Lexical Stress in Northeastern Pashto

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1 Introduction

Pashto (in Northeastern Pashto: /poχto/) is an Indo-Iranian language spoken primarily in Afghanistan and northern Pakistan (Robson & Tegey, 2009). Our language consultant for this study hails from Peshawar, Pakistan and is a native speaker of the northeastern dialect of the language. Born in the region in 1983, and raised there until adulthood, our consultant reports using Pashto as a primary language between friends, family, and acquaintances. In addition to Pashto, he also uses Urdu and English regularly.

Among Indo-Iranian language, Pashto is unique in employing stress in a phonemic capacity (Robson & Tegey, 2009). Kager (2007) notes that in these such "'free stress' languages, word stress is lexically contrastive, resulting in minimal pairs that differ in terms of stress alone" (p. 1). Moreover, as we will note in table (5), Pashto also possess a number of morphological tokens that attract stress. As such, the phonological operation of stress is of importance to a well-rounded description of Pashto's metrical properties. A preliminary analysis of Pashto's metrical structure is proposed in §4.

Though we wish to concern ourselves with the metrical structure of the language, we must also note that the acoustic correlates of stress in the language have not been well-defined in the past literature, and thus we first seek to evidence some of the acoustic correlates of lexical stress in the language. As Kager (2007) notes, "there is no unique phonetic property corresponding to stress, although it is cross-linguistically highly common for stressed syllables to have higher pitch levels, longer duration, and grouter loudness than unstressed syllables" (p. 1). These such acoustic properties and their relation to lexical stress in Pashto will be explored in §3; prerequisite to approaching a metrical analysis of the language's phonology. Overall, the current paper seeks to clarify both the acoustic and phonological properties of lexical stress in the language by proposing preliminary findings in both areas.

2 Background

Past researchers have described Pashto as a language that makes use of phonemic stress (Robson & Target, 2009; Babrakzai, 1999; Shafeev, 1964), a feature that distinguishes it from other Iranian languages (Robson & Tegey, 2009). The table below illustrates a number of minimal pairs that are born from the contrastive use of stress in the language, originating from multiple past sources:

(1) Contrastive stress in Babrakzai (1999, p. 8)

Pashto	**Gloss**
d͡ʒóɭa	'peace / well (f)'
d͡ʒoɭá	'pair'
ɖánɖa	'pond'
ɖanɖá	'bat, club'
téra	'past'
terá	'sharp'

(2) Contrastive stress in Robson & Tegey (2009, p. 725)

Pashto	**Gloss**
ʈánga	'pear tree'
ʈangá	'cart'
ʁúʈa	'knot'
ʁuʈá	'dive!'
áspa	'mare [female horse]'
aspá	'spotted fever'

Our language consultant notes that each of the forms above are recognizable in his native Northeastern Pashto. As Babrakzai (1999) and Robson & Tegey (2009) employ data from the Central dialect of Pashto, we may note little deviation in the use of contrastive stress between regional varieties of Pashto (see also Shafeev, 1964 for a brief discussion of contrastive stress in Western Pashto). Summarily, Robson & Tegey (2009) note that while in Pashto "stress is not predictable, as a general rule, stress is on the last syllable when ending in a consonant, and on the penultimate syllable if the last syllable ends in a vowel" (p. 725). Indeed, this generalization is also true of much of the data we have elicited in Northeastern Pashto (particularly with respect to nouns), a summary of which is illustrated below:

(3) Regular stress placement in Northeastern Pashto

Pashto	**Gloss**
asmán	'sky'
χawʌ́nd	'husband'
zaŋgál	'forest'
má:lga	'salt'
lá:ɾa	'road'
χáza	'woman'

It is nevertheless quite common to come across tokens in Pashto that are both vowel-final and put stress on the ultimate syllable, or alternatively, are consonant-final and place stress on the penultimate syllable. This is in contrast to the general rule of stress placement in Pashto as proposed by Robson & Tegey (2009), and speaks to the unpredictability of stress in the language. See the nouns below:

(4) Irregular stress placement in Northeastern Pashto

Pashto	**Gloss**
tʃuká	'stick'
saɾé	'adult male'
záŋgun	'knee'
tóχəm	'seed'

