob.ræ]	‘floor cloth’
b.viii	*megraːz*	[meg.rɑːz]	‘scissures’

(c) Flat sonority O.O

c.i	*kæptaːg*	[kʰæp.tʰɑːg]	‘shoulder’
c.ii	*hoʃter*	[hoʃ.tʰer]	‘camel’
d.iii	*redʒgu*	[redʒ.gu]	‘marmot’
c,iv	*bæstæg*	[bæs.tʰæg]	‘yogurt’
c.v	*neʃtæg*	[neʃ.tʰæg]	‘single’
c,vi	*sohteg*	[soh.tʰeg]	‘burn’

The data in (19) exhibit that Balochi is among the languages which admit all types of the heterosyllabic clusters. However, some languages like Sidamo (Zec 2007) are more restricted in this case and only prefer clusters in the negative range of syllable contact scale and disfavor clusters in the positive range of scale.

Furthermore, there is one more type of falling sonority syllable contact in IBDs which consists of the sequence of glide (G) and obstruent (O) as shown in (20).

(20) Falling sonority G. O

a.i	*ʃejtaːn*	[ʃej.tɑ̃ːn]	‘evil’
a.ii	*zejtuːn*	[zej.tuːn]	‘olive’
a.iii	*mejdaːn*	[mejdɑ̃ːn]	‘square’
a.iv	*kejtʃiːn*	[k^{k}ej.tʃ^{h}ĩːn]	‘scissor’

3.1.3.1 Internal codas and final codas asymmetry in IBDs

As it has already been discussed, in IBDs both simple consonants and consonant clusters are allowed in the final position (coda) namely CVC and CVCC. However; data in (19) illustrates that medial clusters are heteroyllabic and there is no complex internal codas in IBDs, so only a CVC pattern is allowed word-internally and not CVCC. As the onsetless syllables are disallowed in Balochi, thus the second component of medial consonant clusters is considered as the onset of the following syllable. In fact, this is an argument for considering clusters in codas to involve semisyllables.

In some languages, final consonants and internal codas are symmetrical like Spanish, but in many languages final consonants shape in a different way than internal codas, so in these languages final consonants are referred as exceptional. Two reasons deal with the final coda exceptionality: (a) segmental immunity which allows more consonants in the final position than in the internal codas. (b) metrical invisibility which ignored the final consonants in the metrical process (Côté 2011: 848, 845). The segmental immunity occurs in IBDs. Whereas only one consonant is permitted in internal codas, two consonants may appear in final positions. Côté (2011) discuses five factors which trigger the segmental immunity: alignment, positional faithfulness, licensing parameters, perceptual factors and morphology.

Patterns in (21) postulate the number of consonantal slots in internal codas vs. final position, here the examples are ignored (Côté 2011:854).

(21)	Internal codas		Final position
	a.	ø	C
	b.	C	CC

c.	ø	ø
d.	C	C
e.	C	ø
f.	CC	C

Type (21a) and (21b) show languages that allow more consonants in final position, type (21c) and (21d) indicate the symmetrical languages and finally (21e) and (21f) identify the languages that permit more consonants in internal coda position(Côté).

Type (21b) is found in IBDs, which illustrates ‘final immunity’ effects. Consequently the set of permissible codas in final position, which include all consonants except [w] and [ʔ], is more than the number of consonants in medial coda. Likewise, complex codas are tolerated in final position and not in internal coda. (21) gives the list of final position consonants and internal coda consonants based on my data in IBDs:

(22)	Internal coda consonants	Final coda consonants
	P, b, d, k ,g,s,ʃ, h, dʒ	*p, b, t, d, ʈ, ɖ, k, g, s, z, ʃ, ʒ, h,χ*
	m, n, l, r, j	*m, n, l, r, ɽ, j*

3.1.4 Syllable weight system in IBDs

Syllable weight or syllable quantity is a concept based on the distinction between light (short) and heavy (long) syllables (Davis 2011). The moraic theory (Hyman 1985; Hayes 1989) is a representational theory of syllable weight. The mora represents the contrast between light and heavy syllables; a light syllable is monomoraic whereas heavy syllables are bimoraic. Based on Hayes theory (1989: 256-257) short vowels are underlyingly monomoraic whereas long vowels are bimoraic. As to geminate consonants, geminates are underlyingly moraic while single consonants are not moraic. However, in some languages the non-geminate coda gets moraic status by the rule of Wight-by-Position.

The moraic structure is language dependent. For example, in some languages CVV and CVC are heavy syllables while in others only CVV counts as heavy syllable (Hayes1989:255).

In Iranian-Balochi dialects the distinction between heavy and light syllables is simply a matter of the number of segments in the nucleus: branching nucleus syllables are heavy; non-branching nucleus syllables are light. Thus CV and CVC are light syllables, whereas CVV is the heavy syllable (Ein & van der

Hulst 2001:134-135). Besides, the “CVG”= word-final geminate[3] consonants are counted as heavy syllable in IBDs as well.

However, wight inconsistency occurs in IBDs. It means CVC syllables sometimes pattern as heavy syllable and sometimes as light. Therefore the weight of CVC syllables depends on the context within a word in IBDs. Context dependent weight is a quite common phenomenon like in Kashmiri (Davis2011:127).

In IBDs, context dependent weight of CVC syllables occurs in stress pattern system. Normally in IBDs’ rightmost CVV(C) syllable (bimoraic) gets the primary stress, but if a word has no CVV(C) syllables, then stress falls on the rightmost CVC syllable. (Soohani, Ahangar, van Oostendorp 2011). So this is an example of context dependent weight: a CVC syllable is bimoraic only in words without long vowels, more explanation and examples will be given in section (3.3) which deals with the stress pattern system in IBDs.

Moreover, Gordon (2000) proposes that the coda weight is predictable from syllable structure. As sonorant consonants have greater energy than obstruents and voiced segments have more phonetic energy than voiceless segments, the sonority and voicing of coda play important roles in the language specific weight of CVC. The results of evaluating coda consonants of 62 languages show that languages with light CVC syllable have lower [+voice] to [-voice] and [+sonorant] to [-sonorant] ratios coda consonants than the languages with heavy CVC syllables. Besides CVC syllables in languages with mismatches [+sonorant] to [-sonorant] and [+voice] to

[-voice] may either occur as heavy or light, and it is language–specific indeed (Gorden 2000:9, 14).

IBDs data support Gordon's hypothesis, the number of sonorant consonants in IBDs is less than the number of obstruents in coda position, but the number of voiced segments is more than the number of voiceless consonants in final position. As a result, Balochi is among languages with mismatching between these two features namely sonority and voicing. Thus the CVC syllable may be either heavy or light, as it has been already explained CVC syllable in IBDs is context dependent.

3.1.5 IBDs syllable structure in OT

This section gives the optimality analysis of the syllabic constituency in IBDs. First the data in (1) which deals with the consonant epenthesis in an onset position will be investigated. Second the analysis for the onset consonant clusters in data (2) and (7) will be given. Then the constraints for word-final consonants clusters as shown in data (10) and (12), and syllable contact as

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[3] IBDs have two types of geminate: word-medial and word-final geminate consonants which are underlyingly moraic. It will be discussed in the next section.

clarified in examples (19) will be discussed, and the final analysis will examine the IBDs syllable weight in OT.

3.1.5.1 Obligatory onset in IBDs: an OT approach

The fact that IBDs prefer consonant epenthesis in the empty onset position over onsetless syllables proves that onset is an obligatory component in IBDs. As discussed, glottal stop only occurs in an onset position before vowel. An OT analysis of epenthesis segment uses the following two constraints:

(23) ONSET
Syllables must have onsets.
(Price & Smolensky 1993)

(24) DEP-IO
Output segments must have input correspondents ‘No epenthesis’

The context-free markedness constraint, ONSET says that syllables must not start with vowel. And the anti-epenthesis faithfulness constraint DEP-IO prohibits segment epenthesis.

Epenthesis in onsets shows that IBDs rank DEP-IO below ONSET. Onset epenthesis involves the following ranking:

(25) ONSET >> DEP-IO

This ranking is demonstrated by the following tableau. It contains two candidates, which differ only in the presence versus the absence of an epenthetic consonant.

(26) *æmb* [ʔæmb] ‘mango’

Input: /æmb	ONSET	DEP-IO
a.☞ ʔæmb		*
b. *æmb*	*W	L

Candidate (a) is a winner, since it satisfies the higher ranked ONSET by filling the onsetless position. But candidate (b) violates the undominated constraint and avoids [ʔ] insertion.

