Exhaustive movement, exhaustive tone: a syntactic-prosodic investigation of Gujarati

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Abstract

Based on data collected from speakers of Gujarati, we investigate whether exhaustivity and narrow focus have same effect on the syntactic position of an object and on sentence prosody. The pre-verbal position, which is immediately above the vP in Gujarati has been associated with narrow focus (Joshi 2020), and here we also investigate whether that position also conveys exhaustivity (Kiss 2010). To probe how syntactic position and prosody influence and are influenced by interpretations of exhaustivity and narrow focus on an argument, we conducted production and listening tasks on 10 native speakers of Gujarati. Novel experimental data from the production task suggests that Gujarati speakers are primarily concerned in ensuring that the argument is conveyed as a narrow-focused argument *vis-à-vis* an exhaustively focused one, irrespective of syntactic position, whereas results from the listening task suggest that once prosody was controlled, participants were able to consider syntactic variation as a marker of exhaustivity and not just of narrow focus.

1 The Puzzle

We begin with a puzzle in Gujarati, in which the position of a direct object and the sentence prosody seem to play a role in exhaustivity judgments, as seen in examples such as (2) and (3) for the context in (1). Here, changing the syntactic position of the direct object and changing the pitch contour at the end of the sentence appear to lead to different inferences of whether or not the direct object can be considered exhaustive. In (2), where the direct object *ananas* 'pineapple' can be either to the left or to the right of the adverb *vāramvār* 'frequently', and where we have a falling final contour (L* L%), we receive an exhaustive inference where the subject *šāhrukh* 'Shahrukh' only ate pineapples and not bananas.

(1) **Context:** The doctor had asked Shahrukh to eat pineapples and bananas frequently during the day. So he brought both pineapples and bananas from the market.

(2) šāhrukh-e　　　　(**ananas**) vāramvār (**ananas**) khā-dh-u　**L* L%**
　　Shahrukh.m.sg-erg pineapple frequently pineapple eat-pfv-n.sg
　　'Shahrukh (**only**) ate pineapple frequently.'

Whereas in an example like (3), where see a rising final contour (H* LH%), we lose the syntactic flexibility: the direct object *ananas* 'pineapple' must appear to the left of the adverb *vāramvār* 'frequently', i.e. higher on the clausal spine, for the sentence to convey an exhaustive meaning.

If the direct object *ananas* 'pineapple' remains in situ, i.e to the right of the adverb *vāramvār* 'frequently', we receive the inference where the subject *šāhrukh* 'Shahrukh' ate the pineapples frequently but he probably also ate bananas frequently. The prosodic cues too are different for example (3). Note that in example (3) we have a falling-rising final contour (H* LH%) as opposed to the simple falling contour (L* L%) in sentence (3).

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(3) šāhrukh-e **ananas** vāramvār khā-dh-u **H*LH%** paṇ keḷ-ā nahi khā-dh-ā
    Shahrukh-ERG pineapple frequently eat-PFV-N.SG but banana-PL NEG eat-PFV-N.PL
    'Shahrukh (***only***) ate pineapple frequently.'

In the following section we provide some background information and the theoretical framework we assume going forward, including the specific questions we seek to answer in our study.

