

Prominence Assignment in Saudi Arabic: Are Prosodic Cues Complementary to Word Order, or Are They Redundant?

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Abstract—Languages differ in how they convey prominence and information structure (IS). In Modern Standard Arabic (MSA), a flexible word order language, new information focus is marked by accent, and contrastive focus by word order displacement (Moutaouakil, 1989). Traditionally, rigid word order languages rely on prosody, while flexible word order languages employ syntactic movement (Donati & Nespors, 2003; Cole, 2015). However, the combined use of word order and prosody to mark prominence in flexible-word order languages has not been well studied. This study investigates the interaction between syntactic and prosodic strategies in two Saudi Arabic varieties (Hijazi and Najdi) to determine whether prosody complements or merely replicates the function of word order. A production task with 12 Saudi speakers elicited responses that varied in word order, focus type, and prosodic marking. Acoustic analysis revealed that focused elements exhibited longer vowel durations and wider F0 ranges than non-focused elements, while maximum intensity also varied, though it was influenced by domain-initial strengthening. These results suggest that Saudi speakers use both word order and prosody to mark focus, indicating that prosodic cues are complementary rather than redundant. In addition, the findings contribute to the broader theoretical debate on the syntax-prosody interface and imply the need for a revised typology of focus-marking strategies that integrates both prosodic and syntactic methods.

Index Terms—communication, prosody, Saudi Arabic, syntax-prosody interface, word order

I. INTRODUCTION

Cross-linguistically, languages use various strategies to mark prominence, mainly through prosody and word order. That is, languages assign prominence through prosody and word order to mark new or important and focused information or words with contrastive focus in a discourse (Bolinger, 1986; Selkirk, 1995; Donati & Nespors, 2003; Luchkina & Cole, 2014). Donati and Nespors (2003) categorized languages regarding prominence assignment into either “prominence dislocating languages” or “constituent dislocating languages”.

In prominence-dislocating languages, prominence is indicated prosodically. These languages maintain relatively rigid word order. For example, English mainly employs prosodic cues to indicate focus, regardless of the prominent constituent's position. For instance, some studies on English have shown that words in focus are characterized by hyperarticulation, longer duration, and increased intensity (Beckman & Edwards, 1994; Tamburini, 2005; Cole et al., 2007). Furthermore, other studies indicate that words in focus exhibit salient fundamental frequency patterns (F0) (Ladd, 1996). On the contrary, constituent-dislocating languages mark prominence by reordering constituents in a sentence. Therefore, these languages often exhibit word order flexibility, (i.e., syntactic movement plays a key role in the prominence marking process). However, according to Donati and Nespors (2003), it is important to note that not all languages with flexible word order are constituent-dislocating. Some languages allow variations in word order without necessarily requiring the dislocation of constituents to indicate focus (Fanselow, 2006; Matic & Wedgwood, 2013).

This discussion leads to a simplified taxonomy of focus marking, as it does not rely on complex concepts or additional tools related to prosody and word order. For example, some Bantu languages employ tone shifts and affixation as devices for focus marking (Guldemann, 2003), while East and Southeast Asian languages use focus particles to designate prominence (Xu, 2004). These differences highlight the diversity of focus-marking strategies among languages, showing that prosodic elements and word order are not the only ways of marking prominence.

However, a significant number of languages continue to depend on the interaction of these two mechanisms. Luchkina and Cole (2014) adopted this categorization of Donati and Nespors (2003). They acknowledged that such categorization predicts that using both prosodic cues and word order to mark prominence is rare. This raises the question of whether these two mechanisms provide independent, complementary cues to prominence or whether they serve as redundant signals.

While some studies show that prosodic features and syntactic structure can interact to enhance the perception of prominence (Alzaidi et al., 2019), others suggest that one can substitute for the other, depending on the Linguistic structural requirements of the language. Therefore, redundancy may not be considered as unnecessary duplication, but rather as a support for focus marking, ensuring that prominence is properly conveyed.

A key analysis of this interaction focuses on whether languages with flexible word order can use both prosodic and syntactic cues simultaneously, or whether one cue takes precedence over the other. Examining a language with flexible word order, where it is possible to elicit sentences with identical words in two different word orders, may either support Donati and Nespor's categorization, or challenge it by showing that an interaction between prosody and syntax (specifically word order) is possible. Besides, it has been proposed that such an interaction between syntax and phonology, especially word order and prosody, interact in shaping information structure (IS) across languages. Hendriks (1999) argued that, cross-linguistically, it is inadequate to reduce IS to either syntax or prosody. İşsever (2003) studied Turkish and showed that approaches assuming that either syntax or prosody could explain IS in Turkish were not comprehensive. However, further research is needed to fully explore and understand these interactions.

Marking prominence through prosodic cues and word order is sometimes referred to as marking prominence *in situ* and *ex situ*, respectively. *In situ* prominence is marked prosodically without syntactic movements (Alzaidi, 2014), while *ex situ* prominence marking involves syntactic movement that shifts the focused word from its (canonical) position (Moutaouakil, 1989, p. 25).

