



Prosody and Morphosyntax in Sora: A Preliminary Study*

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Abstract

This study investigates phonetic prominence in morphologically inflected and derived words in Sora, a Munda language spoken in India. The study is based on Sora speech data collected from native Sora men and women while they said targeted three and four syllable Sora words in isolation, in inherently quasi-focal frames, and in out-of-focus frames. Experimental results show that in both three and four syllable Sora words, phonetic prominence, cued by greater vowel intensity, is present on the second syllable.

Index Terms: Sora; intonation; prosodic words; grammatical words; prosodic-morphosyntactic interface

1. Introduction

Sora is a language of the Munda family of the Austroasiatic language phylum spoken by approximately 400,000 people primarily in southern Odisha and adjacent parts of northern Andhra Pradesh, India and in diaspora in Assam, West Bengal, and other areas where tea plantations are found. Previous claims about the system of prominence in Sora alleged that the language was trochaic, with a quantity sensitive pattern in disyllables consisting of a light followed by heavy syllable (Donegan and Stampe 1983, 2004, Donegan 1993). These claims were impressionistic. Instrumental acoustic phonetic data and associated statistical data do not support these claims. Rather, in disyllables, all three active cues of prominence—intensity, duration and fundamental frequency—converge on the second syllable and moreover, vowels are more peripheral and less centralized in second syllables over first syllables (Horo and Sarmah 2015, Horo 2017, Horo Sarmah and Anderson 2020). Thus, Sora is consistently second-syllable prominent in disyllables. In this paper we extend this investigation to derived and inflected forms of Sora nominals having three and four syllables.

Some relevant background information: Almost all Sora nominals occur in two forms: one a syntactically free-standing word (FF), typically disyllabic, and a monosyllabic combining form (CF). The two are typically related in that the combining form is generally a root, and the free form is derived from this by processes such as reduplication, prefixation, infixation or compounding (Anderson 2017); see (1).

(1)	FF	CF	Means	Gloss
	<i>siʔi</i>	<i>-si</i>	infixation	‘hand’
	<i>saŋsaŋ</i>	<i>-saŋ</i>	reduplication	‘turmeric’

<i>kəmbun</i>	<i>-bun</i>	prefixation	‘pig’
<i>ontid</i>	<i>-tid</i>	compounding	‘bird’

Sora has two types of modifiers: one set functions as a syntactically free-standing modifier and is followed by a free-standing noun *gurmaŋ manra-n* [fat man-N.SFX] ‘a/the fat man’ **gurmaŋ-mar-ən*, the other combines into one grammatical word with the combining form *lanʔka-mar-ən* [big-man-N.SFX]. The second pattern is the more common of the two and the one that we examine in this presentation.

The current study aims to analyze the realization of prominence in Sora nominal forms that are morphologically inflected and derived to form three and four syllable words. For this purpose, speech data has been collected from native Sora speakers living in the state of Odisha and the data is analyzed to explore the three acoustic cues of prominence namely, vowel duration, vowel intensity and fundamental frequency. Thus, section 2 discusses the methods used for collecting and analyzing the data and section 3 discusses the results of the study. Finally, section 4 provides a general discussion of the study from a typological perspective.

2. Methods

The present study is based on acoustic analysis of Sora speech data collected from the field. This section describes the methodology used in the study.

2.1. Location and Participants

There are 298,655 Sora individuals in Odisha (Registrar General of India 2011). Therefore, field studies for the present study were conducted in Gajapati district, which is approximately two hundred kilometers from Bhubaneswar, the capital city of Odisha, and is adjacent to the state of Andhra Pradesh in its southern territory. In Gajapati district, four Sora speakers living in two villages, namely, Luhanagar and Luhasing, were recorded, and their speech data are analyzed in this work. Both villages have only Sora residents, however, Odia, the official language of Odisha, is also spoken by the Sora people in the two villages, including the participants recorded in this paper. The participants include the participants and two females of each village, having an average age of 54 years. All four speakers were recorded in their native locations, and it was confirmed that they did not have any articulatory and auditory disparity at the time of their recording. Also, the speakers reported that they have never received any formal education and they use Odia for inter-community communication only.

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2.2. Dataset and Recording

Text data, used for recording the speech data, includes a list of nine Sora nominal forms that are inflected with the plural marker /-dʒi/ and compounded with a masculine gender word /oŋger/. A sample list of the text data is presented in Table 1.