2   Background and theoretical framework

Gujarati is an Indo-Aryan language spoken on the west coast of India (Figure 1), primarily in Gujarat state as well as in the Greater Mumbai region to the south. Gujarati shares many properties with related Indo-Aryan languages such as Hindi/Urdu, Punjabi, and Marathi, in the use of SOV order and head-final constructions, frequent scrambling, pervasive gender and number agreement, and ergativity in the perfective aspect (Cardona and Suthar 2003).
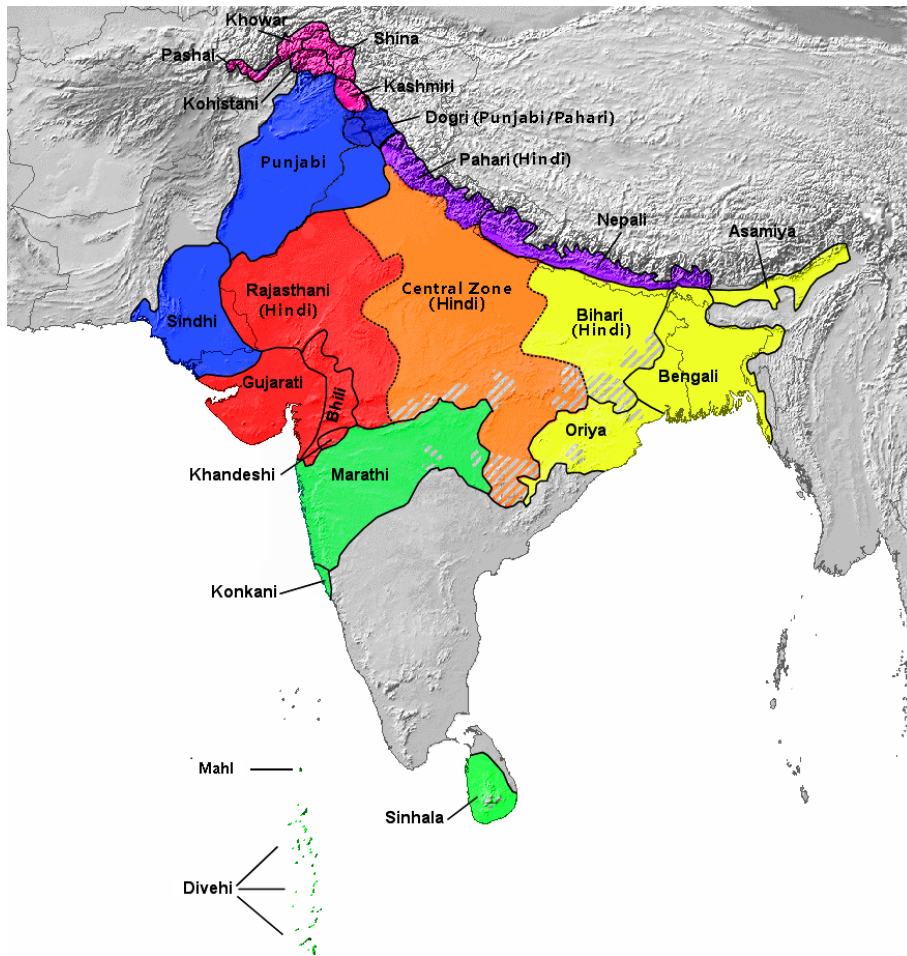

Figure 1: Map of linguistic subregions of the Indo-Aryan language family in South Asia. Gujarati is labeled on the west coast, in red.

Based on previous work by Joshi (2020) for Gujarati and Kidwai (2000) for Hindi/Urdu we propose that the structural position of narrow focus and the position on the clausal spine where an argument receives an exhaustive interpretation is immediately above vP. To test our claims, in

the next section, we discuss the diagnostics to show that there is seems to be an overlap in the structural positions of a narrowly focused argument vs. an exhaustive argument. Here, we use the question-answer congruence test for narrow focus and the *at least-n* test for exhaustivity. We then provide an overview of the basics of Gujarati prosody, drawing on more developed analyses of related languages, before introducing the methods of our current study.

3 Syntactic diagnostics for narrow focus and exhaustivity

3.1 Diagnostics for narrow focus in Gujarati

As has been previously argued for other South Asian languages such as Malayalam in Jayaseelan (2008), Hindi/Urdu in Irani (2014), and Kutchi in Patel-Grosz and Beck (2019), we argue that Gujarati has an information structural FocP in the preverbal position, i.e. immediately above vP.

We argue for this position by using question-answer pairs to detect the precise location of focus following Joshi (2020) (For more on question-answer pairs as focus diagnostics see Rooth (1985) and Rooth (1992)). The focus in the answer corresponds to the new information, which in turn corresponds to the wh-element in the question. Gujarati is descriptively wh-in-situ, but with information structure playing a role in determining the word order, as shown in (4)-(5). In both pairs, the position of the focused element is identical with the position of the wh-word. We have added the adverb *vāramvār* 'frequently', assuming that it has a rigid position as vP adjunct, to serve as an anchor for comparison.

In (4a)-(4b), we show that the focused element always occurs to the left of the adverb *vāramvār* 'frequently' whereas other arguments of the verb appear to the right. In example (4b) for the question in (4a), the focused element of the sentence is *rāj-e* 'Raj-ERG' and it appears to the left of the adverb *vāramvār* 'frequently', matching the position of the wh-element it answers: *kôṇ-e* 'who-ERG'. Given their location between the indirect object and the adverb, both ergative-marked subjects *kôṇ-e* 'who-ERG' and *rāj-e* appear in a different position than the canonical subject position for an SOV language. We argue that this is the specifier Focus position.