3.1.5.2 Word- initial onset clusters in IBDs: an OT approach

As data (1), (2) and (7) show, the onset clusters are allowed in IBDs as well as simple onsets. The onset clusters with rising sonority in (2) follow the sonority sequencing principle, as repeated in (27):

(27) onset-clusters with rising sonority

a.i	*ʈʃlimp*	‘hubble-bubble’
a.ii	*klieɽ*	‘lizard’
a.iii	*dʒwaːn*	‘young’
a.iv	*bwaːn*	‘read!’
a.v	*swaːr*	‘rider’

Based on the sonority dispersion principle (cf. Parker 2011) the most natural onset clusters are obstruent + liquid, obstruent + glide and obstruent + nasal, while the least natural onset clusters are liquid + glide, nasal + liquid and nasal + glide. Dealing with examples in (27), word-initial clusters in IBDs are among natural onset clusters.

In OT, preference for rising sonority onset clusters is captured by ranking relevant Onset-well- Formedness constraints as in (28):

(28) Onset-well-Formedness constraints in IBDs

a. * $_{\sigma}$ [Sonorant^ Obstruent)
The sequence of sonorant- obstruent (falling sonority) in an onset position is not allowed. (Green 2003:239)

b. *COMPLEX
No complex syllable margins.
(cf. Prince and Smolensky 1993)

c. DEP-IO
Output segments must have input correspondents ‘No epenthesis’

d. MAX- IO
Input consonants must have output correspondents ‘No consonant deletion’
(cf.McCarthy2008)

(29) Onset cluster with rising sonority
* $_{\sigma}$ [Sonorant^ Obstruent), DEP-IO >> MAX-IO >>*COMPLEX

This ranking illustrates that rising sonority in onset cluster is achieved by ranking markedness constraints namely * $_{\sigma}$[Sonorant^ Obstruent), and SON-SEQ and also anti-epenthesis faithfulness constraint DEP-IO above the antideletion faithfulness constraint MAX-C and context-free markedness constraint *COMPLEX.

Tableau (30) evaluates candidates for the input /brɑːs/. Four candidates (30a-d) vary in their onset structure. Each of the candidates has at least one violation. Candidate (b) with reversing the onset sequence, fatally violates the undominated context-free markedness constraint * $_{\sigma}$ [Sonorant^ Obstruent). The remaining candidates (30c) and (30d) are also losers, as they violate the faithfulness constraints DEP-IO and MAX-IO, even though they satisfy the higher ranked constraints. The optimal candidate (30a) has one violation mark which is not fatal.

(30) *braːs* [brɑːs] ‘brother’

Input:/brɑːs/	* $_{\sigma}$[Sonorant^ Obstruent)	DEP-IO	MAX-IO	*COMPLEX
a ☞ brɑːs				*
b. rbɑːs	*W			*
c. berɑːs		*W		L
d. rɑːs			*W	L

However, in data (7) examples with falling sonority and plateau sonority are exemplified. All initial-clusters in (7) are counterexamples to the sonority sequencing principle (SSP). The obstruent onset cluster in IBDs is a combination of fricative (F) and stops (S) as follows:

- FS: *staːr* ‘star’, *spiʈʈ* ‘spped’
- SF *bhænd* ‘laugh!’, *psuːtʃ* ‘burn!’
- SS *bkæp* ‘fall down!’, *pkoʈʈ* ‘beat!’

Cross linguistically, the sequence of /s/ followed by a plosive is the most frequent exception to the SSP (Parker 2011). Morelli (2003) notes that in languages with plateaus onset clusters, four possible syllable onsets are attested as in Balochi: FS, SF, SS and FF. She claims that the ‘least marked’ of these types of clusters are FS and the’ most marked’ are SS. (31) expresses the marked relationship for obstruent clusters (Morelli2003:364).

(31) a. FS > FF
b. FS > SF > SS

So far, the list of onset-well-formedness constraints are given in (28).To also deal with the onset cluster with plateau sonority, the following two markedness constraints (cf. Morelli 2003) and one faithfulness constraint could be incorporated in our OT analysis.

(32) *PLATEU
Onset clusters with plateau sonority are not allowed.

(33) *SO
A tautosyllabic sequence of a stop followed by any obstruent in onset position is not allowed.

(34) IDENT (PLACE)
The place of articulation of an input segment must be preserved in its output correspondent. (cf.Kager1999)

The following rankings give the optimal outputs for the input /pkæp/ and /spiːt/ respectively:

(35) MAX-IO, IDENT (PLACE), DEP-IO >> *SO >> *COMPLEX

(36) MAX-IO, IDENT (PLACE), DEP-IO >> *PLATEAU>> *COMPLEX

In both rankings the faithfulness constraints govern all context-free markedness constraints against the plateau sonority. These rankings produce the output with SSG violation which seems to be allowed in IBDs.

Tableau (37) represents the sequence of SS as in /pkæp/. The optimal candidate is (37a), since it does not violate the undominated faithfulness constraints; however, it has two non-fatal violation marks. Both candidates (b) and (c) are losers. Candidate (b) has a fatal violation due to its segment deletion and candidate (c) is eliminated as it violates the higher ranked IDENT (Place) constraint, and finally the last losing candidate (d) violates the DEP-IO by epenthesising a vowel between two obstruent consonants.

(37) *pkæp* [pkæp] ‘fall down!’

Input:/pkæp/	MAX-C	DEP-IO	IDENT(Place)	*SO	*COMPLEX
a. ☞ pkæp				*	*
b. pæp	*W			L	L
c. præp			*W	L	*
d. pekæp		*W		L	L

Tableau (38) shows the sequence of FS in the word-initial position as in /spiːt/. Candidate (b) is a loser, since it violates the anti-epenthesis faithfulness constraints. Besides, candidate (c) is not optimal as well, as it has a fatal violation mark. Candidate (d) violates the IDENT-(PLACE) by replacing the obstruent[t] by a sonorant [r], and also violates MAX-IO by deleting /s/. Thus, candidate (a) is a winner, as it satisfies all higher ranked constraints.

(38) s*piːt* [spiːt] ‘white’

Input:/spiːt/	MAX-IO	DEP-IO	IDENT (PLACE)	*PLATUE	*COMPLEX
a. ☞ spiːt				*	*
b. sepiːt		*W		L	L
c. piːt	*W			L	L
d. sriːt	*W		*W	L	*

3.1.5.3 An OT approach to IBDs coda clusters

As data (10) and (12) show, the coda clusters are permitted in IBDs as well as simple coda. The coda clusters with falling sonority in (10) follow the sonority sequencing principle, but the examples in (12a, 12b and 12c) with rising sonority and in (12d) with flat sonority violate the SSG, as repeated in (40):

(39) Coda-clusters with falling, rising and flat sonority

a.i	[hɑːlg]	‘peach’
a.ii	[p^{h}ohl]	‘bridge’
a.iii	[hæpt]	‘seven’

As it has been shown previously and illustrated in (39a.ii), the last segment of syllable - coda combination in IBDs has formed the semisyllable, it is a non-moraic syllable which contains only an onset and indeed no peak.

The OT analysis of examples in (39) uses three faithfulness constraints: DEP-IO, MAX-IO, and the anti-metathesis constraint namely LINEARITY-IO and, the alignment constraint as in (40).

(40) LINEARITY-IO
The output reflects the precedence structure of the input, and vice versa. (cf.Kager1999)

(41) ALIGNS-EDGE-ς
Align semisyllable to morpheme edge.

In addition, the remaining necessary constraints are markedness: *COMPLEX, SON-SEQ and *C^{unsyll} (cf. McCarthy2008) which militate against the extrasyllabic consonants.

(42) *$C^{unseyll}$
Extra syllabic consonants are prohibited

The following rankings (43-45) of above constraints deal with the coda clusters with falling, flat and rising sonority respectively. In all rankings it seems ranking all constraints except *COMPLEX with respect to one another is totally irrelevant for the optimal output.

(43) Word-final coda clusters with falling and flat sonority
SON-SEQ, MAX-C, DEP-IO>> *COMPLEX

(44) Word-final coda clusters with flat sonority
MAX-C, DEP-IO, *C^{unsyll} >> *COMPLEX

(45) Word-final coda clusters with rising sonority
LINEARITY, SON-SEQ, MAX-C, DEP-IO, ALIGN-EDGE ς >>COMPLEX

Now consider the succeeding tableaux which present the above rankings for the input [hɑlg], [hæpt] and [pohl] respectively.

(46) *haːlg* [hɑlg] 'peach'

Input: /hɑlg/	SON-SEQ	DEP-IO	MAX-C	*COMPLEX
a. ☞ hɑlg				*
b. hɑleg		*W		L
c. hɑl			*W	L
d. hɑgl	*W			*

(47) *hæpt* [hæpt] 'seven'

Input: /hæpt/	MAX-C	DEP-IO	*C^{unsyll}	*COMPLEX
a. ☞hæpt				*
b. hæpet		*W		L
c. hæp	*W			L
d. hæp.t			*W	L

(48) *pohl* [pohl] 'bridge'

Input:/pohl	LINEARITY	SON-SEQ	MAX-C	DEP-IO	ALIGN-EDGE ς	*Complex
a. ☞poh. l						
b. pohl		*W			*W	*W
c. pohel				*W	*W	
d. poh			*W		*W	
e. polh	*W				*W	*W

As shown in tableau (46), candidates (b) and (c) violate the higher ranking faithfulness constraints. Candidate (d) has one violation of the undominated constraint SON-SEQ and one violation of context-free markedness constraint namely *COMPLEX. Candidate (a) satisfies all undominated constraints and only violates *COMPLEX which is not fatal, so the winning candidate is (a).