Table 1: Sample of dataset.

		Nouns	Plural Inflection	Derived Compound
1.	Sora	<i>boŋtel</i>	<i>boŋtel-ən-dʒi</i>	<i>oŋger-boŋ</i>
	English	buffalo	buffalos	male buffalo
2.	Sora	<i>kəmbun</i>	<i>kəmbun-ən-dʒi</i>	<i>oŋger-bun</i>
	English	pig	pigs	male pig
3.	Sora	<i>taŋliʔ</i>	<i>taŋli-ən-dʒi</i>	<i>oŋger-taŋ</i>
	English	cow	cows	male cow
4.	Sora	<i>kummed</i>	<i>kummed-ən-dʒi</i>	<i>oŋger-med</i>
	English	goat	goats	male goat

Nouns (whether in combining or full forms) in Sora also frequently appear in an *n*-suffixed form that is semantically opaque, but obligatory in some contexts (e.g., in possessive constructions): *ənsəlo-n ə-oʔon* [woman-N.SFX POSS-child/son] **ənsəlo ə-oʔon* ‘the woman’s son’. More relevant to our present study, for most speakers it is also obligatory when used with the plural marker *-dʒi* (*kəmbun-ən-dʒi* ‘pigs’ [pig- N.SFX-PL] **kəmbun-dʒi*). Thus, a disyllabic singular often yields a four-syllable plural form. Moreover, in Sora compound words, a nominal combining form (CF) may either be the initial part of the free form (FF) or the final part of the free form. In Table 1 while the words in 1 and 3 are examples of initial CFs, the words in 2 and 4 are examples of final CFs. This study examines the compound words in Sora separately based on having either an initial or a final CF.

Additionally, while recording the dataset, each speaker was asked to say every word three times. In the first iteration, they said all the words in isolation and in the second and the third iteration they produced the target words in the two sentence frames demonstrated in (1) and (2).

- (1) *nen* _____ *gamlai* (I _____ said)
(2) *nen* _____ *akkarra gamlai dirga idʒdʒa* (I _____ said loudly not softly)

The sentence frame in (1) is a phrasal context of utterance which is intended to control the utterance level prosody of each word, and the sentence frame in (2) is an unaccented context of utterance which is intended to capture the prosody of the target words in a non-focal position.

Data recording was conducted in the field in a noise free environment using a Tascam linear PCM recorder and a Shure unidirectional head-worn microphone connected via XLR jack. The digital data were stored at a sampling frequency of 44.1 kHz and 32 bits in .WAV format.

2.3. Acoustic Analysis

For doing the acoustic analysis, data were manually annotated for word, morpheme, syllable, and phoneme boundaries in Praat

(Boersma and Weenink, 2021). The phonemes were annotated by identifying the acoustic correlates of the speech sounds present in the dataset. Accordingly, vowel sounds were demarcated between the beginning and the end of glottalic pulses and sonorant sounds were identified in low amplitude regions. For the obstruent sounds, segments were identified between the point of oral closure and the starting of glottalic pulses in the onset position, and between the end of glottalic pulses and the point of oral closure in the coda position. Subsequently, prominence patterns in Sora were analyzed by exploring the three acoustic correlates of prominence, namely, vowel duration, vowel intensity and fundamental frequency (Fry, 1955; 1958). For this purpose, vowel duration was estimated from the total length of every vowel nucleus in the dataset and for vowel intensity and fundamental frequency, their average values were calculated from the entire length of the vowel segments. Moreover, all values extracted from the dataset were normalized for speaker variability using a z-score normalization method as shown in equation (1).

$$z = x - \frac{\mu}{\sigma} \quad (1)$$

In equation (1) *z* denotes the normalized value that is calculated for every extracted value *x* by taking the mean value μ and the standard deviation value σ of every speaker separately. Later, the analysis is done using the normalized values that are also visually represented in R Version 3.5.3 (R Core Team, 2021) using the *ggplot2* package (Wickham et al. 2016) through its built-in functions of *geom_boxplot* where the normalized values of vowel duration, average vowel intensity and average fundamental frequency are entered as dynamic variables and syllable positions and contexts of utterances (isolation, phrasal and unaccented) are given as factor variables. The following section reports the results of this analysis.

3. Results

This section presents the findings of the acoustic analysis conducted for determining the patterns of prominence in Sora words that are longer than disyllables.