Narrow (wh-answer) subject focus

(4) a. vidyā-ne   (**kôṇ-e**)   vāramvār (??**kôṇ-e**)   pel-i   gāḍi   āp-i?
       Vidyā.F.SG-DAT who-ERG frequently   who-ERG that-F.SG car.F.SG give-PFV.F.SG
       'Who frequently gave that car to Vidya?'

   b. vidyā-ne   [**rāj-e**]_F vāramvār (??**rāj-e**)   pel-i   gāḍi   āp-i?
       Vidya.F.SG-DAT Raj-ERG frequently   Raj-ERG that-F.SG car.F.SG give-PFV.F.SG
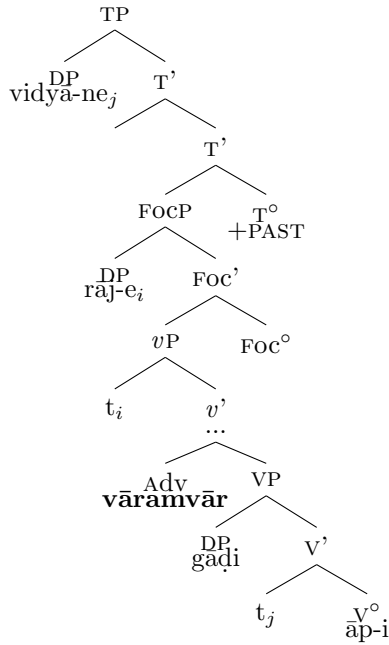   '[Raj]_F frequently gave that car to Vidya'

In sentence (5b) for the question in (5a), the focused element is *Vidya*. Here, the object *vidyā* appears to the left of the adverb *vāramvār* ('frequently').

Narrow (wh-answer) object focus

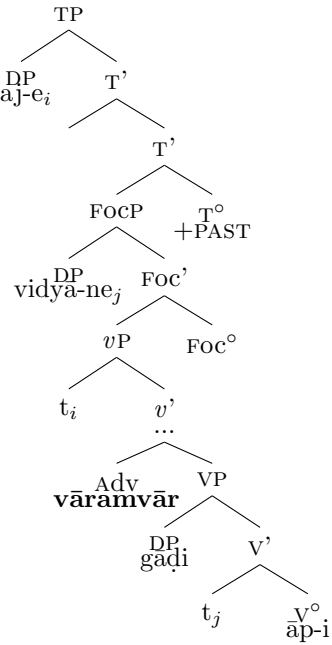(5) a. raj-e   (**kô-ne**)   vāramvār (??**kô-ne**)   pel-i   gāḍi   āp-i?
       Raj.M.SG-ERG who-DAT frequently   who-DAT that-F.SG car.F.SG give-PFV.F.SG
       'Whom did Raj frequently give that car to?'

   b. rāj-e   [**vidyā-ne**]_F vāramvār (??**vidyā-ne**) pel-i   gāḍi   āp-i?
       Raj.M.SG-ERG Vidya-DAT frequently   Vidya-DAT that-F.SG car.F.SG give-PFV.F.SG
       'Raj frequently gave that car to [Vidya]_F'

We illustrate the focus position for example (4b) in (6) and for example (5b) in (7).

(6)

```
            TP
          /    \
       DP        T'
   vidyā-ne_j   /  \
             T'      T°
            /  \    +PAST
        FocP     
        /   \
     DP      Foc'
   rāj-e_i   /   \
           vP     Foc°
          /  \
        t_i   v'
              ...
            /     \
         Adv       VP
      vāramvār    /  \
                DP     V'
              gāḍi    /  \
                    t_j   V°
                         āp-i
```

(7)

```
            TP
          /    \
       DP        T'
    rāj-e_i     /  \
             T'      T°
            /  \    +PAST
        FocP     
        /   \
     DP       Foc'
 vidyā-ne_j   /   \
            vP     Foc°
           /  \
         t_i   v'
               ...
             /     \
          Adv       VP
       vāramvār    /  \
                 DP     V'
               gāḍi    /  \
                     t_j   V°
                          āp-i
```

3.2 Diagnostics for exhaustivity in Gujarati

After having established the structural position of a narrow focused constituent, we now discuss a diagnostic for exhaustivity. Here we put forth new evidence supporting the exhaustive interpretation of an argument in the same structural position as narrow focus. We use the *at least n*-test adapted from Kiss (2010). This test is mainly based on the interpretation of scalar elements. If the test were to work out, we expect a scalar element n, interpretable as '*at least n*' out of focus, can only mean '*exactly n*' in the preverbal focus slot, involving the exclusion of all alternatives but that denoted by the focused constituent. And in fact that is exactly what we observe.