In tableau (47), candidate (a) is a winner; it does not violate any higher ranked constraints while candidates (b), (c), and (d) all violate the higher ranked faithfulness constraints.

Finally, all candidates in tableau (48), except candidate (a), violate the ALIGN-EDGEς Moreover, candidate (b) violates higher ranked constraint SON-SEQ due to the sequence of rising/falling segments in coda cluster. Besides, both candidates (c) and (d) violate the faithfulness constraints DEP-IO and MAX-IO by inserting and deleting a consonant in the coda position respectively. Candidate (e) has a fatal violation; it has a metathesis in the coda cluster, so it violates the undominated faithfulness constraint LINEARITY. The optimal candidate is (a), which satisfies all constraints.

3.1.5.4 IBDs Syllable peak in OT

The set of syllabic segments in the languages are different; it may include vowels, liquids, nasals and obstruents. As it has been discussed, the set of syllabic segments in IBDs only includes vowels. The sonority hierarchy of syllable peaks is given in (49).

(49) Sonority threshold on syllabicity
μ_h /V > μ_h / L > μ_h / N > μ_h / O
(Zec 2007)

The sonority hierarchy of syllable peaks in (49) illustrates a four-point peak hierarchy. The most sonorant segments (vowels) are above the sonority threshold, the second position is liquid and nasals are in the third point and the least sonorant segments (obstruents) are in the final point. Balochi is among languages whereby vowels are above the sonority threshold and not any other segments. However, there are languages such as IT Berber that allows not only vowels, but also liquids, nasals and even obstruents in the nucleus position (cf. Zec 2007).

In OT, the set of relevant constraint rankings deal with the syllabicity is as follows:

(50) Constraints on syllabicity (Prince and Smolensky 2004)
*μ_h /O >> *μ_h / N >> *μ_h / L >> * μ_h / V

(50) indicates that obstruents with less sonority are the most marked segments and vowels with high sonority are the least marked segments in the nucleus position.

The vowel preference in the nucleuses position in IBDs can be illustrated by ranking the context-free markedness constraint ONSET and faithfulness constraint DEP-IO above the constraint which bans the vocalic nuclei.

(51) ONSET, *μ_h / L, MAX-IO, DEP-IO >> * μ_h / V, *COMPLEX

Tableau (52) presents the above ranking for the input /gruːg/. Candidate (a) is the optimal candidate, since it prefers the vocalic nucleus over the liquid nucleus, though it has two violation marks which are not fatal. Candidate (b) and (c) are losers as they violate the undominated constraints ONSET and*μ_h / L by selecting the liquid nucleus which is not allowed in the IBDs.

(52) *gruːg* [gruːg] ‘storm’

Input: /gruːg/	ONSET	*μ_h / L	DEP-IO	* μ_h / V	*COMPLEX
a.☞ gruːg				*	*
b. gr.uːg	*W	*W		*	L
c. ge.r.uːg	*W	*W	*W	*	L

3.1.5.5 IBDs syllable contact: an OT approach

Data in 19 (a), (b), and (c) provide evidence that all types of heterosyllabic clusters are found in IBDs: medial-clusters with falling, rising and flat sonority as in (53).

(53) Heterosyllabic cluster with falling, rising and flat sonority

a.i	[pelpel]	‘pepper’
a.ii	[sobræ]	‘floor cloth’
a.iii	[hoʃter]	‘camel’

Examples like (53a.ii) show that Syllable Contact Law (SCL) which prefers descending sonority over the syllable boundary does not have strong influence on word-medial clusters with rising sonority. Conversely; in heterosyllabic clusters with falling sonority as in (53a.i), the SCL has a main role.

The role of SCL in OT is determined by outranking the SYLLCONT constraint (cf. Green2003) over other relevant constraints as given in (54).

(54) Ranking for falling sonority over syllable boundary
SYLLCONT>> *COMPLEX, ONS, MAX-C >> *C^{unsyll}

This ranking is supported by the following tableau of /pelpel/, which represents the medial-cluster with falling sonority.

(55) *pelpel* [pelpel] ‘paper’

Input: /pelpel/	SYLLCONT	*COMPLEX	ONS	MAX-C	*C^{unsyll}
a. ☞ pelpel					
b. pe.lel				*W	
c. pelp.el		*W	*W		
d. pe .l. pel					*W
e. pe.lpel		*W			
f. pep.lel	*W				

As tableau (55) proves, all candidates except candidate (a) have at least one violation marks. Thus, candidate (a) is the winner, and all other candidates are eliminated.

Considering the second type of word-medial cluster like in [sobræ], leads us to ranking (56). It deals with the word-medial clusters with rising sonority. This type of heterosyllabic clusters are against SCL. So, in ranking (56) SYLLCONT is not among undominated constraints.

(56) Ranking for rising sonority over syllable boundary
LINEARITY, MAX- C, *COMPLEX, ONS, *C^{unsyll} >> SYLLCONT

Tableau (57) evaluates the candidates that match the input [sobræ]. Although all constraints have one violation, it is not fatal for candidate (a). It satisfies all undominated constraints and only violates the lower ranking SYLLCONT. Thus the optimal candidate is (a). All remaining candidates satisfy the SYLLCONT constraint at the expense of the violation of one of undominated constraints (LINEARITY, MAX-C, *COMPLEX, ONS, and *C^{unsyll}).

(57) *sobræ* [sobræ] ‘floor cloths’

Input:/sobræ/	LINEARITY	MAX- C	*COMPLEX	ONS	*C^{unsyll}	SYLLCONT
a. ☞ sob.ræ						*
b. soræ		*W				L
c. sor.bæ	*W					L
d. sobr.æ			*W	*W		L
e. so.bræ			*W			L
f. sob.r.æ				*W	*W	*

The Heterosyllabic cluster with flat sonority like in (53.iii) is the third type of word-medial cluster in IBDs. The relevant ranking is that in (58). As hierarchy shows, the SYLLCONT is dominated by other relevant undominated constraints just like in ranking (56). The illustration of it is offered in tableau (59).

(58) Ranking for flat sonority over syllable boundary
MAX- C, *COMPLEX, ONS, *C^{unsyll} >> SYLLCONT

(59) *hoʃter* [hoʃter] ‘camel’

Input: /hoʃter/	MAX-C	*COMPLEX	ONS	*C^{unsyll}	SYLLCONT
a.☞ hoʃ.ter					*
b. hoter	*W				L
c. hoʃt.er		*W	*W		L
d. ho.ʃter		*W			L
e. hoʃ.t.er			*W	*W	*

An optimal candidate is (a), which satisfies all undominated constraints and only violates the lower ranked SYLLCONT. Candidate (c) and (d) have complex coda and complex onset respectively which militate against the anti-complex cluster in syllable margins constraint; also candidate (c) has an extra violation mark. Candidate (b) deletes the first component of hetereosyllabic cluster so it is eliminated just like candidates (c) and (d). Finally, candidate (e) has the most violations and is a loser as well.

3.2 Consonant geminates in IBDs

3.2.1 Introduction

This section attempts to identify and represents two different types of geminates, namely, the single vowel-adjacent geminate and the intervocalic geminate in Iranian-Balochi dialects. In addition, analyses of these geminate processes are given in the framework of OT.

Geminates normally refer to a long consonant that contrasts phonemically with its shorter or ‘singleton’ counterpart (Davis 2011). In IBDs, almost all singleton consonants have geminate counterparts. As data illustrate, geminates in IBDs are mostly in word-final position, where they are preceded only by short vowels. However, there are examples of intervocalic geminate, but no geminates occur in word-initial position as shown in (60) and (61) respectively.

In IBDs, besides ‘true’ geminates which are underlyingly long, there are also few examples of ‘fake’ geminate as well which will be discussed in the next chapter of the present thesis (for discussion of true and fake geminates, see e.g. Pycha 2010).