Indeed, such exceptions to the rule are sure to exist in any language employing stress in a contrastive capacity. It is with this in mind that we also introduce the existence of stress-attracting morphemes in the language. Though they do not assist in creating conformity to the general rule of stress in Pashto, they are "the sole cases of predictable stress" in the language (Robson & Tegey, p. 726). These morphemes include: mə- (prohibitive prefix), nə- (negative prefix), wə- (perfective prefix). Examples of such affixes are given in the table below:

(5) Stress-attracting morphemes in Pashto (Robson & Tegey, 2009)

Pashto	**Gloss**
daredə́m	'I was standing'
nə́daredəm	'I wasn't standing'
wə́daredəm	'I stood'
wə́nə́daredəm	'I didn't stand'

The examples above illustrate the ability for lexical stress to be displaced in conjunction with the use of such stress-attracting affixes. In the case of "I was standing" /daredə́m/, which employs no such affixes, stress is located in ultimate position. In the two derivations that follow, stress moves to the location of affixation. Curiously, we notice that two instances of stress are found in the derivation "I didn't stand" /wə́nə́daredəm/, which employs two of the stress-attracting morphemes. Aptly, Shafeev's notes that "in morphology and derivation the stress can be moved from one syllable to another" (1964, p. 5). In this case, not only does the stress move from the initial construction, but another is generated.

Indeed, this leads to questions regarding the specific phonological operations of stress movement and adjacent stressed syllables evidenced in the language. Additionally, we are prompted to seek where primary stress occurs in constructions employing multiple stress-attracting morphemes, as in "I didn't stand" /wə́nə́daredəm/ (both stresses here are denoted with a rising accent marker, though transcribed in

the original source with an underlined vowel, and thus not distinguished between primary and secondary stress). These questions are explored in the following sections, which will first concern themselves with phonetic observations on the Northeastern Pashto data (§3), and subsequently with an analysis of the metrical structure of lexical stress from an Optimality Theoretical perspective (§4).

3 Acoustic Correlates of Stress

3.1 *Recordings* For the purposes of this study, we have asked our consultant to record 15 sentences (2 repetitions each). These constructions employ the same verb and subject, but vary in their conjugations, incorporating the use of the stress-attracting affixes introduced in §2. Such sentences allow us to view the movement of stress as it is impacted by affixation, and removes the variation that may otherwise be introduced by the use of content words employing varying stress patterns. The data is presented in the following table; it is annotated for both primary and secondary stress (denoted by a high and low accent, respectively).

(6) Stress-attracting morphemes and conjugation patterns

	Gloss	**Pashto**
a.	The man is eating	/səɭé χwaɾák kawí/
b.	The man isn't eating	/səɭé χwaɾák nə́-kawì/
c.	The man was eating	/səɭí χwaɾák kawó/
d.	The man wasn't eating	/səɭí χwaɾák nə́-kawò/
e.	The man ate	/səɭí χwaɾák wə́-ko/
f.	The man didn't eat	/səɭí χwaɾák wə̀-ná-ko/
g.	Is the man eating?	/səɭé χwaɾák kawí ja na/
h.	Is the man eating?	/səɭé χwaɾák kawí↗[1]/
i.	Is the man not eating?	/səɭé χwaɾák nə́-kawì↗/
j.	Was the man eating?	/səɭí χwaɾák kawó ja na/
k.	Was the man eating?	/səɭí χwaɾák kawó↗/
l.	Was the man not eating?	/səɭí χwaɾák nə́-kawò↗/
m.	Did the man eat?	/səɭí χwaɾák wə́-ko↗/
n.	Did the man eat?	/səɭí χwaɾák wə́-ko ja na/
o.	Did the man not eat?	/səɭí χwaɾák wə̀-ná-ko↗/

Immediately, just as was detailed in §2, we may observe that stress is attracted to the negative prefix /nə̀-/ (as in b, d, f, etc.), and the perfect prefix /wə̀-/ (as in e, f, etc.). Thus, it stands to reason that Northeastern Pashto does not deviate from the past literature in terms of stress-attracting morphemes. Moreover, our recordings permit us the opportunity to note secondary stress in addition to primary stress. Here we note that the utterance-initial /səɭí/ shows an irregular stress pattern, whereas the noun /χwaɾák/ 'man' employs a regular pattern. With respect to the verb 'to eat', the stress pattern is also irregular, located word-finally (see a and c), however in the cases where stress is mandated in adjacent stress-attracting morphemes, the latter receives primary stress (see examples f and o). These observations are explores in more detail in the following section.