Consider examples (9a) and (9b) for the context in (8). In example (9a) the quantifier *bê* 'two' and the argument *chokrā-o-ne* 'boy-PL-DAT' appear to the left of the adverb *vāramvār* 'frequently' and as a result, we get the exhaustive interpretation of there being *exactly* two boys. Whereas in (9b) since the argument appears to the right of the adverb, we get a non-exhaustive interpretation of there being *at least* two boys.

(8) **Context:** At a music concert, where members of the audience are rewarded if they listen to two boys on the stage.

(9) a. jê-ṇe   **bê chokrā-o-ne** vāramvār sāmbhḷ-y-ā ha-š-e   ê-ṇe   inām maḷ-š-e
       who-ERG two boy-PL-DAT   frequently hear-PFV-PL be-FUT-3 3SG-ERG reward get-FUT-3
       'Whoever has frequently heard (***exactly***) two boys will get the reward.' (exhaustive)

   b. jê-ṇe   vāramvār **bê chokrā-o-ne** sāmbhḷ-y-ā ha-š-e   ê-ṇe   inām maḷ-š-e
       who-ERG frequently two boy-PL-DAT   hear-PFV-PL be-FUT-3 3SG-ERG reward get-FUT-3
       'Whoever has frequently heard (***at least***) two boys will get the reward.' (non-exhaustive)

Note that the structural position where an argument receives the exhaustive interpretation is located to the left of the adverb *vāramvār* 'frequently', a position immediately above *v*P. This is exactly where narrow focus arguments appear on the clausal spine (refer to (4)-(5) and the syntax trees in (6)-(7)). Thus, there seems to be syntactic overlap between a narrow focus argument *vis-à-vis* an exhaustively focused one.

Having established this overlap in syntax we now turn to prosody, to test if how it can help disambiguate narrow focus from an exhaustively interpreted argument.

4   Intonation of Gujarati

Like most other South Asian languages (Khan 2020), utterances in Gujarati are composed of long sequences of repeating rising contours (RRCs). RRCs are analyzed as such: a rising contour is assigned onto every Accentual Phrase (AP), a roughly word-sized prosodic unit that canonically includes a single content word, often with surrounding functional material. Using the model presented in Intonational Transcription of South Asian Languages (InTraSAL, Khan (2020)) — itself based in Autosegmental-Metrical (AM) Theory — these rising APs are analyzed as being composed of a low pitch accent (L*) highlighting the stressed/initial syllable and high boundary tone (Ha) identifying the AP's right edge, with pitch interpolation producing a steady rise between the two tonal targets.

Three of these rising APs can be seen in Figure 2: *ant* 'end', *havā* 'wind', and *hār* 'defeat'. (The reader may note some subtle variation in how the functional material happens to be phrased in this recording: in this instance, the locative marker *mā* is phrased as an extension of the preceding AP, while the ergative marker *e* is not.)
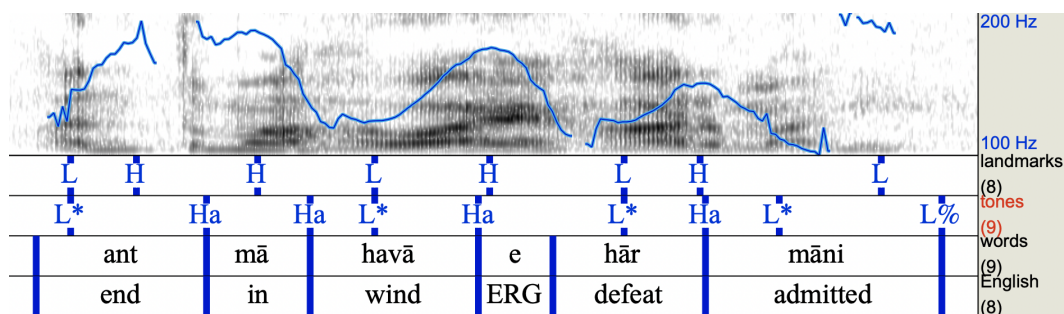

Figure 2: Example of a Praat-generated pitch contour and text grid with InTraSAL annotation of a Gujarati sentence *antmā, havāe hār māni* 'In the end, the Wind admitted defeat'.