(60) Word-final geminate consonants

(I) Sonorants

a.i	*tʃæmm*	[tʃæ̃mm]	‘eye’
a.ii	*ɖenn*	[dẽnn]	‘hill’
a.iii	*wæll*	[wæll]	‘kind of melon’
a.iv	bell	[bell]	‘permission’
a.v	*ʃærr*	[ʃærr]	‘good’

(II) Obstruents

a.i	g*æbb*	[gæbb]	‘bracelet’
a.ii	*kipp*	[k^{h}ip^{h}p]	‘tight’
a.iii	*sædd*	[sædd]	‘dam’
a.iv	*bæɖɖ*	[bæɖɖ]	‘hug’
a.v	*loʈʈ*	[loʈʈ]	‘wood’
a.vi	*bægg*	[bægg]	‘cattle’
a.vii	*lokk*	[lokk]	‘short’
a.viii	*næzz*	[næzz]	‘squat’
a. ix	*hæʃʃ*	[hæʃʃ]	‘mill’
a.x	*gæʒʒ*	[gæʒʒ]	‘swallow’
a. xi	*toss*	[toss]	‘fart’
a. xii	*letʃtʃ*	[letʃtʃ]	‘mud’
a. xiii	*gædʒdʒ*	[gædʒdʒ]	‘spit’

(61) Intervocalic geminate consonants

(I) Sonorants

a.i	*pællink*	[p^{h}ællĭnk]	‘pigtail’
a.ii	*bællok*	[bællok]	‘ancestor’
a.iii	*tʃællæ*	[tʃællæ]	‘ring’
a. iv	*henna*	[hẽnnɑ]	‘henna’
a. v	*dʒænnæt*	[dʒænnæt]	‘heaven’

(II) Obstruents

a.i	*wæssu*	[wæssu]	‘mother-in-law’
a.ii	*peʃʃok*	[p^{h}eʃʃok]	‘cat’
a.iii	*dʒækkæg*	[dʒækk^{h}æg**]**	‘cough’
a.iii	*hekkok*	[hekk^{h}ok]	‘hiccup’
a.iv	*kossi*	[k^{h}ossi]	‘wrestling’
a.v	*tuppan*	[t^{h}upp^{h}ɑ̃n]	‘storm’
a.vi	*koɖɖæl*	[k^{h}oɖɖæl]	‘aviary ‘
a.vii	*gætʃtʃæl*	[gætʃtʃ^{h}æl]	‘bedridden’

Examples in (60) and (61) demonstrate that in IBDs , as already mentioned , geminate consonants are mostly restricted to word-final position preceded by a short front vowel /i, e, æ/ or short mid-high back vowel /u/; also there are a number of intervocalic geminate consonants, but no word-initial geminate consonants have been observed in IBDs data. In addition, it seems almost all consonants, except for glides /j, w/ and / glottals /h, ʔ/, can appear as geminate consonant.

Overall table (62) summarizes the distribution of geminates in IBDs: single vowel–adjacent geminates including final geminates and intervocalic geminates are permitted, while non-vowel-adjacent geminates and initial geminates are disallowed.

(62) Distribution of geminates in IBDs

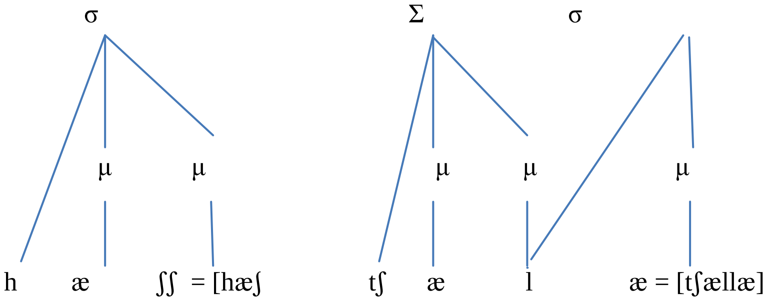
intervocalic geminate	VGGV	allowed
single vowel-adjacent geminates	VGG#	
	CGGV	not allowed
	#GGV	
non-vowel-adjacent geminates	#G +GC	

3.2.2 The moraic representation of geminate

'The moraic representation of geminate which is posited by Hayes (1989) is considered as the standard view of representation in current phonological works' (Davis, 2011:874). On this view, geminates are represented as underlyingly moraic or heavy; a geminate consonant differs from a short consonant in that the former is underlyingly moraic while the latter is non-moraic.

In (63) the moraic representation of *hæʃʃ* 'mill' as final geminate and *tʃællæ* 'ring' as intervocalic geminate is shown.

(63) Moraic representation of geminate in IBDs


a. *hæʃʃ* 'mill' b. *tʃællæ* 'ring'

As the data in (60) and (61) demonstrate, there is no geminate consonant preceded by a long vowel or a diphthong. Therefore; IBDs geminate consonants only occur after short vowels. This fact supports the cross-linguistically common phenomenon called 'avoiding trimoraic syllables' (Prince 1990).
against geminates is *GEM (Rose 2000). *GEM is considered as a family of constraints that target particular segmental type of geminates (Pajak2009), as illustrated in (64). The main idea of *GEM is that geminate obstruents typologically are more common than geminate sonorants at least in the intervocalic environment.

3.2.3 IBDs geminate in OT

In OT, the constraint which is used.

(64) *GEMGLIDE >> *GEMLIQUID >> *GEMNASAL >>*GEMOBS

The main idea in (64) is that the geminate obstruents are more common and perceptible than geminate sonorants, so the anti-sonorant geminate constraints are ranked over the anti-obstruent geminate constraints.

Moreover, typological evidence shows that geminates in intervocalic position are more usual than geminates which are non adjacent to any vowel (Muller 2001). This typological fact correlates with perceptual evidence, whereas intervocalic singleton-geminate contrasts are the most perceptible, non-vowel-adjacent singleton-geminate contrasts are the least perceptible (Pajak 2009).

As table (62) illustrates, vowel adjacency is an important property to define common geminate contexts in IBDs. This property can be shown in the framework of OT. Pajak (2009) gives the universal ranking of contextual constraints on geminates as shown in (65).

(65) *GEM / NVA >> *GEM /1VA >> *GEM / V_ V

Correspondingly, the constraint against non-vowel-adjacent geminates is ranked the highest, while the constraint against intervocalic geminates is ranked the lowest.

As to the IBDs data in (60) and (61), they follow the universal ranking constraints on geminates (65), where no initial geminate has been observed, while intervocalic and word-final geminates are allowed.

In analyzing the data in (60) and (61) the following context dependent markedness constraints are needed (Pajak 2009).

(66) *GEM / V_ V
‘No intervocalic geminates’

(67) *GEM / 1VA
‘No single vowel-adjacent (1VA) geminates’

In addition to the faithfulness constraints MAX-IO and DEP-IO, two more faithfulness constraints namely FAITH μ as in (68) and OCP as in (69) are involved in our analysis. As it is shown in (60) and (61) both types of geminates in IBDs are underlyingly moraic so, the FAITH μ is a constraint on moraic faithfulness which militates against mora insertion and deletion. OCP constraint is against the adjacency of two identical autosegments.

(68) FAITH μ
‘No mora deletion or insertion’
(Davis 2003)

(69) OCP
At the melodic level, adjacent identical elements are prohibited
(Kager1999)

The full OT analysis of intervocalic geminates and single-vowel-adjacent geminates (word-final geminates) in IBDs are provided as follows.

(70) shows the constraints ranking for the intervocalic geminate as in /tʃællæ/. FAITH μ, and MAX-IO constraints are higher-ranked, so adding or deleting mora is prohibited. But two constraints OCP and *GEM / V_ V which are against geminate must be lower-ranked.

(70) Ranking for the intervocalic-geminate in IBDs
FAITH μ, MAX-IO >> OCP, *GEM/ V_V

Tableau (71) presents the above ranking for the input /tʃællæ/. The candidate (a) with intervocalic geminate, surfaces as optimal; because it satisfies both undominated constraints and it has non-fatal violations, whereas other candidates are eliminated by higher-ranked constraints namely FAITH μ and MAX-IO. The intervocalic-degeminated candidates (b) incur the violations of both undominated faithfulness constraints. Besides candidate (c) is a loser since it violates the MAX-IO and OCP by deleting the intervocalic consonant and vowel lengthening respectively. Finally, candidate (d) violates the undominated constraints FAITH μ and MAX-IO twice which is definitely fatal.

μ μ μ μ μ μ

(71) *tʃællæ* [tʃællæ] ‘ring’

μ μ μ Input: /tʃællæ/	FAITH μ	MAX-IO	OCP	*GEM/ V_V
a.☞ μ μ μ tʃællæ			*	*
b. μ μ tʃælæ	*W	*W	L	L
c. μ μ μ tʃæːlæ		*W	*	
d. μ tʃæl	**W	**W	L	L

Tableau (73) illustrates ranking (72) which deals with the word-final geminate as in /hæʃʃ/ in IBDs. Candidate (a) with word-final geminate is a winner candidate, but both degeminated candidates (b) and (c) violate the higher-ranked faithfulness constraints.

(72) Ranking for single-vowel-adjacent germinates
FAITH μ, MAX-IO, DEP-IO >> OCP, *GEM/1VA

μ μ

(73) *hæʃʃ* [hæʃʃ] ‘mill’

μ μ input: /hæʃʃ/	FAITH μ	MAX-IO	DEP-IO	OCP	*GEM/1VA
a.☞ μ μ hæʃʃ				*	*
b. μ hæʃ	*W	*W		L	L
c. μ μ hæʃæʃ			*W	L	L

As examples in (60) and (61) demonstrate, glottal segments and glides are not found as consonant germinate in word-final position. It is well known that guttural consonants (pharyngeals, laryngeals, uvulars) resist geminating in some Semitic languages (McCarthy 1994). It seems to be true for IBDs with glottal consonants [h,ʔ], as a subgroup of gutturals. Moreover, based on ranking in (64), geminate glides are more marked than geminate obstruents.