3.2 *Primary Stress* Correlates of stress differ by language; in English this is primarily associated with fundamental frequency and intensity (Lieberman, 1960; Kunter & Schramm, 2011); vowel length also plays a consistent role in demarking stressed syllables in English and Swedish (Fant, Kruckenberg & Nord, 1991); also attested are duration and amplitude as well as the f0 movement in pitch accent in Greek (Arvaniti, 2000). Among Iranian languages, Wakhi is noted as taking pitch frequency (f0) and duration as primary correlates of stress (Ivanov & Silanteva, 2020); while length is pointed to as the most consistent indicator of lexical stress in Persian (Sadeghi, 2011).

In order to understand the correlates of primary stress in Pashto, we sought to analyze a few phonetic properties of the words elicited. In this case, the primary focus was on two aspects: pitch, and length.

[1] The grapheme '↗' Indicates sentence-level rising intonation; located in certain question construction forms volunteered by the consultant.

Where we observed bisyllabic words, containing just one stress (whose locations were informed by our consultant), each of these aspects appear to correlate with the existence of primary stress to some degree. For instance, Figure 1 illustrates both the pitch prominence in the second syllable of the word /səɭé/ as well as its comparative length.

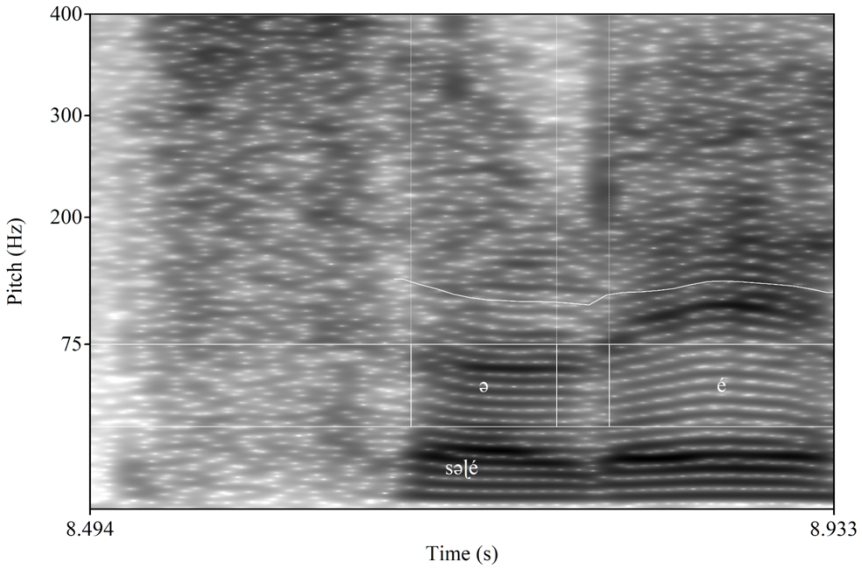

Figure 1: The pitch track across the spectrogram of /səɭé/ in /səɭé χwarák kawí/ 'the man isn't eating'

Our consultant tells us that the word that follows, /χwarák/ 'man', also contains stress in the ultimate syllable. However, whereas the difference in pitch between the unstressed and stressed syllables of /səɭé/ in Figure 1 were very evident, the same cannot be said as resolutely about the /χwarák/. A spectrogram and pitch track are supplied in Figure 2:

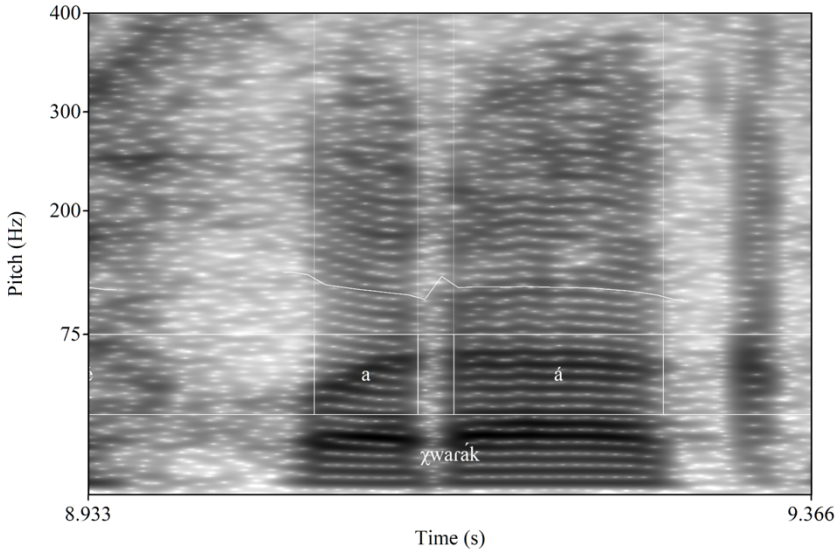

Figure 2: The pitch track across the spectrogram of /χwarák/ in /səɭé χwarák kawí/ 'the man isn't eating'

Indeed, here the pitch pattern is not so pronounced as in Figure 1. Whereas the pitch begins to fall at the location of the first (unstressed) syllable, and does indeed show a dip preceding the second syllable (stressed), the prominence does not show such a great contrast as in Figure 1. Nevertheless, it is viewable from this figure as well that prominence is held for the length of the nucleus of the stressed syllable, and thus we may hypothesize that pitch possesses at least some relation to stress in Pashto. Again, here we

notice the length of the stressed vowel in comparison with the unstressed vowel. Indeed, this would appear to suggest that length also plays a role in distinguishing stress in Pashto, and thus we proceed with our analysis keeping these observations in mind. It may also be noted that in general, the role of length in stressed syllables (and perhaps additionally, pitch) is consistent with past literature on Iranian languages and their acoustic correlates of stress.

3.3 *Secondary Stress* In table (6), both primary and secondary stress is given for sentence constructions incorporating multiple stress-attracting affixes. In Figure 3, we supply the pitch track of /wànáko/ 'PRF-NEG-eat' against a spectrogram of the word in question. The excerpt originates from example (f): /səl̪í χwarák wànáko/ 'the man didn't eat'.

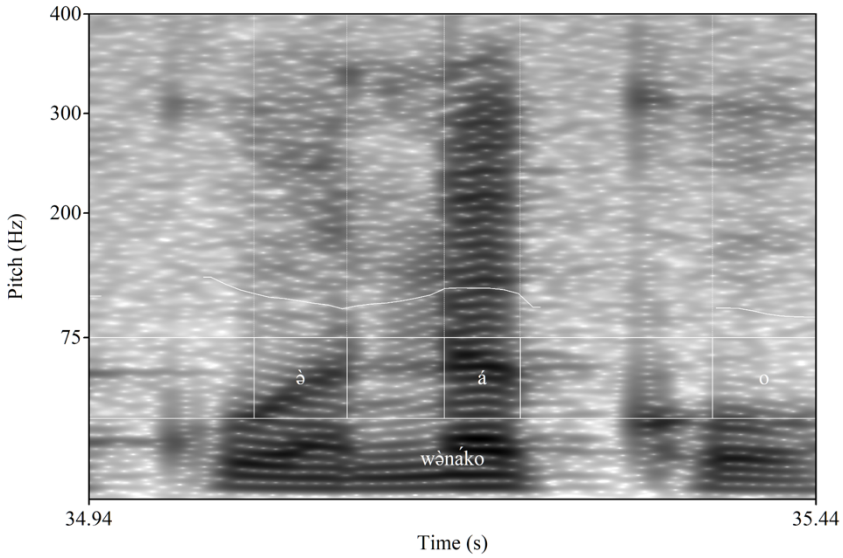

Figure 3: The pitch track across the spectrogram of /wànáko/ in /səl̪í χwarák wànáko/ 'the man didn't eat'