Also like other South Asian languages, the final AP within an Intonation Phrase (IP) in Gujarati often bears a different contour than the non-IP-final APs. This is due to concurrent boundary tone overriding (a common feature in many intonation systems), where the boundary tone of a larger prosodic unit (e.g. an IP) deletes and replaces that of a smaller prosodic unit (e.g. an AP) that ends on the same syllable. For example, an extremely common IP-final contour in South Asian languages is composed of the usual low pitch accent (L*), with a low IP boundary tone (L%) deleting and replacing the expected Ha tone for that final AP. As such, instead of a rise, this generates a low-falling final contour, as seen on *mān-i* 'admit-PFV.F.SG' at the end of Figure 2.

To our knowledge, there has been no published work on Gujarati intonation using modern frameworks such as Autosegmental-Metrical (AM) Theory (Pierrehumbert (1980), Pierrehumbert and Beckman (1988), Ladd (2008)), but early descriptive work by Firth (1957) perfectly captures the aforementioned prosodic patterns. In hand-drawn pitch tracks of the perceived pitch contour, Firth provides examples of two IP-final contours copied in Figure 3: a low-falling final contour (L* L%) at the ends of declaratives such as at the end of *utr-e ch-e* 'descend-3 be-3', and a low-rising final contour (L* LH%) — conventionally called a continuation rise, such as at the end of *mil-o ch-e* 'mill-PL be-3', although he does not use this terminology or labeling.

These prosodic characteristics, both in terms of the use of rising APs non-IP-finally and the use of different final AP contours to convey "higher-level" meanings, match those described for closely-related languages such as Hindi (Moore 1965, Harnsberger 1996, 1999, Nair 2001, Patil et al. 2008), Urdu (Hussain 1997, Jabeen 2019), and Bengali (Hayes and Lahiri 1991, Khan 2014), as well as other
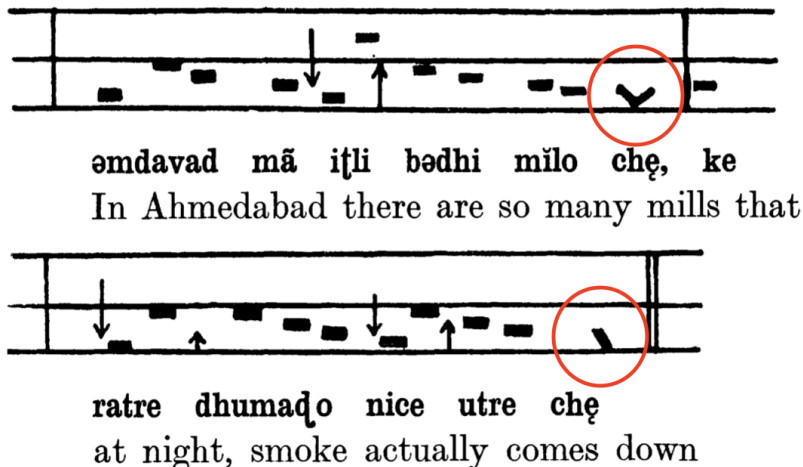
Figure 3: Example of a hand-drawn pitch contour of a Gujarati sentence *amdāvād mā iṭli badhi milo che, ke rātre dhumāḍo nice utre che* 'In Ahmedabad there are so many mills, that at night, smoke comes down' in Firth (1957).

South Asian languages such as Tamil (Keane 2014) and even other AP-based languages outside the region, e.g. Korean (Jun 1996) and French (Jun and Fougeron 2000, Delais-Roussarie et al. 2015).

Because of the lack of published work on Gujarati prosody since Firth (1957), a combination of this early work plus more current work on related South Asian languages was leveraged to better analyze the intonation of Gujarati for the current study. In the following section, we discuss the methodology we adopted for our data collection tasks.

4.1 Questions motivating the study

Three large questions arise from the initial puzzle and how it fits with our initial understandings of focus, exhaustivity, and prosody in Gujarati.

Our first question is: does the exhaustivity reading of an object affect its likelihood to be raised or remain in situ, or does raising for narrow focus make it impossible to convey exhaustivity vs. non-exhaustivity?