Besides Modern Standard Arabic (MSA), Arabic comprises several regional varieties. Even within an Arabic-speaking country, various varieties can exist. For example, in Saudi Arabia, two of the major varieties are Najdi, spoken in the center, and Hijazi, spoken in the west.

II. THEORETICAL BACKGROUND

Previous research on Arabic word order has made a distinction between new information focus and contrastive focus in MSA (Moutaouakil, 1989). Furthermore, IS, focus, and word order have also been studied in different Arabic varieties, and these studies (Moutaouakil, 1989; Fassi Fehri, 1993; Dahlgren, 1998; Benmamoun, 2000; Woidich & Heinen-Nasr, 2004; Aoun et al., 2009; Edwards, 2009; Holes, 2009; Ingham, 2010; Alzaidi et al., 2019; Alzamil & Hellmuth, 2022) have shown that different varieties can exhibit different word orders. However, examining contrastive focus and new information focus across different word orders in Arabic varieties remains an area that requires further investigation.

There is a significant gap in the literature regarding the interaction between word order and prosody in various spoken Arabic dialects. Accordingly, this study seeks to investigate the use of word order and prosody in Saudi Arabic (Najdi and Hijazi) as devices for marking prominence—especially regarding new information and contrastive focus—through a systematic experimental approach.

Moutaouakil (1989) distinguishes between two types of focus (new information and contrastive) are realized differently. For instance, in (1a) below (Moutaouakil, 1989, p. 25), basic word order shows nuclear prominence. In contrast, to express contrastive focus, the focused constituent must undergo syntactic movement, as shown in (1b) (Moutaouakil, 1989, p. 25). According to Moutaouakil (1989), contrastive focus in MSA is typically realized at the left periphery of the clause (*ex situ*), while new information focus remains *in situ*. However, other studies show that, in some cases, prosodic marking alone is enough to express contrastive focus without requiring syntactic movement, especially in informal contexts (Fassi Fehri, 1993; Benmamoun, 2000).

(1) Examples of focus in MSA:

a. New information focus:

Q: maaða ʔakalta?

What ate-2s

‘What did you eat?’

A: [ʔakaltu θariidan]_F

ate-1s tharid-acc

‘I ate tharid’

b. Contrastive focus:

Q: ʔa Zaidan sʕaafahta ʔam Amran?

Q Zaid-acc greeted-2sg or Amr-acc

‘Was it Zaid you greeted or Amr?’

A: [Zaidan]_F sʕaafahtu

zaid-acc greeted-1s

‘It was Zaid that I greeted’

A. Focus Marking in Arabic Dialects

(a). Word Order Patterns in Arabic Varieties

Considering the different patterns of word order structures in Arabic, it is important to explore how these dialects mark prominence using both syntactic and prosodic means. A survey of these patterns, as realized in several dialect, is

given below.

- Although SVO occurs in discourse contexts, Bedouin Najdi Arabic predominantly preserves VSO and noun-initial structures (Ingham, 2010; Dahlgren, 1998).
- Bahraini Arabic mostly retains verb-initial syntactic structures. However, it allows for certain SVO arrangements (Holes, 2009).
- Egyptian Arabic shows various SVO structures (Edwards, 2009; Woidich & Heinen-Nasr, 2004).
- Lebanese Arabic mainly exhibits contrastive focus *ex situ* (Aoun et al., 2009).
- While SVO is dominant in spontaneous discourse, Hijazi Arabic shows VO, VSO, SVO, and VOS orders (Alzaidi, 2014).

These observed differences indicate that Arabic dialects employ both prosodic and syntactic means of marking prominence. However, the magnitude of their individual contributions requires further research.

(b). *Prosodic Cues*

Prosody plays a key role in conveying contextual information and is crucial for expressing the pragmatic meanings for an utterance. In addition, it encompasses the acoustic prominence of words and utterances, thus indicating both prominence and focus. According to Keating (2006), prosody serves two major functions: (1) a grouping function, where smaller units (like words) combine to form larger units such as phrases, and (2) a contrasting function, where accents indicate phrasal prominence.

While syntactic reordering plays a key role in marking prominence, prosodic strategies also contribute to focus realization. Alzaidi et al. (2019) provide a detailed analysis of how prosodic features like F0 range, intensity, and duration interact with different syntactic positions in Hijazi Arabic. Their findings suggest that prosody and word order are not entirely independent but work together in focus marking.

Similarly, Alzamil and Hellmuth (2022) argue that contrastive focus in Najdi Arabic is characterized by prosodic features (such as expanded F0 range and longer duration) and syntactic reordering. However, they reported cases where prosody alone was sufficient to mark focus, making changes in word order redundant. These findings suggest that while word order and prosody interact, the nature of this interaction is flexible and context-dependent rather than strictly hierarchical.