To account for a form like dɪh ‘beast’, a constraint preventing glottal geminate, *GEMGUTT, is necessary in addition to the OCP and FAIT μ , as well as familiar faithfulness constraints within correspondence theory such as MAXIO and DEP-IO. Hence, the following ranking against guttural geminates is demonstrated in tableau (75).

(74) Ranking for degeminated glottal consonants in word-final position
FAITH μ, * GEMGUTT, OCP, DEP-IO >> MAX- IO

μ
|
(75) *dɪh* [dɪh] ‘beast’

μ | Input:/dɪh/	FAITH μ	* GEMGUTT	OCP	DEP-IO	MAX-IO
a. ☞ μ | dɪh					
b. μ μ | / dɪhh	*W	*W	*W	*W	
c. μ | dɪ					*W
d. μ μ μ | | / dɪhhɪ	*W	*W	*W	*W	

As is shown in tableau (75), candidate (a) is an optimal output, since it does not violate any constraints, whereas for example, both candidates (b) and (d) violate all undominated constraints , though candidate (c) satisfies all higher-ranked constraints it has one violation, which is fatal.

Furthermore, in the case of degeminated glide consonants, the anti-geminate constraints *GEMGLIDE which prevents glide consonant geminates, is high ranked. Tableau (77) evaluates candidates for an input *dʒew* ‘straw’. In this tableau, like tableau (75), the optimal output is candidate (b) which is degeminated and in fact does not violate any ranked constraints.

(76) Ranking for degeminated glide consonants in word-final position
FAITH μ, * GEMGLIDE, OCP, DEP-IO >> MAX- IO

μ

(77) *dʒew* [dʒow] ‘straw’

μ Input:/dʒew/	FAITH μ	* GEMGLIDE	OCP	DEP-IO	MAX-IO
a. ☞ μ dʒew					
b. μ μ dʒeww	*W	*W	*W	*W	
c. μ dʒe					*W
d. μ μ μ dʒewi	*W	*W	*W	*W	

The summary of the constraint ranking that accounts for the distribution of geminates in IBDs is provided in (78). The intervocalic geminates and single-vowel-adjacent germinates are allowed due to the low-ranked constraint *GEM/V_V and *GEM/1VA respectively. The glide and glottal consonants undergo degemination, which are assured by higher-ranking *GEMGUTT and *GEMGLIDE constraints.

(78) Constraint ranking responsible for the distribution of geminates in Sarawani Baloch

Intervocalic geminates	VGGV	FAITH μ, MAX-IO>> OCP, *GEM/ V_V
Single vowel-adjacent geminates	VGG#	FAITH μ, MAX-IO, DEP-IO >> OCP, *GEM/1VA
Word-final glottal consonants geminate	disallowed	FAITH μ, * GEMGUTT, OCP, DEP-IO >> MAX- IO
Word-final glide consonants geminate	disallowed	FAITH μ, * GEMGLIDE, OCP, DEP-IO >> MAX-IO

Based on all data analyses which have been done in IBDs geminate consonants so far, it can be claimed that typologically Balochi is among languages in which geminate glide consonants are disallowed. While there are many examples of obstruents and liquid geminate consonants in both word-final and intervocalic positions, there are no geminate consonants in word-initial position.

3.3 The Stress Pattern System in IBDs

3.3.1 Introduction

The fact that stress is the linguistic manifestation of rhythmic structure is regarded as the central assumption of metrical stress theory (Liberman 1975; Liberman & Prince 1977; Hayes 1995). In stress languages, one or more syllables in each content word are more prominent than others. Most stress languages distinguish two degrees of stress: stress and unstressed. Cross-linguistically stressed syllables have higher pitch levels, longer duration, and greater loudness than unstressed syllables (Kager 2007).

In many languages stress is phonologically predictable; however, the morphological structure of words such as affixes may affect the position of stress, these languages are known as ‘fixed stress’ languages. Whereas, in ‘free stress’ languages, word stress is lexically contrastive, so there are minimal pairs which differ only in terms of stress such as in Russian (see Hayes 1995; Kager 2007).

Balochi is a stress language. The stress patterns in Balochi differ among its dialects; in Western dialects such as in Sarhaddi Balochi, the stress is on the last syllable of a word, while in Southern dialects as in Lashari Balochi the place of stress depends on the weight of the syllable and finally in Eastern Balochi like in Marri, the last heavy syllable of a word is stressed (Jahani & Korn 2009).

IBDs generally can be considered as Balochi dialects in which the placement of stress in mono-morphemic words is largely predictable, in regularly falling on the rightmost heavy syllable, so IBDs have the fixed stress system as illustrated by the forms in (79):

(79) Primary stress in IBDs

a.i	*hændʒiːr*	[hæn.dʒíːr]	‘pigtail’
a.ii	*sobæk*	[so.bǽk]	‘light’
a.iii	*gohaːr*	[go.hɑ́ːr]	‘sister’

The present section consists of two subsections: Section (3.3.2) provides a description of the IBDs stress patterns based on metrical structure, section (3.3.3) gives an OT analysis of the linguistic data under investigation.

3.3.2 IBDs stress patterns: Metrical structure

In IBDs which stress placement is predictable, the segmental make-up of the syllables is relevant, as well as the position of a syllable in a word; thus heavy syllable likes to bear stress than light ones. The stress rules seek out a heavy syllable, so the stressed syllable is weight-sensitive. As discussed in section (3.1.4) the IBDs syllables types are as follows:

(80) Syllable types in IBDs

a. heavy: CV: (C), CVG, CVCC
b. light: CV, CVC, CCVC

As listed in (80), the CVC syllable is considered as a light syllable, it has been also explained in section (3.1.4) that the CVC syllable in IBDs sometimes patterns as light and sometimes as heavy, so the weight of the CVC syllable is based on its context within a word; this phenomenon is known as context dependent weight. In IBDs, the rightmost CVV syllable attracts primary stress, but if a word has no bimoraic syllable (CVG or CVCC) then CVC syllable surfaces as heavy and receives primary stress as in (81).

(81) Context dependent weight in IBDs

a.i	σ̀ σ́	*b̀ibiː́*	‘grandmother’
a.ii	σ̀ σ́	*guèluː́*	‘calf’
a.iii	σ̀σ́	*dʒòmaː́*	‘Friday’
a.iv	σ̀ σ́	*kòruː́s*	‘rooster’
a.v	σ̀σ̀	*zæ̀gaː́l*	‘carbon’

a.vi	σ́σ̀	*báːkæ̀s*	‘match’
a.vii	σ́σ̀	*tʃéːʃæ̀g*	‘cough’
a.viii	σ̀σ́	*ʔàːsmáːn*	‘sky’
a.ix	σ̀σ́	*ʔàːptáːb*	‘sun light’
b.i	σ́σ̀	*káːhgèl*	‘thatch’
b.ii	σ̀σ́	*hòrmáːg*	‘date’
b.iii	σ̀σ́	*hæ̀ngúːr*	‘grape’
b.iv	σ́σ̀	*tʃíːntʃòk*	‘pinky’
c.i	σ́σ̀	*kòtʃǽk*	‘dog’
c.ii	σ́σ̀	górdʒæ̀	‘tomato’
c.iii	σ̀σ́	sæ̀bǽt	‘basket’
c.iv	σ̀σ́	gæ̀rσǽg	‘core’
c.v	σ̀σ́	hòʃtér	‘camel’
d.i	σ́σ̀	*báːlèʃt*	‘pillow’
d.ii	σ́σ̀	*ʔáːdìnk*	‘mirror’

The generalization illustrated by the stress patterns in (81) is that the presence of heavy syllables affects stress: in 81a (i, ii, iii, iv,v, xi, x) or in 81b (i, ii, iii) mono-morphemic words ending in (CVV(C)) syllable receive final stress, whereas mono-morphemic words ending in the light syllable (CV) or (CVC) as in 81a (vi, vii) or 81b (i, iv) receive penultimate stress. However, in 81 (c.i- c.v) words do not have any (CVV(C)) syllables, so in the absence of long vowels, final CVC syllable becomes bimoraic and attracts the primary stress. 81d (i, ii) proves that CVV syllable is heavier than the CVCC syllable.

Moreover, if intervocalic geminate consonants occur in the mono-morphemic words then the penultimate CVC heavy syllable gets the stress like in 82a (i, ii, v) as discussed in section 3.2.2, geminate consonants are underlyingly moraic. Besides, in the mono-morphemic words with word-final consonant clusters, the main stress falls on final heavy syllable like in 82b (i, ii, iii) .There is an exception, though in 82b (iv, v), the primary stress falls on the penultimate heavy syllable and not in final CVCC syllable. It seems that in IBDs the CVV(C) syllable is heavier than CVCC and even CVG. Also I can conclude that CVG syllable is heavier than CVCC as in 82a (iv) Syllable.