Secondly, does the exhaustivity reading of an object affect the final contour of the clause? Specifically, can the use of e.g. L% (declarative, completeness) vs. LH% (interrogative, incompleteness) be leveraged for this purpose, so that L% might convey not just "declarative" and "complete" but also "exhaustive", and that LH% might convey not just "interrogative" and "incomplete", but also "non-exhaustive"?

And thirdly, given the complexity of looking at the intersection of syntax and prosody and how it reflects the intersection of exhaustivity and narrow focus, will observed patterns vary based on whether we're looking at forced choices between syntactic options, lab-style production of prosody, or ratings of recorded speech? We imagine that attention to different aspects of a sentence (e.g. its written form, its vocalized intonation) may lead to different answers to our questions above.

5 Methods

Our experimental methods incorporated three main tasks: one component included a forced choice task coupled with a production task, and another component was a listening task. We worked with a set of five distinct consultants for each of the two components. Both these tasks were conducted

over Zoom calls, recorded with prior consent of the consultants. We then transcribed the recordings using InTraSAL developed in Khan (2020).

5.1 Forced-choice task & Production task

In the forced-choice task and production task, five consultants were presented with six target sentences (four biclausal and two monoclausal) with the object being in one of two structural positions: in-situ vs. raised. We illustrate a sentence pair (monoclausal and biclausal) used in the experiment in examples (11) and (13). Sentences (11a) and (11b) are examples of monoclausal constructions and these examples were preceded by the context in (10). All target sentences were preceded by a context sentence/paragraph intended to overtly bias the reader into an exhaustive or a non-exhaustive interpretation of the object.

(10) **Context:** Raj and Shoaib were arguing about which award it was that Shahrukh had frequently won during the course of his acting career. To this Raj said:

(11) a. šāhrukh-e **filmfare award** vāramvār jit-y-u
Shahrukh.M.SG-ERG Filmfare award frequently win-PFV-N.SG
'Shahrukh frequently won the Filmfare award.'

b. šāhrukh-e vāramvār **filmfare award** jit-y-u
Shahrukh.M.SG-ERG frequently Filmfare award win-PFV-N.SG
'Shahrukh frequently won the Filmfare award.'

Note that the position of the argument *Filmfare award* is different in the two examples. The argument *Filmfare award* appears to the left of the adverb *varamvār* ('frequently') in example (11a), whereas in (11b) it appears to the right. We deliberately constructed these examples as we wanted to test if the syntactic position of an argument has any repercussions on its exhaustive vs. non-exhaustive interpretation.

The sentences in (13a) and (13b) are examples of biclausal constructions that were presented to the consultants along with the context in (12). Note that the position of the argument *sanjay-sāthe* ('with Sanjay') is different in both the examples. the argument *sanjay-sāthe* appears to the left of the adverb *vāramvār* ('frequently') in example (13a), whereas in (13b) it appears to the right.

(12) **Context:** Vidya had worked with Sanjay in multiple films. In a discussion, Sachin asked Wasim, who it was that Vidya frequently worked with in her films. He responded:

(13) a. vidyā-e **sanjay-sāthe** vāramvār film-õ-mā kām kar-y-u
Vidya.F.SG-ERG Sanjay-with frequently film-PL-LOC work do-PFV-N.SG
'Vidya frequently worked with Sanjay in films.'

b. vidyā-e vāramvār **sanjay-sāthe** film-õ-mā kām kar-y-u
Vidya.F.SG-ERG frequently Sanjay-with film-PL-LOC work do-PFV-N.SG
'Vidya frequently worked with Sanjay in films.'

Each target sentence was preceded by a context paragraph as illustrated in (10)-(13). The consultants were asked to follow the steps in the following order: They were asked to read the context in silence. After reading the context they were asked to select one of the two syntactic options presented to them that would constitute an appropriate answer to the given contexts. They would reveal their syntactic selection to the investigator as "option 1" or "option 2" (the order of which was randomized). Finally, in the production task, those same participants then read the context out loud, followed by reading their selected option out loud, to record their intonation. All target sentences and their contexts are provided in the Appendix.

We also included three fillers interspersed through the course of the experiment, as distractors. In addition, the participants were asked to read aloud a story written in Gujarati script before they started the actual task, partially to get them into a "Gujarati mode" before starting the experiment.