Furthermore, several studies have associated prominence and focus with certain prosodic cues, for instance:

- English: Prominence is characterized by longer duration, increased F0 range, and increased intensity (Jackendoff, 1972; Ladd, 1996; Morrill, 2012).
- Swedish and German: Duration is the most reliable focus cue (Allwood, 1974; Féry & Kügler, 2008).
- Korean: Focus is characterized by Pitch accents and duration (Jun & Kim, 2007).
- Mandarin and Taiwanese: Intensity shifts indicate focus (Chen et al., 2009).

Several studies have also examined prosodic cues of focus in different Arabic dialects:

- Lebanese Arabic: Chahal (2001) found that in SVO sentences, focused words show increases in F0, intensity, pitch range, and duration.
- Moroccan, Kuwaiti, and Yemeni Arabic: Yeou et al. (2007) reported that contrastive focus increased the F0 range and lengthened duration more significantly than new information focus.
- Hijazi Arabic: Alzaidi et al. (2019) showed that contrastive focus words exhibited a stronger F0 expansion than that of new information, suggesting a syntactic-prosodic relationship in *ex situ* focus marking.
- Najdi Arabic: Alzamil and Hellmuth (2022) depicted the interaction between prosodic features and syntactic structures, suggesting that word order flexibility contributes to prominence assignment. Their study showed that contrastive focus in Najdi Arabic is typically marked by a combination of prosodic cues (especially, increased F0 range and longer duration) and syntactic reordering. Meanwhile, new information focus relies mainly on prosody. These results align with findings from Hijazi Arabic (Alzaidi et al., 2019), suggesting that both Saudi dialects employ a hybrid approach that integrates prosodic and syntactic cues to mark prominence.

Although these studies provide valuable insights into prosodic cues for focus marking, they largely focus on SVO word order. Other research mainly discusses word order variation without examining how prosody interacts with syntax to mark prominence. The interaction between prosodic and syntactic strategies in Arabic remains under explored, indicating the need for further empirical research.

B. *Current Study*

This study examines the interaction between word order and prosody in Saudi Arabic, specifically:

- Do prosodic cues complement or are they redundant in different word orders when marking focus?
- Do prosodic cues (vowel duration, F0 range, and maximum intensity) correlate with specific prominence types (e.g., new information vs. contrastive focus).
- Whether certain word orders show greater prosodic cues than others in Najdi and Hijazi Arabic?

Findings will reveal whether Saudi Arabic exhibits contrastive focus in both *in situ* and *ex situ*, similar to MSA. In addition, the study will identify the preferred word orders in Najdi and Hijazi Arabic and contribute to the theoretical literature on the Arabic syntax-prosody interface.

By addressing the prosody-word order relationship, this study examines whether word order alone is sufficient to mark prominence or whether prosodic reinforcement is necessary. In the case when word order alone suffices, prosodic markers diminishes when the focused constituent is syntactically fronted. In contrast, if prosody enhances prominence perception, both strategies may work in to optimize communicative efficiency. Therefore, the study thus provides empirical data to inform linguistic typology and the understanding of the universal properties of focus-marking systems.

III. METHODOLOGY

A. Participants

Twelve participants, aged between 20 and 33 years (mean age = 26.6 years, SD = 4.8), participated in this experiment. The sample comprised six Hijazi speakers (three females and three males) and six Najdi speakers (three females and three males). All participants were enrolled at George Mason University as either graduate or undergraduate students. All participants were born and raised in Saudi Arabia and acquired their respective dialects (Hijazi or Najdi) as their native language. During the training session, the researcher confirmed that Arabic was the primary language for all participants, who were raised in the regions where these dialects are spoken. None of the participants self-reported any diagnoses of speech, hearing, or reading disorders.

B. Materials

This study examines how focus marking in Saudi Arabic through a comparative analysis of identical sentences that differ only by of focus—new informational focus versus contrastive focus. For this comparative analysis, structured elicitation questions based on a pre-arranged passage were used to elicit sentences representing either contrastive or new information focus. Based on the focus type being examined, these questions were designed to produce response word orders reflecting at least two distinct configurations. Firstly, the question intended to elicit new information focus characterized by a single focused constituent, according to Phillips-Bourass (2012) and Alzaidi (2014)—was aimed at generating the expected word order [S]_FVO. Secondly, the question focused on the verb, with expected response word orders including [V]_FSO or [V]_FOS; that is, with the verb expected to appear at the beginning of the sentence.

The stimulus material included 20 passages in an informal, neutral Saudi Arabi, which is often termed the "white dialect." Using the "White Dialect" helped maintain a neutral, natural linguistic register, minimizing the chances of hypercorrections or shifts toward Standard Arabic. This approach ensured consistency among participants, and reduced variability that could affect the prosodic results (for Arabic passages and their English translations, see Appendix B).

Following each passage, six questions developed to elicit either the subject or the verb responses. In total, 120 questions were created (60 designed to elicit new information focus on subjects and 60 designed to elicit contrastive focus on verbs).