Evident from Figure 3 is that the pitch peak occurs in the area of the second vowel formant, which overlaps with the word-medial negative affix /nà-/. This peak is preceded by a dip following the initial syllable, followed by a rise to prominence, which is then sustained across the duration of the second syllable nucleus. Additionally, we note that the pitch prominence of the second syllable follows a similarly high prominence at the beginning of the word-initial syllable, indicating the possible location of a secondary stress, on /wà-/. As this affix is well established in the literature as stress-attracting, and indeed as past authors have parsed it as stressed in instances where it is found adjacent equally stress-attracting affixes (see the Robson & Tegey, 2009 data in table 5), so to do we in this instance assign it stress. Specifically, we denote secondary stress based on the phonetic factors available to us. This decision is further informed by our observation of the general decline in the prominence of pitch across the length of the word in Figure 3. Our hypothesis thus proposes that vowel length and pitch work in tandem to delineate primary and secondary stress in the language. However, further phonetic and statistical analysis is necessary in order to establish the strength of the relationship.

4 Metrical Structure

The following examples serve to illustrate one way in which we might foot the syllables of a handful of sentences elicited. In the initial cases we will see, bisyllabic feet are constructed, with stress conforming to a standard iambic pattern (i.e. employed bisyllabic unstressed-stressed feet). Note that sentence-level stress is not considered in the following metrical grids:

(7) Tentative iambic footing of lexical stress in the sentence ‘the man is eating’

Level	
Word	(x) (x) (x)
Foot	(_ x) (_ x) (_ x)
Syllable	σ σ σ σ σ σ
	sə.ɭé χwa.ɾák ka.wí
	‘the man is eating’

(8) Tentative iambic footing of lexical stress in the sentence ‘the man was eating’

Level	
Word	(x) (x) (x)
Foot	(_ x) (_ x) (_ x)
Syllable	σ σ σ σ σ σ
	sə.ɭí χwa.ɾák ka.wó
	‘the man was eating’

Indeed, the simple metrical pattern proposed in the above two examples would suppose iambic foot structure, though as we are well aware from the data in table (4), not all words conform to the general rule of stress placement in the language. Even here, both /səɭé/ and /kawí/ break the general stress placement rule, as they are expected to put stress on the initial syllable given that these words are vowel-final; however, this is not the case. Additionally, we must ask how to rectify the issue of expecting conflicting footing patterns in words such as /χáza/ ‘woman’, which follows a trochaic pattern; and /asmán/ ‘sky’, which follows an iambic pattern.

In order to account for the question of how to Pashto stress and footing interact, we must consult a set of words with greater syllable counts. These will alow us to view more clearly the location of multiple stresses at the word level, including how they may alternate, and where the primary stress seems to occur. A list of such words—provided by our consultant throughout multiple elicitation sessions with collaborators on this project—is illustrated in the tables that follow:

(9) Lexical stress location in Pashto words (4 syllables)

	Pashto	**Gloss**
Verbs (Trochaic)	/**ó**.do.**rè**:.dəl/	210 ‘stand (verb-inf)’
	/**gχó**.ru.**zè**:.dəl/	212 ‘fall (verb-inf)’
	/**wí**.ja.**ɾè**:.dəl/	224 ‘fear (verb-inf)’
	ú.da.**kè**:.dəl/	225 ’sleep (verb-inf)’
Verbs (Iambic)	/ni.**t͡ʃó**:.ɭa.**wə̀ l**/	264 ‘squeeze (verb-inf)’
	/gu.**zá**:.ɾa.**wə̀l**/	272 ‘throw (verb-inf)’

In the above forms, we can observe two general patterns of stress in 4-syllable Pashto verbs (infinitive forms). The first of such patterns assumes trochaic feet beginning at the left boundary of the prosodic word, thus amassing two stresses in the process (on the first and third syllables, respectively). Preliminary acoustic analysis also points to the location of primary stress on the initial foot, and secondary stress on the latter foot. This would seem to indicate that stress is applied left to right in the prosodic word (where the leftmost stress shows peak prominence). In contrast, we also see forms reminiscent of iambic footing: primary stress on the second syllable, and final stress on the fourth syllable. Here too, primary stress begins at the leftmost stressed syllable, with the fourth syllable receiving secondary stress. Next, we will consider the wider set of 3-syllable words in the data:

(10) Lexical stress location in Pashto words (3 syllables)