(82) The primary stress in mono-morphemic words with intervocalic geminate or final clusters

a.i	σ́σ̀	*hénnà*	‘henna’
a.ii	σ́σ̀	*gǽtʃtʃæ̀l*	‘bed riders’
a.iii	σ́σ̀	*tʃǽllæ̀*	‘ring’
a.iv	σ̀σ́	*pǽllìnk*	‘pigtail’

a.v	σ́σ̀	*kúʈʈèk*	‘watermelon’
b.i	σ̀σ́	*bæ̀dræ̋ng*	‘cucumber’
b.ii	σ̀σ́	*mæ̀sésk*	‘fly’
b.iii	σ̀σ́	*hæ̀rgóʃk*	‘rabbit’

Based on the data in (81) and (82), it can be concluded that the heavy syllable hierarchy in IBDs is as follow:

(83) IBDs heavy syllable hierarchy
CVV(C) > CVG> CVCC > CVC > CV

The analysis of IBDs stress is straightforward. In most cases the calculation of stress must go from right to left. The foot template allows at most two syllables and is right- strong, Hayes (1995) calls this foot template ‘iamb’.

The formal representation of IBDs stress in metrical phonology is given in (84) for the binary foot as in kælporækɑːn ‘name of a village near Sarawan, Iran’, and, unary foot as in hormɑːg ‘date’ and degenerate foot as in mɑː́t ‘mother’. The two layers of metrical structure are considered for each word. The first layer is ‘foot construction’ and the second layer is ‘word construction’. The difference between primary and secondary stress can be determined by these layers (Hayes1995). Throughout this section, I will use flattened bracketed grid representations as in Hayes (1995). ( ) denote the foot boundaries; /**.** / completely stressless syllables and /× / stressed syllables.

(84) The formal representation of stress in IBDs

a.	(×) . (. ×)	b. (. ×)	c. (×)	Foot
	σ σ σ σ	σ σ	σ	Construction
	kæ̀lpo ræ kaː́n	*hòrmaː́g maːt*		
	(. ×)	(. ×)	(×)	Word Layer
	(×) (. ×)	(. ×)	(×)	Construction
	σ σ σ σ	σ σ	σ	
	kæ̀lpo ræ kɑː́n	hòrmɑː́g	*maːt*	

Now consider the representation of three syllabic mono-morphemic words as in *dʒæræmbɪk* ‘tarantula’, and *portægaːl* ‘orange’, indeed the final conclusion about the direction of foot construction in IBDs can be made based on (84) and (85).

(85) Foot construction in three syllabic words

a.	(. ×) (×)	b.	(×) (. ×)	Foot
	σ σ σ		σ σ σ	Construction
	dʒæræmbɪk		*portægaːl*	
	(. ×)		(. ×)	Word Layer
	(. ×) (×)		(×) (. ×)	Construction
	σ σσ		σ σσ	*dʒæræmbɪk*
				portægaːl

It seems that for making iambs in IBDs, we should go from left to right, and the final syllable attracts the primary stress. So IBDs have rightward iambs.

However, examples (86) appear to disagree with with iambic foot construction in IBDs:

(86) Primary stress in negative and prohibitive verb forms

a.i	*mǽ-wær*	‘Don’t eat!’
	Prohibitive marker-eat	
a.ii	*mǽ-jaː*	‘Don’t come!’
	Prohibitive marker- come	
a.iii	*mǽ-lut̪t̪*	‘Don’t want’
	Prohibitive marker- want	
a.iv	*nǽ -waːrt*	‘(s)he does not eat.’
	Negative marker- eat-Present.3SG	
a.v	*nǽ -hændaːn*	‘I do not laugh’
	Negative marker- laugh-Present.1SG	

(86) demonstrates that, the first light syllable, which is a prefix, gets the primary stress. That difference shows that morphology can also play a role in the stress system of the word: those in (81) and (82) are mono-morphemic words, while the words in (86) are complex words. Thus, *næ* and *mæ* are accent-bearing affixes; they override the stress pattern of the original morpheme and attract the primary stress.

Alderete (1999) considers two types of morphological influence on stress and pitch accent: (1) root-controlled accent and affix-controlled accent. In root-controlled stress, the root accent overrides the affix accent, but in affix-controlled accent, the presence of the particular affix triggers stem accent to be deleted, inserted or shifted. Thus, data in (86) exemplified the affix-controlled accent; in these examples indeed affix overrides the stem accent by shifting the primary stress to itself.

Now this question may be raised: ‘Does Morphology govern the accent in IBDs?’ or in other words, ‘Does word structure in IBDs affect the phonological categories like stress?’ To find the accurate ansir, let us examine more roots with other affixes in IBDs.

In (87), the position of primary stress in roots and affixes is shown. Indeed, in all examples, it is only phonology which governs the accent, and the default accentual structure is preserved no matter whether it is root or affix: if there is a long vowel then it is stressed as in 87(I), (II: a.iii, a.iv), (III: a.iii), (IV: a.i), and (V), in which final or penultimate heavy syllable (CVVC) gets the primary stress, otherwise final CVC syllable surfaces as heavy and attracts the primary stress as in 87(II:a.i, a.ii), (III: a.i), and (IV: a.v). Furthermore, in 87(I: a.iii) and (II: a.iii), the penultimate CVG as bimoraic syllable has primary stress.

(87)

(I)	- *aːn* (plural marker)		
	a.i	*drǽhtʃ+aːn → drætaː́n*	‘trees’
	a.ii	*ʈíːlæk + aːn →ʈiːlækaː́n*	‘eye-balls’
	a.iii	*kúʈʈek + aː́n →kuʈʈekaː́n*	‘watermelons’
(II)	– *en,-æg* (infinitive marker)		
	a.i	*hoʃké+ten → hoʃketén*	‘to hear’
	a.ii	*dʒǽn+ǽg → dʒænǽg*	‘to hit’
	a.iii	*dáːnt+ en→daː́nten*	‘to know’
	a.iv	*leː́tʃen+æg→leː́tʃenæg*	‘to stick’
(III)	–*ok* (diminutive marker)		
	a.i	*dohtǽr+ok → dohtærók*	‘young girl’
	a.ii	*miéh+ok →miéhok*	‘small nail’
	a.iii	*ṕotʃˈtʃ+ok →pótʃtʃok*	‘small cloth’
(IV)	– *ter* (comparative marker)		
	a.i	*ʈuː́h+ter →ʈuː́hter*	‘bigger’
	a.ii	*séll+tér → séllter*	‘worse’
	a.iii	*wǽʃʃ+ter →wǽʃʃter*	‘better’
	a.iv	*tǽhl+ter →tǽhlter*	‘bitterer’
	a.v	*sobǽk+tér → sobæktér*	‘lighter’
(V)	-*terien/ teriːn/teriən* (superlative marker)		
	a.i	*laː́ger+teriːn →laːgerteriː́n*	‘thinnest’
	a.ii	*sǽkk+terién →sækkterién*	‘roughest’
	a.iii	*haː́mæg+teriːn →haːmægteriː́n*	‘raist’
	a.iv	*ʃólleg +teriən → ʃollegteriə́n*	‘weakest’

Having discussed affixation, now I turn to compounding in IBDs. Compounds are morphologically complex units that include two or more lexemes. Compounds in IBDs typically have a Strong (S) weak (W) pattern. It means the primary stress of the entire compound falls on the primary stressed syllable of the first item of the compound and any other following stressed syllables bear the secondary stress. The compounds below in (88) show that this pattern holds regardless of the word categories of compound items, or the number of syllables in each item. It also does not matter whether the compound is endocentric (the semantic head is the second component of compounds) or exocentric (the semantic head is not part of the compounds itself).

(88) The primary stress in IBDs compounds
(I) Noun + Noun
 a.i *braː́+zǽhk →* *braː́zæ̀hk* ‘nephew’
 [[brother]$_N$[born]$_N$]]$_N$
 (exocentric)
 a.ii *bón+bǽllok → bónbæ̀llok* ‘grand grandmother’
 [[root]$_N$[grandmother]$_N$]]$_N$
 (endocentric)

 a.iii *pǽntʃ+ʃæḿmæ →pǽntʃʃæ̀mmæ* ‘Thursday’
 [[five] $_N$ [Saturday] $_N$]$_N$
 (exocentric)
 a.iv *tʃaː́r+ʃaː́næg →tʃáːrʃàːnæg* ‘strong man’
 [[four]$_N$[shoulder]$_N$]$_{ADJ}$
 (exocentric)
(II) Noun + Adjective
 a.i *sijaː́h+ dél→sijaː́hdèl* ‘stone heart’
 [[heart]N[black]ADJ]ADJ
 (exocentric)
(III) Noun + Verb
 a.i *gǽt̪t̪+geptén →gǽt̪t̪geptèn* ‘to bite’
 [[bite] $_N$ [to get] $_{stem}$]$_V$
 (endocentric)
 a.ii *waː́b+giː́ndæg → waː́bgiː̀ndæg* ‘to dream’
 [[sleep] $_N$ [to see] $_{stem}$]V
 (endocentric)

In (89), the metrical representations for *gǽt̪t̪ geptèn, sijaː́hdèl and bónbæ̀llok* are presented. The primary stress falls on the heavy syllable of first component of compound.