3.1. Prominence in Sora nouns having plural inflection

3.1.1. Vowel Duration

One of the cues of prominence we examined in this Sora data set was vowel duration. In the phrasal and unaccented frames, greatest average vowel duration was found to be on the second syllable. In isolation on the other hand, the final syllable exhibited the greatest vowel duration. It is likely that utterance level phenomena have over-ridden word-level patterns in such instances in Sora. These trends can be seen in Figure-1.

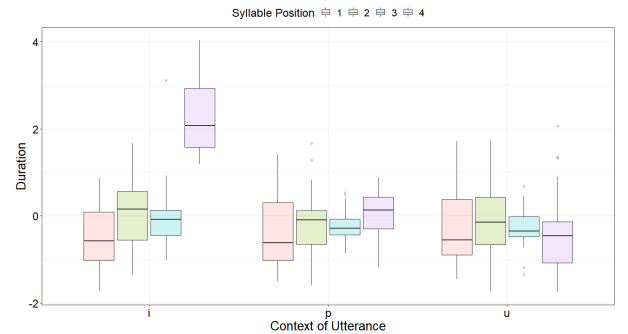


Figure 1: Vowel duration in Sora nouns having plural suffix

Another robust cue of prominence in Sora is vowel intensity. In these four-syllable inflected nominal forms in Sora across all three contexts (viz., isolation, in a quasi-focal sentential frame in an explicitly out-of-focus frame), average vowel intensity peaked on the second syllable in each instance. See Figure-2.

3.1.2. Vowel Intensity

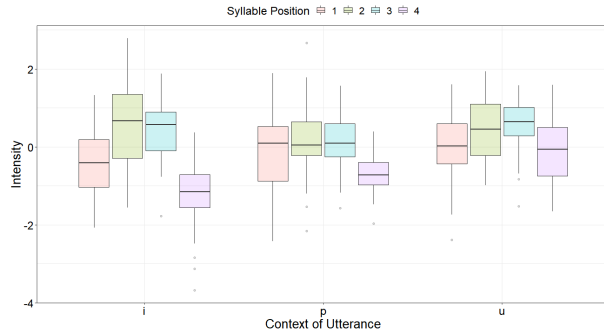


Figure 2: *Vowel Intensity in Sora nouns having plural suffix*

3.1.3. Fundamental Frequency

Fundamental frequency shows a different pattern in four-syllable inflected nominal forms; see Figure-3. In isolation and in out-of-focus frames, fundamental frequency peaks on the penultimate syllable—the semantically opaque *n*-suffix—while it peaks on the plural marker itself in the quasi-focal phrasal frame. It is not yet clear why the peaks of pitch are found in penultimate or ultimate positions here, but as pitch is known to have interactions with utterance-level and information-structure considerations, it is likely that such factors are overriding factors sensitive to word-level distributions.

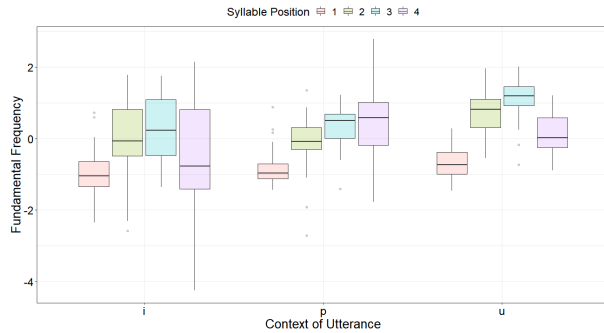


Figure 3: *f0 in Sora nouns having plural suffix*

3.2. Prominence in Sora compound nouns having initial CF

We turn now to an examination of three-syllable nominal forms consisting of a modifier and a nominal combining form that occurs in initial position in the corresponding full form (like *boy* in *boytel*).

3.2.1. Vowel Duration

With respect to duration as a cue for prominence, this converges on the second syllable in trisyllabic forms of this shape when words are recorded in isolation and in the out-of-focus frame, but on the final syllable when in the quasi-focal phrasal frame, as was seen with fundamental frequency in the plural forms: penultimate (i/u) vs. ultimate (p). See Figure-4.