	Pashto	**Gloss**
Nouns (Trochaic)	/**zá**.na.**wàr/**	57 ‘animal’
	/**zá**.na.**nà**/	173 ‘woman’

Noun (Iambic)	/saɾ.**má**.na/	66 ‘skin’
	/ha.**dú**.ke/	69 ‘bone’
	/wa.**zá**.ɾa/	75 ‘feather’
Verbs (Trochaic)	/**gár**.ze.**dəl**/	205 ‘walk (verb-inf)’
	/**tá**:.we.**dəl**/	211 ‘turn (verb-inf)’
	/**pré**:.wa.**təl**/	213 ‘fall (verb-inf)’
Verbs (Iambic)	/swa.**zé**:.dəl/	170 ‘burn (verb-inf)’
	/paɭ.**sé**:.dəl/	186 ‘swell (verb-inf)’
	/ga.**ɾá**.wəl/	195 ‘scratch (verb-inf)’
	/kha.**nás**.təl/	196 ‘dig (verb-inf)’

The data above illustrate the same two patterns found in iambic pattern, where the even syllables are stressed; or they follow a trochaic pattern, where the odd syllables are stressed. Interestingly, we can observe a number of things from the above forms: that both nouns and verbs can take either stress pattern, as previously the only four-syllable words available to us were verbs; and that given the appearance of the iambic forms in (9) and the trochaic forms in (10), we can conclude that word-final syllables can receive stress. With these observations in mind, we turn now to a preliminary OT analysis.

4.1 *Analysis* The following analysis of the metrical structure of Pashto stress will assume a framework in Optimality Theory (Prince & Smolensky, 2002), and will begin by proposing a number of constraints to account for the present data. Evidenced by the lexical stress patterns observed in §4.1, prosodic words in Pashto appear to follow a binary system, meaning that “stressed and unstressed syllables alternate by binary intervals, so that all odd-numbered or even-numbered syllables, counting from the left edge or the right edge of the word, are stressed” (Kager, 2007, p. 12). In line with the constraints detailed in Kager (2007), we first propose the following:

Rule 1) PARSE-SYL: A violation is incurred if a syllable is not parsed in a foot

Rule 2) FOOT-BIN: A violation is incurred if a foot is not binary

In the following table, we illustrate the required ranking of these two constraints, such that the optimal candidate is selected (with respecte to footing). In this case, we know that foot binarity is a constraint that is not strictly imposed by the Pashto phonology, as words with an odd number of syllables can still take word-final secondary stress, meaning that at least one foot in these such constructions will not be well-formed. Hence, we rate PARSE-SYL above FOOT-BIN.

a) ‘walk (verb-inf)’ /ˈgar.ze.ˌdəl/	PARSE-SYL	FOOT-BIN
i. **?** [(ˈgar.ze).(ˌdəl)]		*
ii. **?** [(ˈgar).(ze.ˌdəl)]		*
iii. [(ˈgar.ze).dəl]	*!	
iv. [gar.(ze.ˈdəl)]	*!	

b) ‘burn (verb-inf)’ /swa.zé:.dəl/	PARSE-SYL	FOOT-BIN
i. **?** [(swa.ˈze:).(ˌdəl)]		*
ii. **?** [(ˈswa).(ˌze:.dəl)]		*
iii. [(swa.ˈze:).dəl]	*!	
iv. [swa.(ˈze:.dəl)]	*!	

As can be seen in the above tableaux, PARSE-SYL allows for stress syllables outside of well-formed feet, necessary in words like ‘walk (verb-inf)’ /ˈgar.ze.ˌdəl/; however it also has the adverse effect of

introducing stress where it is not evidence in the optimal candidates of words like ‘burn (verb-inf)’ /swa.zéː.dəl/. In order to create a unified account of lexical stress in Pashto, we therefore must introduce additional constraints in order to ensure that these optimal candidates are indeed selected.