5.2 Listening task

Separately from the forced-choice and production tasks, we conducted a listening task with five native speakers of Gujarati. Because we wanted to use the same sentences across tasks (for better comparison), we made sure that none of the participants in the listening task had participated in the forced choice + production task. Like the previous experimental tasks, the listening task was conducted over a recorded Zoom call and the responses were logged in GoogleForms.

Since we worked with a different set of participants in this task we could use the same target sentences (four biclausal and two monoclausal constructions) that were part of the production task, and explicitly ensure that participants would be exposed not only to different syntactic options, but also different prosodic options for each sentence. Specifically, for each example sentence (which had its own context sentence, as in the previous tasks) each participant was provided with eight possible syntactic x prosodic combinations, with their order randomized. One possible randomized order of these eight combinations is provided in Table 1.

Object position	Final contour
In-situ object	H* LH%
In-situ object	L* LH%
In-situ object	H* H%
In-situ object	L* L%
Raised object	H* LH%
Raised object	L* LH%
Raised object	H* H%
Raised object	L* L%

Table 1: Items presented in the listening task

The participants of the listening task were asked to follow the steps in the following order: First, each participant heard the eight options listed in Table 1 along with the contexts. The recordings, which included both the context portion and the target sentence, were played using embedded videos in the GoogleForm through which the participant navigated. Then, participants were asked to rate all eight of permutations of a given sentence on a scale of 1-7, '1' being least acceptable and '7' being most acceptable.

6 Results & discussion

We first report syntactic results in forced-choice responses, followed by prosodic results in their productions. We then move on to the listening task ratings and a synthesis of findings.

6.1 Forced-choice task: Syntax results

In the forced-choice task, participants chose between two written variants of a single sentence, where the only variation between the two options was in the position of the narrow focused object: raised

or in situ. In this task, participants did not appear to take exhaustivity into account, as they overwhelmingly chose the option with raised objects for all target sentences. While the preference for raising was expected in monoclausal and biclausal exhaustive contexts (raising was chosen 7 out of 10 times for each), it is unexpected that participants would also prefer raising in non-exhaustive biclausal examples (9 out of 11 times; one participant provided two options). It seems this preference for raising persisted regardless of the level of exhaustivity established in the context (see Figure 4), suggesting that participants in this task were primarily motivated by focus considerations rather than by exhaustivity considerations.

Total productions (10 per row)

Context		Object in situ	Object raised
Monocl.	Exh.	3	7
Biclausal		3	7
	Non-exh.	2	9

Figure 4: Number of productions analyzed by each intonational option (in columns) for each sentence type (in rows), across all 5 participants. (The final row has one extra production as one participant wanted to include two possible responses.)

6.2 Production task: Prosody results

After making their syntactic choice, however, these same participants did appear to show sensitivity to exhaustivity in the prosody of their productions.

Total productions (10 per row)

Context		Object in situ				Object raised			
		L* L%	L* LH%	H* H%	H* LH%	L* L%	L* LH%	H* H%	L* HL%
Monocl.	Exh.	3	0	0	0	7	0	0	0
Biclausal		1	2	0	0	1	2	0	4
	Non-exh.	1	1	0	0	1	6	1	1

Figure 5: Number of productions analyzed by each intonational option (in columns) for each sentence type (in rows), across all 5 participants. The dominant pattern for each sentence type is highlighted.)

As seen in Figure 5, participants uniformly produced the canonical declarative-final L* L% in monoclausal declaratives (10 out of 10 recordings). In most biclausal declaratives in non-exhaustive contexts, participants largely switched to the "continuation rise" L* LH% at the end of the first clause (7 out of 11 recordings), regardless of whether they raised the object or not, suggesting they are sensitive to the difference between the end of a "complete" monoclausal utterance vs. an "incomplete" clause in the middle of a biclausal construction.

In biclausal declaratives in exhaustive contexts, there was wide variation with no dominant prosodic pattern. The fact that there was no dominant pattern for exhaustive biclausal declaratives, while there was a dominant pattern for non-exhaustive ones, suggests that participants were indeed sensitive to the concept of exhaustivity when choosing a prosodic contour, although it's hard to interpret these results given the lack of consensus on any dominant pattern in this latter case.

6.3 Overview of listening task results

Our listening task was aimed at not forcing participants into just one syntactic and prosodic choice for a given context, but rather probing for judgments on all sorts of syntactic and prosodic permutations.

Curiously, one observation that jumped out in the results is that mean ratings in the listening task were rather high (5+) for almost all possible syntax + prosody combinations (represented by shades of green in Figure 6), hinting at the wide variation speakers allow for in prosody, and in the syntax of a scrambling language.