(89) Metrical representation of compound stress in IBDs

a.	(×) (. ×)	b. (. ×) (×)	c. (×) (×)	Foot
	σ σσ	σ σ σ	σ σ σ	Construction
	gǽʈʈ geptén	*sijaːʹh dél*	*bón bǽllok*	
	(×)(. ×)	(. ×) (×)	(×) (×)	Word Layer
	(×) (. ×)	(. ×) (×)	(×) (×) .	Construction
	σ σ σ	σ σ σ	σ σ σ	
	gǽʈʈ geptén	*sijaːʹh dél*	*boń bǽllok*	
	(× .)	(× .)	(× .)	Compound-
	(×) (. ×)	(. ×) (×)	(×) (×)	word Layer
	(×)(. ×)	(. ×)(×)	(×) (×)	Construction
	σ σ σ	σ σ σ	σ σ σ	
	gǽʈʈ geptèn	*sijaːʹh dèl*	*bónbællòk*	

Furthermore, the distribution of stress in verb forms occurs in the following way:

(a) In the simple present and present perfect like in examples (91), the primary stress goes to the final heavy syllable, here it means personal ending, if it contains a long vowel such as in (a. i) and (a.iii). But in the absence of a long vowel in both root and personal ending, the final CVCC syllable gets the stress as in (a. iv), or CVC syllable in the personal ending surfaces as the heavy syllable like in (a. v). Otherwise, as it is shown in (a.ii) the long vowel in the root attracts the primary stress.

(90) The distribution of stress in present tense in IBDs

(I) a.i *daːʹn +aːn →dàːnaːʹn* ‘I know’’
know, Present- Personal ending 1.SG
a.ii *dʒaːʹ+j+it* → dʒɑːʹjit ‘(s)he chews’
chew, Present- consonant hiatus- Personal ending, 3.SG
a.iii *dʒǽn+ iːn →* *dʒæniːʹn* ‘I hit’
hit, Present- Personal ending,1.PL
a.iv *wæptǽg+ejt→wæptægéjt* ‘You have slept’
sleep, Perfect- Personal ending ,2.PL
a.v *ræw+ej→rǽíj* ‘You go’
go, Present.2SG

(b) The primary stress pattern in simple past and past perfect as illustrated in 90(II) follows the same pattern as in present tense 90(I). In (b.i) and (b.iv), the final heavy syllable (personal ending) gets the primary stress; however, in (b.ii) the penultimate heavy syllable attracts the stress in the absence of the long vowel in the personal ending.

(II) b.i *waː́rt+iːt →waːrtiː́t* ‘You ate’
eat, Past- Personal ending,2.PL
b.ii *zaː́nt+it →zaː́ntit* ‘(s)he knew’
know, Past- Personal ending,1.SG
b.iii *hændést+ent →hændestént* ‘They laughed’
laugh, Past- Personal ending, 3.PL
b.iv *waː́ptæt+aːn →waːptætaː́n* ‘I had slept’
sleep, Perfect- Personal ending, 1.SG

In sum, based on the examples in 90 (I) and (II), the default accentual structure in IBDs is preserved in all types of verb forms.

3.3.3 IBDs stress pattern system in optimality theory

This section presents the optimality-theoretic analysis of the preliminary metrical representations of IBDs data developed in section 3.3.2. As discussed already, the foot type in IBDs is iamb, and in most cases the feet are binary though unary or degenerate feet are allowed as well. Further, the direction of syllable parsing is from left to right. So, the left to right binary foot will be determined by ranking the following constraints (e.g. Kager 1999, McCarthy 2008, and Kager 2007):

(91) PARSE-SYL
Syllables are parsed by feet.

(92) FT-BIN
Feet are binary under moraic or syllabic analysis.

(93) ALL-FT-LEFT
‘Every foot stands at the left edge of the PrWd (prosodic word).’

Moreover; as data shown, IBDs is an example of the quantity- sensitive language, which means the weight of the syllable affects the stress position. So, heavy syllables attract the primary stress. In OT this phenomenon is enforced by the following constraint (Kager 1999a):

(94) Weight-To- Stress Principle (WSP)
Heavy syllables must be stressed. (If heavy, then stressed.)

Thus, if the non-heavy syllable gets the primary stress, then this constraint is violated. Besides, the position of primary stress in IBDs as the data illustrate, is on the right edge of the prosodic word. It can be shown by constraint (95):

(95) ALIGN-HEAD- R
‘The PrWd ends with the primary stress.’
(Kager1999)

The other important constraint which is relevant for our data analysis is PEAK PROMINENCE (Kager 207:215) which measures the syllable weight degrees. It requires the stress falls on the heaviest syllable according to the syllable parse direction.

(96) PEAK PROMINENCE (PK-PROM)
Peak (x) is more harmonic than peak (y) if ǀxǀ > ǀyǀ.

3.3.3.1 An OT analysis of mono-morphemic words

Focusing on the position of primary stress in disyllabic mono-morphemic words like examples in (83) leads us to the following rankings:

(97) FT-BIN, PARSE-SYL >> ALIGN-HEAD- R>> WSP, PK-PROM

As above ranking shows, FT-BIN, PARSE-SYL constraints are undominated constraints. The first constraint requires the prosodic word parsed by feet and the second enforces feet to be binary. ALIGN-HEAD- R shows that the right edge of the foot has the primary stress. WSP requires the primary stress falls on the heavy syllable and PK-PROM needs the heaviest syllable attract the stress. Tableaux (98) - (100) represent the above ranking for the selected data from (81).

The first three examples *guelː*, *koruːs* and *baːkæ*s, all contain long vowel in final or penultimate syllables. As a default accentual structure in IBDs, the long vowel attracts the primary stress since it is in the top of the IBDs syllable weight hierarchy. Now consider the following tableaux (my analysis focus only on the position of primary stress):

(98) *gueluː* [gueluː́] ‘calf’

Input: gueluː	FT-BIN	PARSE-SYL	ALIGN-HEAD- R
a.☞ (gue.luː́)			
b. (gué.luː)			σW
c. (gué).luː	*W	*W	
d. gue.(luː́)	*W	*W	

In tableau (98), the optimal candidate is candidate (a) since it satisfies all constraints; *gueluː* has a sequence of two heavy syllables and as accentual default structure in IBDs, stress falls on the rightmost heavy syllable. Candidate (b) is not optimal since the penultimate heavy syllable gets the primary stress which violates the ALLGN-HEAD-R. Besides, two other loser candidates violate the higher ranked constraints namely FT-BIN and PARSE-SYL, since they have a parsed syllable and a non-unary foot.

(99) *koruːs* [koruː́s] ‘rooster’

Input: koruːs	FT-BIN	PARSE-SYL	ALIGN-HEAD- R	PK-PROM	WSP
a.☞ (ko.ruː́s)					
b. (kó.ruːs)			σW	*W	*W
c. ko.(ruːś)	*W	*W			
d. (kó).ruːs	*W	*W	σW	*W	*W

As tableau (99) demonstrates, all candidates except candidate (a) have at least two violation marks. Candidate (d) does not satisfy any of ranked constraints since it has unary foot and the light penultimate syllable gets the primary stress which is against the accentual default structure in IBDs. Candidate (b) satisfies undominated constraints, but it has three fatal violations. Finally candidate (c) violates both undominated constraints; as a result, the optimal candidate is candidate (a).

(100) *baːkæs* [bɑː́kæs] ‘match’

Input: koruːs	FT-BIN	PARSE-SYL	WSP	PK-PROM	ALIGN-HEAD- R
a.☞(bɑː́.kæs)					σ
b. (bɑː.kǽs)			*W	*W	L
c. (bɑː́).kæs	*W	*W			L
d. bɑː.(kǽs)	*W	*W	*W	*W	L

As the above tableau represents, all candidates even the optimal one have a violation mark. The winner is candidate (a) which satisfies all the higher ranked constraints and its violation is not fatal. In candidate (b), the primary stress is attracted by light syllable which is against the WSP and PK-PROM. Both candidates (c) and (d) violate the higher ranked constraints namely FT-BIN and PARSE-SYL.

Now, consider the next three tableaux which evaluate the candidates as inputs of data in (82). All examples in (82) have intervocalic geminate or final CC cluster (CVCC) or CVC syllable, but no long vowels not in final nor in penultimate positions. The following three tableaux represent the optimal output for these inputs: gærdæg, kuʈʈek, and Pællink. The constraint ranking for these inputs is as tableau (98).