Rule 3) IDENT(STRESS): A violation is incurred if an instance of stress is removed or added in the output. A violation is incurred if the stress is either demoted to secondary or promoted to primary stress in the output. (based on Collie, 2007)

Rule 4) RH-TYPE(T): A violation is incurred if a well-formed foot is not trochaic

The constraint IDENT(STRESS) blocks consideration of forms iii and iv in (a), as well as i and ii in (b), as it disallows the deletion or addition of stress between the input and the output. The constraint RH-TYPE(T) ensures that feet conform to the trochaic standard—a pattern which is far more common in 4-syllable verbs (see table 9). This will also ensure that we are able to select between the two candidates that are equally ranked in tableau (a). These constraints are both inviolable, and are thus ranked above PARSE-SYL. IDENT(STRESS) and RH-TYPE(T) are ranked evenly, as both are inviolable. The following tableaux thus illustrate the updated constraint ranking: IDENT(STRESS), RH-TYPE(T) >> PARSE-SYL >> FOOT-BIN

c) /ˈσ.σ.ˌσ/	IDENT(STRESS)	RH-TYPE(T)	PARSE-SYL	FOOT-BIN
☞ i. [(ˈσ.σ).(ˌσ)]				*
ii. [(ˈσ).σ.(ˌσ)]			*!	**
iii. [(ˈσ).(σ.ˌσ)]		*!		*
iv. [(ˈσ.σ).σ]	*!		*	
v. [σ.(σ.ˈσ)]	*!*	*	*	

d) /σ.ˈσ.σ/	IDENT(STRESS)	RH-TYPE(T)	PARSE-SYL	FOOT-BIN
i. [(σ.ˈσ).σ]		*!	*	
☞ ii. [σ.(ˈσ.σ)]			*	
iii. [σ.(ˈσ).σ]			**!	*
iv. [(ˈσ).(ˌσ.σ)]	*!*			*
v. [(σ.ˈσ).(ˌσ)]	*!	*		*

e) /ˈσ.σ.ˌσ.σ/	IDENT(STRESS)	RH-TYPE(T)	PARSE-SYL	FOOT-BIN
☞ i. [(ˈσ.σ).(ˌσ.σ)]				
ii. [(ˈσ.σ).(ˌσ).σ]			*!	*
iii. [(ˈσ).σ.(ˌσ).σ]			*!*	**
iv. [(ˈσ).σ.(ˌσ.σ)]			*!	*
v. [(ˈσ).(σ.ˌσ).σ]		*!	*	*

f) /σ.ˈσ.σ.ˌσ/	IDENT(STRESS)	RH-TYPE(T)	PARSE-SYL	FOOT-BIN
i. [(σ.ˈσ).(σ.ˌσ)]		*!		
ii. [σ.(ˈσ).(σ.ˌσ)]		*!	*	*
☞ iii. [σ.(ˈσ.σ).(ˌσ)]			*	*
iv. [(σ.ˈσ).σ.(ˌσ)]		*!	*	*
v. [σ.(ˈσ).σ.(ˌσ)]			**!	**

As can be seen in the above tableaux, each of the forms shown in (9) and (10) can be accounted for by the present constraint ranking. However, the issue remains of the direction of footing. With the present data (which lacks words greater than 4 syllables in length), we cannot yet propose whether feet are parsed

from the leftward or rightward direction, thus the issue will need to be revisited in further developments of this analysis. Additionally, as noted in §2, stress-attracting affixes may attract or create additional instances of stress in Pashto verbal constructions. Thus we turn now to addressing their interaction with the metrical analysis currently proposed.

4.2 *Stress Attracting-affixes* Looking at the following constructions from (10), we can observe that the addition of the negation prefix causes primary stress to be attracted to the suffix, while the stem-final stress is demoted to secondary stress.

(11) The negative prefix /nə́-/ attracts primary stress

	Gloss	**Pashto**
a.	The man is eating	/səl̪é χwarák kawí/
b.	The man isn't eating	/səl̪é χwarák nə́-kawì/
c.	The man was eating	/səl̪í χwarák kawó/
d.	The man wasn't eating	/səl̪í χwarák nə́-kawò/

Curiously, however, primary stress is not always located at the left boundary of the prosodic word. In the case of /wənáko/, phonetic analysis indicates that primary stress is located on the second syllable, meaning the negative prefix /nə́-/, and not the word-initial perfective prefix /wə̀-/. In this case, not instance of stress remains in the stem; thus, it would appear the stem conforms to foot binarity whereas the affixes do not.