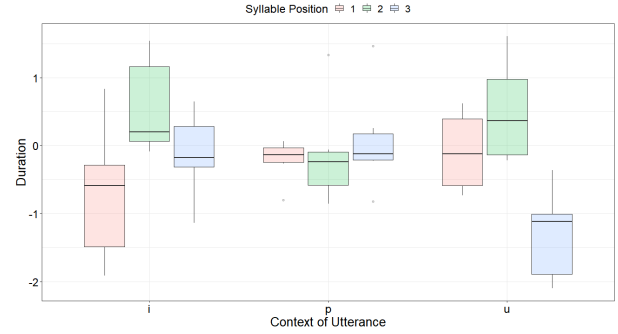


Figure 4: *Vowel duration in Sora compound nouns having initial CF*

3.2.2. Vowel Intensity

Vowel intensity patterns in the trisyllabic modifier structures shows the same pattern as the four-syllable plural forms: the acoustic cue of vowel intensity peaks on the second syllable in all such instances. This can be seen graphically in Figure-5.

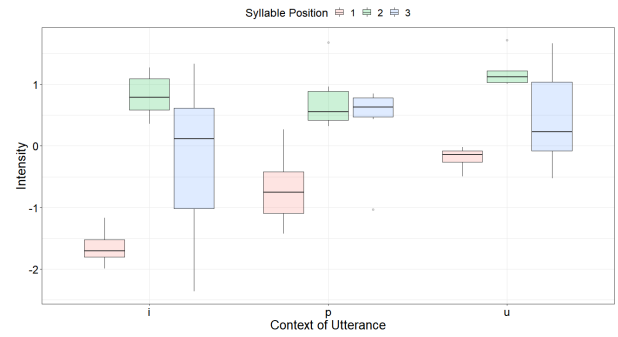


Figure 5: *Vowel Intensity in Sora compound nouns having initial CF*

3.2.3. Fundamental Frequency

Turning now to the distribution of fundamental frequency in trisyllabic modifier formations, we find a somewhat different pattern. As seen in Figure-6, the isolation context has the second/penultimate syllable cued as prominent in terms of pitch, but it is rather the final/third syllable that is so indicated in the phrasal and out-of-focus contexts.

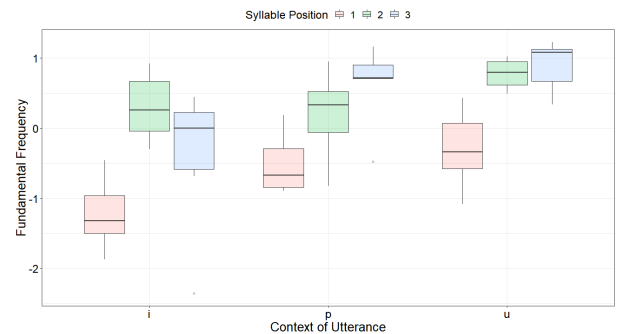


Figure 6: *f0 in Sora compound nouns having initial CF*

3.3. Prominence in Sora compound nouns having final CF

The last set of forms we examine in this study are another set of trisyllabic forms where the first two syllables are the adjectival modifier and the final syllable is a combining form of a noun

that was originally in second position in the syntactically free-standing form, e.g. *-bun* 'pig' in *kambun* 'pig'.

3.3.1. Vowel Duration

The distribution of the acoustic cue of vowel duration shows the same pattern as with the plural-inflected forms. The vowel in the second syllable is clearly the longest in the phrasal and out-of-focus contexts but it is the final syllable when the form is recorded in isolation (see Figure-7). This suggests utterance level considerations for duration may over-ride word-level ones in Sora.

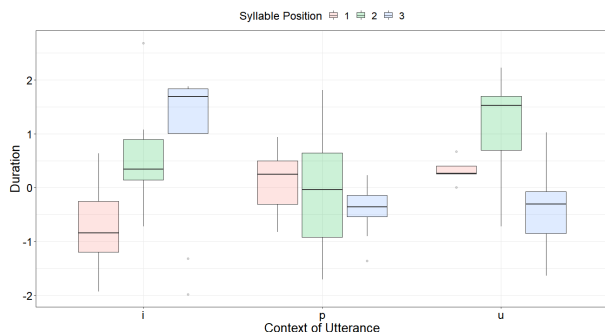


Figure 7: Vowel duration in Sora compound nouns with final CF

3.3.2. Vowel Intensity

Vowel intensity in these trisyllabic forms show the same patterning as the other two sets examined: there is a consistent cueing of second syllables as prominent through highest intensity levels, regardless of the context of the utterance. See Figure-8.