(101) *gærdæg* [gærdǽg] ‘core’

Input: gærdæg	FT-BIN	PARSE-SYL	ALIGN-HEAD-R
a. ☞(gær.dǽg)			
b. (gǽr.dæg)			σW
c. (gǽr).dæg	*W	*W	σW
d. gær.(đǽg)	*W	*W	

Tableau (101) illustrates the example in which weight -by -position applies. As there are no long vowels or bimoraic syllable, then the consonants in the coda positions becomes moraic. So we have the sequence of HH syllables, since in IBDs the rightmost heavy syllable gets the primary stress so both candidates (b) and (c) are losers. Candidate (a) is winner, because it has no violations marks. Candidate (d) satisfies the lower ranked constraint ALIGN-HEAD-R, but violates all higher ranked constraints, so it is definitely a loser.

(102) *kuʈʈek* [kúʈʈek] ‘watermelon’

Input: kuʈʈek	FT-BIN	PARSE-SYL	WSP	PK-PROM	ALIGN-HEAD-R
a.☞(kúʈ.ʈek)					σ
b. (kuʈ.ʈék)			*W	*W	L
c. (kúʈ).ʈek	*W	*W			σ
d. kuʈ.(ʈék)	*W	*W	*W	*W	L

Tableau (102) demonstrates the representation of the position of primary stress in a mono-morphemic word with intervocalic geminate, as discuss in section 3.2 the geminate is underlyingly moraic in IBDs, so the first syllable is the heavy syllable and attracts the primary stress which is against ALIGN-HEAD-R constraint. While candidates (b) and (d) satisfy the ALIGN-HEAD-R, they have at least one fatal violation. Candidate(c) not only violates the lower ranked constraint ALIGN-HEAD-R, but also violates both undominated constraints. Thus candidate (a) is an optimal candidate, eventhough it has a non-fatal violation.

(103) *pællink* [pǽllȉnk] ‘pigtail’

Input: pællink	FT-BIN	PARSE-SYL	WSP	PK-PROM	ALIGN-HEAD-R
a.☞(pǽl.link)			*		σ
b. (pæl.línk)			*	*W	L
c. (pǽl).link	*W	*W	*		σ
d. pæl.(línk)	*W	*W	*	*W	L

In Tableau (103), relevant candidates for input *pællink* are understudied. In this case, two heavy syllables namely CVG and CVCC compete to attract the primary syllable. It is expected that final heavy syllable CVCC gets the primary stress, but as CVG syllable in IBDs is heavier than CVCC, then it gets the primary stress. Candidate (a) is a winner candidate, it satisfies all higher ranked constraints and its violation is not fatal.

3.3.3.2 An OT analysis of primary stress position in compounds

The accentuation of compounds in IBDs shows that the first component of compounds gets the primary stress of the entire compound. So, based on this pattern the primary stress falls on the left most of whole compound edge. Although, the bare mono-morphemic words may have final heavy syllable stressed, compounds may not. Besides, the position of primary stress in compound does not depend on the number of syllables or whether the compound is right headed or left headed. Returning to the OT analysis, the following constraints are needed:

(104) $\text{NONFINALITY}_{\text{p-Comp}}$
The final syllable of compound may not bear accent (stress)
(Alderete 1999)

(105) PROS-FAITH
The prosody features in input and output are identical.
(Alderete 1999)

(106) ALIGN-HEAD-L (PROM- Comp)
The left edge of compound gets the primary stress.

The ranking responsible for the above constraints is as in (107). $\text{NONFINALITY}_{\text{p-Comp}}$ is ranked higher, and thus the primary stress is not allowed to fall on the final heavy syllable of compound.

(107) NONFINALITY$_{\text{p-Comp}}$, ALIGN-HEAD-L (PROM- Comp) >> PROS-FAITH

Tableau (108) evaluates the optimal candidate for the input *tʃaːrʃaːnæg* ‘strong man’. As it is shown, candidate (a) is a winner form. It satisfies both undominated constraints, and has a violation which is not fatal. In candidate (b), the primary stress falls on the penultimate syllable of the compound which is against the ALIGN-HEAD-L (PROM- Comp), so it is a loser. Candidate (c) is eliminated, since the final syllable of second component gets the primary stress which violates the higher ranked constraints.

(108) *tʃáːr+ʃáːnæg* → [*tʃáːrʃaːnæg*] ‘strong man’

Input: /tʃɑ́ːr+ʃɑ́ːnæg/	NONFINALITY$_{\text{p-COMP}}$	ALIGN-HEAD-L(PROM- Comp)	FAITH-PROS
a. ☞tʃɑ́ːrʃɑːnæg			*
b. tʃɑːrʃɑ́ːnæg		σW	*
c. tʃɑːrʃɑːnǽg	*W	σσW	*

3.3.3.3 An OT analysis of primary stress position in root with an affix

As the data in (87) illustrate, the morphology governs the accent in IBDs only in the case of prohibitive and negative forms of the verb. In these two cases, the prefixes *mæ* and *næ* get the primary stress; howver they have light syllable. It seems the position of primary stress in these forms of the verb is just like compound stress as explained in 3.3.3.2. It means these two prefixes make a prosodic compound with the roots, so the leftmost syllable attracts the primary stress. Consequently, an optimal output is not faithful to the root accent and it violates following faithfulness constraint suggested by (Alderete 1999):

(109) FAITH (Accent)$_{\text{Root}}$
‘Root- controlled accent’

Two more constraints which are involved in final ranking for an input with negative or prohibitive prefix are famous faithfulness constraints which militate against the stress deletion and stress insertion namely MAX- PROM and DEP-PROM (Alderete 1999).

With these constraints in hand, the affix-controlled accent such as (87) can be defined in OT by higher ranking MAX-PROM $_{\text{Affix}}$ as in (110):

(110) MAX-PROM $_{\text{Affix}}$>> MAX-PROM $_{\text{Root}}$, FAITH (Accent) $_{\text{Root}}$

The following tableau represents the above ranking for input *mæhænd* ‘Do not laugh!’ As it is shown, all candidates have at least one violation. Candidate (a) is an optimal form; it has the primary stress in its affix, so it satisfies undominated constraint, but violates lower ranked constraints, which is not fatal. Candidate (b) is eliminated, since it is faithful to root accent and militate against the higher ranked constraint namely MAX-PROM $_{\text{Affix.}}$

(111) *mæ + hǽnd* →[mǽhæ̀nd] ‘Do not laugh!’

Input:/mæ+hǽnd/	MAX-PROM $_{\text{Affix}}$	MAX-PROM $_{\text{Root}}$	FAITH(Accent)$_{\text{Root}}$
a. ☞mǽhænd		*	
b. mæhǽnd	*W	L	

On the other hand, data in (88) demonstrate that the primary stress pattern in the root with other affixes preserves the default accentual structure in IBDs and word category (affix or root) does not have any role. For example in the root with an infinitive suffix like in *dáːnten* ‘to know’ the long vowel in the root gets the stress, whereas in *hoʃketén* ‘to hear’ the final heavy syllable in the suffix attracts the primary stress. The relevant constraints for OT analysis of these examples are ranked as bellow:

(112) ALIGN-HEAD- R>> WSP, PK-PROM

(113) WSP, PK-PROM >> ALIGN-HEAD-R

Ranking (112) actually deals with the input in which two heavy syllables compete to get the primary stress, but as the basic accent rule in IBDs, the rightmost heavy syllable attracts the stress such as *hòʃketén*, so ranking (112) insists on the edge of the syllable, whereas ranking (113) is (112) reranking indeed, and is relevant for an input with only one heavy syllable no matter in right edge or left edge, it then gets the primary as in dɑ́ːntèn, and thus the constraint ranking in (113) focuses on syllable weight and not syllable edge.

The following two tableaux demonstrate the above rankings for inputs hoʃketén and dɑ́ː*nten* respectively.

(114) *hoʃkét+ en →hoʃketén* ‘to hear’

Input:/hoʃkét+en/	ALIGN-HEAD- R	WSP	PK-PROM
a.☞ hoʃketén		*	*
b. hóʃketen	σσW	*	*
c. hoʃkéten	σW	**W	**W

In tableau (114), the optimal candidate is (a), it satisfies the undominated constraint by violating two other two constraints which deal with syllable weight. Both candidate (b) and (c) are losers; they do not satisfy any undominaed nor dominated constraint.

(115) *dáːnt + en → dáːnten* ‘to know’

Input:/ dɑ́ːnt + en/	WSP	PK-PROM	ALIGN-HEAD-R
a.☞ dɑ́ːnten			σ
b. dɑːntén	*W	*W	L
c. dɑ́ːntén	*W	*W	σ

As tableau (115) shows, all constraints have at least one violation. In candidate (a), primary stress falls on the heaviest syllable, however it is not in right edge. So it satisfies undominated constraints and has a non-fatal violation. Both candidates (b) and (c) do not satisfy any higher ranked constraints nor lower ranked constraint, so they are eliminated. Thus, the optimal form is candidate (a).