The target lexicon, including subjects and verbs, was carefully selected to ensure phonetic comparability between the different conditions. In addition, high-frequency vocabularies were employed to control the possible effects of lexical familiarity effects. Precautions in methodology ensured that observed prominence patterns were the result of focus marking rather than inherent word-internal properties.

Example (2) presents a relevant quotation and questions to provoke a response to complement it (for the full list of prompts, see Appendix A):

(2) Sample (Arabic and English):

رامي يلعب كرة. فريقه المفضل برشلونة. لينا أخت رامي ما تلعب كرة بس تشجع ريال مدريد وتكره برشلونة. برشلونة دائماً يفوز على ريال مدريد ولينا تزعل. رامي روحه رياضية ما يزعل حتى إذا فاز ريال مدريد. لما رامي وعائلته يزوروا برشلونة، رامي يحضر مباريات برشلونة بس لينا ما تحضر.

1. مين يلعب كرة؟
2. مين تزعل من برشلونة؟
3. مين يحضر مباريات؟
4. يكره وإلا يلعب كرة رامي؟
5. تحب وإلا تزعل من برشلونة لينا؟
6. يتفرح وإلا يحضر مباريات رامي؟

English Translation:

Rami plays soccer and Barcelona is his favorite team. On the other hand, his sister, Lina, does not take part in playing soccer, but is a strong supporter of Real Madrid. On trips to Barcelona, while Rami goes for Barcelona matches, Lina avoids them.

(a) New information focus (SVO):

- i) Who plays soccer?
- ii) Who gets upset because of Barcelona?
- iii) Who attends matches?

(b) Contrastive focus (verbal sentences):

- i) Plays or hates soccer, Rami?

Does Rami hate or play soccer?

ii) Loves or gets upset of Barcelona, Lina?

Does Lina love or get upset of Barcelona?

iii) Watches from home or attends the games, Rami?

Does Rami watch games from home or visit the stadium?

The research compared focused subjects to their non-focused counterparts, as well as between focused verbs and non-focused verbs. This methodology allowed for a systematic analysis of variability in prosodic features, including, duration, F0 and intensity, and how focus marking affects them.

For instance, in response to “Who plays soccer?”, the answer “Rami plays soccer” was analyzed, where “Rami” stood for focus on recently mentioned facts in focus conditions. For “Dislikes or likes soccer, Rami?” “Rami” did not have focus, but the verb “dislikes” retained focal prominence. This setup allowed for a clear contrast between focused and non-focused subjects and verbs within similar syntactic structures.

C. Procedure

The experiment was conducted in a sound-attenuated recording booth at the George Mason University Linguistics Program. Participants were recorded using a Zoom H2 portable digital recorder. They were seated in front of a table where the recorder was placed at a 90-degree angle, approximately 8–12 inches away from their mouths. The stimuli were typed in Arabic.

To minimize Labov’s (1972) observer’s paradox, participants attended a familiarization session before any recordings began. They completed practice trials to reduce self-monitoring effects and to become accustomed to the laboratory setup. The recordings were conducted in an informal, and relaxing environment, establishing the atmosphere for free speech. Participants were instructed to use their daily dialect of Arabic and to reply in full sentences rather than in single words.

After the training session, the participants proceeded with the experiment, read 20 passages, and responded to the associated questions. A three-minute break was provided after the tenth passage. Following the experiment, participants completed a background questionnaire that included questions about their Arabic variety and demographic information. The sound files were then transferred to a MacBook Pro and analyzed using PRAAT (Boersma & Weenink, 2024).

D. Data Analysis

The analysis focused on the subjects and verbs produced by participants in response to the questions. All sentences included at least one subject, verb, and object. Using PRAAT, the following intervals were labeled: sentence, subject, verb, and stressed and unstressed syllables in the subjects and verbs. These elements were labeled to measure vowel duration (ms), F0 range (Hz), and maximum intensity (dB). The analysis concentrated on vowels within stressed syllables of the target subjects and verbs. Furthermore, F0 range was determined by calculating the difference between the maximum and minimum F0 values (Hz) for the stressed vowel in each target word. Then all measurements were then extracted automatically using a PRAAT script to ensure standardization.

Linear mixed-effects models (LMMs) were performed to analyze the impact of focus, sentence type, and part of speech on vowel duration, F0 range, and maximum intensity. This approach accounted for both fixed effects (focus, sentence type, part of speech) and random effects (variability across and within participants and lexical items). The likelihood ratio tests were employed to compare nested models, with the significance determined by χ^2 statistics associated p-values. This statistical strategy thoroughly addressed between-speaker and within-speaker variability in prosodic realization.

IV. RESULTS

In total, the 12 participants produced 1,437 sentences (12×120) based on six questions following each of the 20 passages. Each participant produced 120 sentences, except for one Najdi speaker, who skipped three questions, resulting in 117 sentences.

Table 1 presents the distribution of word orders per dialect. For Hijazi speakers, there were 720 cases in total—435 SVO, 242 VSO, and 43 VOS sentences.