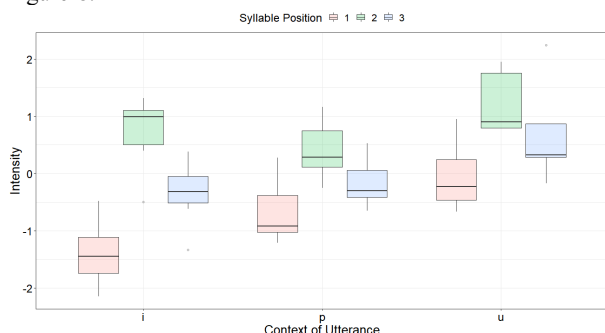


Figure 8: Vowel Intensity in Sora compound nouns having final CF

3.3.3. Fundamental Frequency

The distribution of the peaks in fundamental frequency in these trisyllabic forms matches (see Figure-9) that of the previous set seen in Figure-6: In Isolation, the peak is on the second/penultimate syllable but on the third in the phrasal and out-of-focus contexts. In both instances, the prominent syllable in such forms is the combining form, which is semantically robust and salient, so there may be considerations of discourse salience or attention flow that may be at play here in helping determine the distribution of the various cues of prominence active in Sora.

4. Discussion

We examined three structural types of nominal forms in Sora.. Sora was once claimed to have a quantity-sensitive trochaic

system of prominence [1]-[3]. Recent instrumental analysis demonstrated that in disyllabic words in Sora of whatever structure, the three acoustic cues or prominence—duration, intensity, and fundamental frequency—all converge on second syllable prominence [4]-[6], further underscored by the fact that vowels are more peripheral and differentiated in second syllables of Sora disyllables over those of first syllables. Thus, Sora is neither quantity sensitive, nor trochaic. The present study expanded this to three- and four-syllable sequences of Sora nouns: four-syllable plural forms of disyllables and modifier constructions consisting of a disyllabic modifier and a monosyllabic combining form of two distributional types.

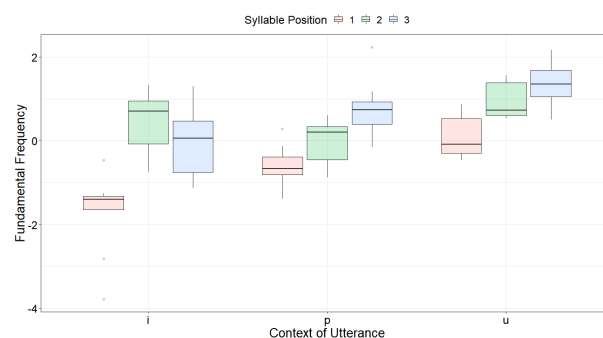


Figure 9: f0 in Sora compound nouns having final CF

The same three acoustic cues conspire to signal prominence in these longer forms. Intensity is consistent across all examined word types and all contexts of utterance (isolation, in a sentential frame and in an out-of-focus frame). It appears to be the acoustic cue most robustly signaling word-level prominence. Both duration and fundamental frequency can be subjected to other types of considerations that interact with and may override word-level factors. For example, Sora sometimes will lengthen the last syllable of a word, especially if said in isolation (Figs. -1, - 7). Fundamental frequency may also sometimes interact with discourse salience.

Much remains to be done to have a complete understanding of the nature of p-words and g-words vs. phrases in Sora. This study is just the first step to our understanding of how the intonational system of Sora may or may not be sensitive to word-level processes and to what degree utterance or information structure considerations influence the distribution of the three acoustic cues (duration, intensity, and fundamental frequency) shown to be active in the language for cueing prominence. What we can say is that overall, intensity on the second syllable is a robust cue of word-level prominence in Sora disyllables of any morphological makeup, and on the second syllable in three- and four-syllable Sora nouns of specific derivational and inflectional configurations. Duration and fundamental frequency also play a role, and never do these converge on initial syllables as previous studies of Sora have suggested. The next steps entail expanding this to cover larger nominal structures of 5-8 syllables in length and to compare these with phrases of similar lengths and with similarly sized 3-8 syllable verbal forms as well, and to tease apart what the various factors that favor duration or fundamental frequency to peak on syllables after the second one when such data are attested. These remain the object of ongoing research.

5. References

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