(12) The /wə̀-/ perfective prefix attracts non-primary stress

	Gloss	**Pashto**
e.	The man ate	/səl̪í χwarák wə́-ko/
f.	The man didn't eat	/səl̪í χwarák wə̀-ná-ko/

Because in all other cases we have seen, primary stress is located in the leftmost stress syllable, we may wish to propose that the negative prefix /nə́-/ is unique in specifying primary stress underlyingly. Thus, we distinguish the stress-attracting affixes in question based on whether they simply attract or introduce stress, and whether that stress requires primary prominence in the prosodic word. As we have introduced the constraint IDENT(STRESS) previously, which assigns a violation for the demotion of stress from primary to secondary, and similarly, assigns a violation for the promotion of stress from secondary to primary, we theorize that this will block a non-attested candidate from being selected with an input like /wənáko/, given our present constraint ranking.

g) 'eat $_{(PRF, NEG)}$' /wənáko/	IDENT(STRESS)	RH-TYPE(T)	PARSE-SYL	FOOT-BIN
☞ i. [(ˌwə).(ˈna.ko)]				*
ii. [(ˌwə).(ˈna).ko]			*!	**
iii. [(wə.ˈna).ko]	*!	*	*	
iv. [wə.(ˈna.ko)]	*!		*	
v. [(ˈwə.na).ko]	*!*		*	
vi. [(ˈwə.na).(ˌko)]	*!*	*		*
vii. [(ˈwə).(ˌna).ko]	*!*		*	**

5 Conclusion

The present paper has sought to describe in more detail the lexical stress system as it is observed in Northeastern Pashto. Particular focus has been given to two components: (§3) the acoustic correlates of primary and secondary stress, and; (§4) the phonological system of metrical stress in the language. In each case, we have sought to provide a tentative analysis of the factors that contribute to stress and metre, respectively.

With respect to acoustic correlates, we observed both vowel length and the pitch track in a number of instances. In each case, stress appeared to appear in conjunction with vowels that were lengthened in comparison to their non-stressed counterparts. We also observe a distinct movement in pitch where stress occurs. Typically, this takes the form of a dip, followed by a quick rise in pitch before the location of stress; this is then sustained for the duration of the vowel where it occurs. Thus, we propose tentatively that these two features play a role in the acoustic correlates of pitch. This is also in line with the descriptions of other Iranian languages, including Wakhi, whose correlates of stress appear to be primarily pitch frequency (f0) and vowel duration (Ivanov & Silanteva, 2020); and Persian, where length is described as the most apparent correlate of lexical stress (Sadeghi, 2011).

In our phonological description of the Pashto metrical system, we propose a ranking of constraints following an Optimality Theory-based model. This tentative ranking takes into account the fact that Pashto stems appear to take one of either a trochaic or iambic-like stress alternating pattern (see tables 9 and 10). The ranking that we propose is as such: IDENT(STRESS), RH-TYPE(T) >> PARSE-SYL >> FOOT-BIN. Additionally, this ranking takes into account the movement of stress in the language caused by affixes such as /nə-/ (negative prefix), /wə-/ (perfective prefix), ensuring that their attraction of stress is permitted. Interestingly, we observe through acoustic analysis (Fig. 3) that /nə-/ appears to take primary stress, putting the peak prominence word-medially, whereas elsewhere this is observed at the left edge of the prosodic word. Indeed, this case will need to be explored further in future works.

As mentioned, there appears to be some inconsistencies in the site of primary stress once stress-attracting affixes are introduced. Were that not the case, we might propose that the general model of stress in Pashto would suppose that primary stress occurs on the leftmost stressed syllable of the prosodic word. This may take the form of a constraint like ALIGN-HEAD-L (Kager, 2007), which would ensure that the primary stress is located as close as possible to the left edge of the prosodic word. Alternatively, we might explore the notion that primary stress cannot be located in a degenerate foot (which would explain cases like /wə̀náko/—in which the primary stress alone is contained in a well-formed foot, see tableau g). In addition to the considerations made in the analysis of stress-attracting affixes under a metrical analysis, attention must also be given to the directionality of footing; in order to solve each of these, more varied data, and longer sentence constructions are required.

6 References

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