When the subject was in focus, it was almost always produced as [S]_FVO, with only three exceptions (two V[S]FO sentences and one VO[S]_F sentence). These three sentences were excluded from the acoustic analysis as they were the only examples of their respective types. The acoustic analysis focused on vowel duration, F0 range, and maximum intensity in the stressed syllables of subjects and verbs across different word orders.

TABLE 1
DESCRIPTIVE STATISTICS OF THE THREE-WORD ORDERS PER DIALECT

		Sentence Type			Total
		SVO	VSO	VOS	
Dialect	Hijazi	435	242	43	720
	Najdi	391	244	82	717
Total		826	486	125	1437

As indicated in Table 1, the participants employed three different word orders (SVO, VSO, and VOS) to answer the questions for the passages. SVO exhibited the most common in both Hijazi and Najdi varieties (57%), followed by VSO (34%) and then VOS (9%). Brustad (2000) argued that SVO is the basic word order in spoken Arabic, while Yasin (2012) considered both SVO and VSO to be canonical word orders in Arabic. The Najdi and Hijazi varieties follow this pattern, with SVO being the most common, followed by VSO. In contrast, MSA tends to favor VSO, reflecting the classical structure maintained in formal and written registers (Edwards, 2010).

Table 2 presents the prosodic measurements (vowel duration, F0 range, and maximum intensity) for words. This enables a comparative word-level analysis between focused and non-focused subjects and verbs in different word orders, providing a general overview of word-level prominence patterns.

TABLE 2
THE THREE PROSODIC CUES (DURATION, F0 RANGE AND INTENSITY) OF THE WORD

Sentence Type	Part of Speech	Focus (Yes/No)	N. of cases *	Vowel Duration (ms)	F0 range (Hz)	Max Intensity (dB)
[S] _F VO	S	Y	717	465.52	46.55	70.18
[S] _F VO	V	N	717	363.45	34.39	67.59
S[V] _F O	S	N	110	451.55	53.23	68.92
S[V] _F O	V	Y	107	345.48	43.20	67.67
[V] _F OS	S	N	126	378.40	48.70	65.07
[V] _F OS	V	Y	122	416.28	50.68	71.27
[V] _F SO	S	N	482	387.97	34.00	67.27
[V] _F SO	V	Y	487	458.41	57.27	69.79

*TOTAL NUMBER OF CASES = 720

Table 3 analyzes the prosodic marking of the stressed syllables in both focused and non-focused subjects and verbs. This table allows for a detailed examination of how stress is used to mark focus.

TABLE 3
THE THREE PROSODIC CUES (DURATION, F0 RANGE AND INTENSITY) OF THE STRESSED SYLLABLE

Sentence Type	Part of Speech	Focus (Yes/No)	N. of cases *	Vowel Duration (ms)	F0 range (Hz)	Max Intensity (dB)
[S] _F VO	S	Y	717	245.04	31.90	67.29
[S] _F VO	V	N	717	138.18	21.20	64.35
S[V] _F O	S	N	110	227.82	33.80	66.17
S[V] _F O	V	Y	107	137.97	26.99	64.74
[V] _F OS	S	N	126	200.32	27.51	61.80
[V] _F OS	V	Y	122	161.58	27.55	67.14
[V] _F SO	S	N	482	199.77	21.39	64.46
[V] _F SO	V	Y	487	175.93	35.85	65.97

*TOTAL NUMBER OF CASES = 720

As shown in Table 3, when the subject is in focus, it is produced almost only as [S]_FVO (99%, 717 out of 720 cases). When the verb is focused, it appears ex situ as either [V]_FSO (67%) or [V]_FOS (17%). However, in some cases, the focused verb appears in situ, as S[V]_FSO (15%).

These findings suggest that SVO remains the dominant word order even when contrastive focus falls on the verb. At the same time, the results indicate that contrastive focus on the verb can trigger word order changes, resulting in ex situ structures.

The following subsections provide a detailed comparison of vowel duration, F0 range, and maximum intensity between focused and non-focused parts of speech.

A. Duration

As shown in Table 3 above and Figure 1 below, the stressed syllable of the focused subject in [S]_FVO has a longer vowel duration (245.04 ms) than the stressed syllables in non-focused subjects, which range from 227.82 ms in S[V]_FO to 200.32 ms in [V]_FOS and 199.77 ms in [V]_FSO. Regarding verbs, ex situ (focused) verbs have a longer vowel duration (175.93 ms) in [V]_FSO than both ex situ focused verbs in [V]_FOS (161.58 ms) and in situ focused verbs in S[V]_FO (137.97 ms) and non-focused verbs in [S]_FVO (138.18 ms). Figure 1 shows these results, with the x-axis representing the part of speech (S for the subject and V for the verb) and the y-axis representing the mean vowel duration of the stressed syllable. The focused parts of speech are shown in black, while the non-focused parts of speech are in grey.

In the following figures, the SVO word order is represented by four bars as in encompassed four combinations: focused and non-focused subjects and focused and non-focused verbs ([S]_FVO and S[V]_FO). In contrast, for the other word orders (VOS and VSO), there are no instances of focused subjects, as focused subjects only occur in the initial position (i.e., [S]_FVO). Similarly, non-focused verbs do not appear in the initial position, because when the verb is not focused, it never appears at first. Therefore, there are only two bars (one for S and one for V) in VSO and VOS in the three figures below.

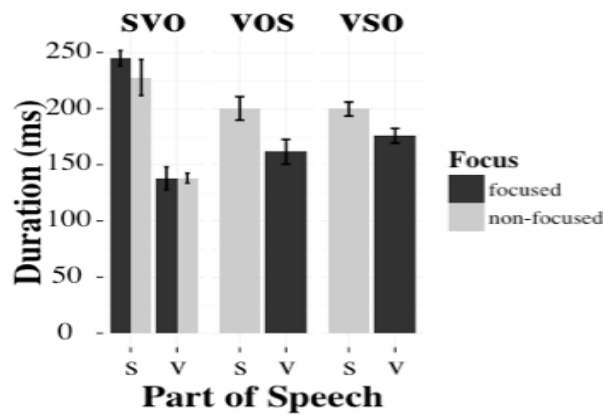


Figure 1. Mean of Vowel Duration Length of the Stressed Syllable
 X-Axis = Part of Speech, Y-Axis = Mean of Vowel Duration (ms)
 Black Bar = focused, Grey Bar = non-focused

The analysis of vowel duration, as summarized in Table 3 and Figure 1, demonstrates that focused elements exhibit longer vowel durations compared to non-focused elements. To determine whether this difference is statistically significant, linear mixed-effects regression models were performed in R (see Procedure above). Model comparisons indicate that focus is a significant predictor of vowel duration ($\chi^2 = 24.60, p < .01$), confirming that focused elements undergo lengthening relative to non-focused elements. These findings align with research on other Arabic varieties, such as Lebanese, Moroccan, Kuwaiti, and Yemeni Arabic, as well as other languages that employ vowel lengthening as a cue for focus.

A subsequent analysis revealed that elements in sentence-initial positions exhibit longer durations, which is consistent with domain-initial strengthening (Keating, 2006). This phenomenon is observed in English (Fougeron & Keating, 1997) and French (Fougeron, 2001), where initial positions in phrases show enhanced articulations. To determine whether focus or domain-initial effects account for the observed increases in duration, an additional regression analysis was performed that excluded sentence type as a predictor. The model comparisons revealed that sentence type did not significantly predict vowel duration ($\chi^2 = 21.60, p > .05$), reinforcing the claim that focus has greater influence on vowel duration than utterance position.

B. F0 Range

The mean F0 range of the focused subject in [S]_FVO (31.90 Hz) was narrower than that of the non-focused subject (33.80 Hz) in the same word order. For the other word orders, the F0 ranges were as follows: [V]_FOS (48.7 Hz) and [V]_FSO (34 Hz). Regarding verbs, ex situ (focused) verbs exhibited the widest F0 range (35.85 Hz) in [V]_FSO compared to those in [V]_FOS (27.55 Hz) and in situ verbs in S[V]_FO (26.99 Hz). The non-focused verbs in [S]_FVO had the narrowest F0 range (21.20 Hz).

Figure 2 illustrates these results, with the x-axis represents the part of speech (S for subject, V for verb), and the y-axis representing the mean F0 range (Hz). Black bars indicate focused elements, while the grey bars represent non-focused elements.

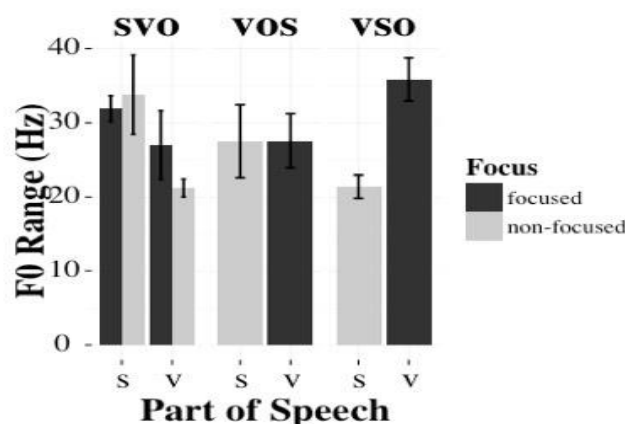


Figure 2. Mean of F0 Range of the Stressed Syllable
 X-Axis = Part of Speech, Y-Axis = Mean of F0 Range (Hz)
 Black Bar = focused, Grey Bar = non-focused

Table 3 and Figure 2 show that focused verbs exhibit a wider F0 range compared to non-focused elements. To assess the statistical significance of this pattern, linear mixed-effects regression models were performed in R (see Procedure above). Model comparisons indicate that focus significantly predicts F0 range ($\chi^2 = 17.80$, $p < .01$), confirming that F0 range is a reliable cue of focus across different word orders. These results align with previous findings that the F0 range is a crucial prosodic cue for focus in various languages, including multiple Arabic varieties.

However, an unexpected finding revealed that the focused subject in $[S]_FVO$ exhibited a smaller F0 range (31.90 Hz) compared to the non-focused subjects (33.80 Hz in $S[V]_FO$). Arguably, pre-focus constituents exhibit a degree of prosodic prominence that reduces the available pitch movement for the focused subject. This effect has been observed in other languages, where post-focal compression is common. Furthermore, pre-focal accentuation may also affect F0 range (Xu, 2005). Further analysis is needed to determine whether this is a general characteristic of Saudi Arabic prosody, or a result of the specific experimental conditions used in this study. This unexpected F0 range pattern highlights the complex interaction between focus, pre-focal prominence, and word order. The next section examines whether similar trends emerge in intensity measurements.

To eliminate the influence of domain-initial strengthening on F0 range, an additional model was examined with sentence type excluded from the predictors. The results showed that sentence type was not a significant predictor of F0 range ($\chi^2 = 4.769$, $p > .05$). This suggests that pitch patterns associated with focus are not solely determined by syntactic structure but are also influenced by prosodic prominence.

C. Intensity

The mean maximum intensity of the focused subjects in $([S]_FVO)$ showed the highest at 67.29 dB. In contrast, when the subject was not focused, intensity values varied across conditions: 66.17 dB in $S[V]_FO$, 64.46 dB in $[V]_FSO$, and 61.80 dB in $[V]_FOS$. Similarly, focused verbs exhibited variation in intensity: focused verbs in $[V]_FOS$ reached the highest intensity at 67.14 dB, while in situ focused verbs in $S[V]_FO$ had the lowest intensity at 64.74 dB. However, it was still higher than that of the non-focused verbs in $[S]_FVO$ (64.35 dB).

Figure 3 shows these results, showing the contrast in intensity between focused and non-focused elements.

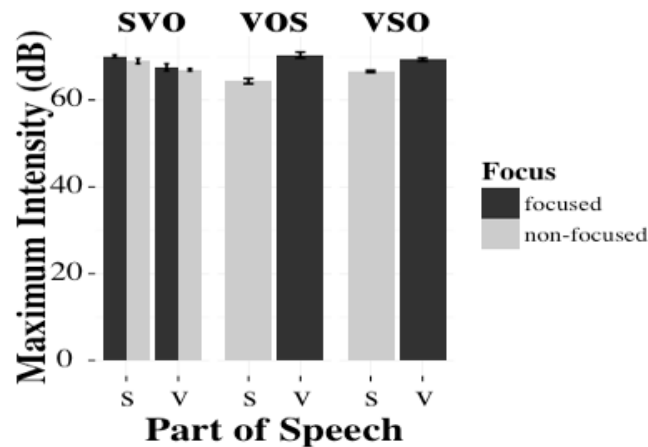


Figure 3. Maximum Intensity of the Stressed Syllable
X-Axis = Part of Speech, Y-Axis = Maximum Intensity (dB)
Black Bar = focused, Grey Bar = non-focused

Table 2 and Figure 3 demonstrate that focused elements exhibit higher intensity than their non-focused counterparts. To assess whether this difference was statistically significant, linear mixed-effects regression models were performed in R (see Procedure above). Comparisons of model fit indicates that focus is a significant predictor of intensity ($\chi^2 = 534.87$, $p < .001$). These results indicate that focused elements have greater intensity across different word orders.

Although intensity has not been widely considered a major cue of focus in Arabic, it has been found significant in Lebanese Arabic and other languages. These findings suggest that intensity may serve as an additional prosodic cue in focus marking in Saudi Arabic.

To examine the effect of domain-initial intensity strengthening, a model that excluded Sentence Type (SVO, VSO, or VOS) as a factor was employed. The findings revealed that intensity was significantly affected by sentence type ($\chi^2 = 101.19$, $p < .001$), supporting the idea that constituents positioned at the beginning of a sentence exhibit increased intensity regardless of focus.

The significance and implications of these findings are discussed further in the following section.

V. DISCUSSION AND CONCLUSION

This study focused specifically on word order and prosody in Saudi Arabic, addressing two major issues. First, do prosodic cues function independently of word order, do they complement it? Second, do specific prosodic cues (vowel duration, F0 range, and intensity) exhibit systematic differences based on focus type and word order changes? The findings indicate that Saudi Arabic speakers employ both syntactic and prosodic strategies to express prominence, indicating that prosody complements word order rather than operating independently.

The results provide evidence that both Hijazi and Najdi Arabic syntactically mark contrastive focus through allowing verb movement to the left periphery. While the two dialects appear mainly to be SVO, contrastively focused verbs do not necessarily remain in situ (S[V]_FO). Instead, verbs may be fronted and found within [V]_FSO and [V]_FOS structures. This finding aligns with that of Alzaidi et al.'s (2019), who found similar patterns in Hijazi Arabic.

Nevertheless, although MSA is traditionally assumed to have a default VSO word order (e.g., Edwards, 2010), corpus-based analyses indicate that SVO word order frequently appears in discourse (e.g., Brustad, 2000; Yasin, 2012). This suggests that the word order in MSA may be more flexible than traditionally assumed, depending on discourse and register.

Alzaidi et al. (2019) reported that focus-preposing is possible in Hijazi Arabic. The findings of this study also indicate that speakers of both Hijazi and Najdi Arabic used VOS and VSO. In addition, contrastive focus was marked in situ (S[V]_FO) in both varieties, indicating the syntactic flexibility of focus realization in spoken Saudi Arabic.

Furthermore, the findings indicate that three prosodic cues (vowel duration, F0 range, and maximum intensity) are employed to mark focus in both Najdi and Hijazi Arabic. Although a few studies have examined the role of prosody in Arabic focus marking, previous research has linked longer durations with focus in Lebanese, Moroccan, Yemeni, and Kuwaiti Arabic (Chahal, 2001; Yeou et al., 2007). Similarly, the F0 range has been associated with focus in these varieties and in Egyptian Arabic (Hellmuth, 2006), while intensity has been identified as a significant cue in Lebanese Arabic.

Research on Hijazi Arabic indicates that focused lexemes exhibit higher F0, which aligns with similar findings in Najdi Arabic. For instance, Alzamil and Hellmuth (2022) identified pitch as a major prosodic marker for focus in the Najdi dialect, supporting the broader conclusion that various Arabic varieties use a combination of syntactic and prosodic strategies to indicate focus.

Generally, the findings indicate that focused elements exhibit a longer vowel duration, wider F0 range, and increased intensity than non-focused elements. These differences were confirmed by a series of linear mixed-effects regression models. In addition, the study examined the effects of a strong start (domain-initial strengthening) on the first word of a sentence to rule out its potential confounding influence. The results show that, although a strong start seems to affect the first focused element, this effect is not significant for vowel duration or F0 range. In contrast, maximum intensity is significantly affected by focus and is also affected by domain-initial strengthening (i.e., the first element in an utterance may exhibit increased intensity regardless of focus assignment). These findings suggest that intensity alone may not serve as a reliable cue for distinguishing focus, as it interacts with sentence position effects.

Furthermore, the findings provide new evidence of a correlation between at least two of the cues (vowel duration and F0 range) and word order in spoken Arabic. This suggests that speakers of Saudi Arabic mark the focused element prosodically even when it undergoes syntactic movement to the left periphery of the sentence to a more salient position. In general, the results indicate that prosody correlates significantly with focused conditions and hence with word order, supporting the idea that prosodic cues are complementary to word order, supporting the idea that prosodic cues complement word order rather than being redundant. In other words, although Arabic speakers marked focus by displacing the focused constituent, they also depend on prosodic marking. Moreover, prosodic marking prioritizes the saliency of meaning over the economical use of language.

The finding that word order and prosody are interactively complementary calls into question the completeness of Donati and Nespor's (2003) categorization of languages as either "prominence dislocating languages" or "constituent dislocating languages". This framework assumes that languages belong to one of these two categories, excluding the possibility of a language combining both. Cole (2015) highlighted this limitation and suggested that a third method of marking prominence might exist. More studies on flexible-word order languages are needed to explore this potential categorization. However, the current results provide new evidence in support of the creation of a third category in Donati and Nespor's research, indicating that certain languages use both prosody and word order in combination to mark prominence. Besides the need for more studies of the syntax-prosody interface in other spoken Arabic varieties, perception studies are required to verify these findings. Such a study should examine whether listeners consider word order and prosody together when interpreting word prominence. In addition, there is a need to explore which prosodic cues are most significant, taking into account the differences between types of focus.

In conclusion, both Saudi Arabic varieties (Hijazi and Najdi) were shown to mark prominence both *ex situ* and *in situ*, in contrast to MSA. The findings show that at least two of the three prosodic cues—vowel duration and F0 range, along with parts of speech in the different word orders, are statistically significantly correlated. In other words, only word order is insufficient to mark focus and assign prominence; instead, word order and prosody appear to complement each other. However, maximum intensity, was affected by a domain-initial strengthening and the placement of the focused element at the beginning of the sentence, making it an unreliable cue when word order changes to mark focus.

Furthermore, these findings suggest the need for a third category that combines both prosody and word order in marking prominence. Future studies on flexible word order languages, especially those in which syntactic movement occurs to the right periphery of a sentence, should further examine these findings. In addition, perception studies are recommended to validate these results and rank the prosodic cues in terms of their perceptual importance.

APPENDIX A. STIMULI

Available upon request.

APPENDIX B. TABLE OF SUBJECTS, VERBS, AND OBJECTS IN ARABIC AND ENGLISH PASSAGES

Available upon request.

APPENDIX C. R CODES

Available upon request.

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