Figure 6 summarizes the mean ratings (1-7) of each of the eight syntax x prosody options (in columns) for each of the three sentence types (in rows). Each sentence type had two target sentences in it, and thus the means reflect an averaging across the two target sentences and across the five participants. Colors are added to help highlight the major patterns: darker green shades represent higher mean ratings (e.g. participants loved the use of a continuation rise-like falling-rising contour H* LH% on a direct object in situ when in a non-exhaustive context: rated 6.3), while darker orange shared represent lower mean ratings (e.g. participants completely rejected the use of a the yes/no question-like high rising contour H* H% on a direct object raised to focus position in a monoclausal context: rated 1.9).

Mean ratings (1–7)

Context		Object in situ				Object raised			
		L* L%	L* LH%	H* H%	H* LH%	L* L%	L* LH%	H* H%	H* LH%
Monocl.	Exh.	6.3	2.9	2.3	3.1	5.9	4.5	1.9	3.1
Biclausal		5.6	5.1	4.3	5.9	5.3	5.9	4.7	6.4
	Non-exh.	5.1	5.5	4.7	6.3	5.7	5.4	4.9	6.1

Figure 6: Mean ratings (on a scale of 1-7) for each intonational option (in columns) for each sentence type (in rows), with low mean scores (1-3) in in dark orange, high mean scores (6-7) in dark green, and lighter shades for scores in between.

While ratings were overall somewhat high, they do appear to vary across prosodic contours, apparently based on completeness (monoclausality vs. biclausality), not based on exhaustivity. We show below that the variation in ratings across syntactic options within each contour category, however, appear to subtly reflect exhaustivity. We first report prosodic factors, followed by syntactic factors.

6.4 Listening task: Prosody results

Since ratings are overall very high for almost all options, we focus here on the option with the overall highest mean rating per exhaustivity context, as shown more clearly in Figure 7, where only the highest-rated syntax x prosody option for each sentence type is shaded in green.

Mean ratings (1–7)

Context		Object in situ				Object raised			
		L* L%	L* LH%	H* H%	H* LH%	L* L%	L* LH%	H* H%	H* LH%
Monocl.	Exh.	6.3	2.9	2.3	3.1	5.9	4.5	1.9	3.1
Biclausal		5.6	5.1	4.3	5.9	5.3	5.9	4.7	6.4
	Non-exh.	5.1	5.5	4.7	6.3	5.7	5.4	4.9	6.1

Figure 7: Mean ratings (on a scale of 1-7) for each intonational option (in columns) for each sentence type (in rows), with only the highest mean score for each row highlighted for comparison.

In taking this perspective, some meaningful patterns begin to emerge. In monoclausal declaratives, participants uniformly preferred the declarative-final L* L%, matching the universal pattern in the production task. Furthermore, in biclausal declaratives, participants gave the highest ratings to the H* LH% contour, regardless of exhaustive vs. non-exhaustive context. While this particular contour was not described in Firth (1957), it appears to be equivalent to Hindi and Bengali examples in which the high pitch accent (H*) common in IP-final position is combined with the LH% of

the continuation rise, creating something that is similar (but not identical) to the typical L* LH% continuation rise seen in the production task. These prosodic preferences suggest that participants are at least paying attention to the completeness of a declarative (monoclausal vs. biclausal), even if not directly considering exhaustivity.

6.5   Listening task: Syntax results

While exhaustivity didn't make any interpretable difference in prosodic preference, there are subtle preferences in the syntax based on exhaustivity. In Figure 7, among both exhaustive and non-exhaustive biclausal declaratives, participants gave the highest mean ratings to the recordings with the final contour H* LH%, a contour much like the continuation rise. Now if we look within the subset of ratings of these recordings with H* LH%, we see that participants gave the highest mean score to raised objects when in the exhaustive condition (6.4), and to in-situ objects in the non-exhaustive condition (6.3). While this observation is very subtle, it could suggest a nuanced role of exhaustivity in syntactic preference, once prosody is held constant.

6.6   Synthesis of results

Participants in the forced-choice task seem to ignore the subtleties of exhaustivity, instead opting to raise almost all objects. We interpret this to mean that participants were most concerned with marking these objects with narrow focus, and thus chose to raise objects no matter what. In their subsequent recordings, however, exhaustivity played a role in the final contours those very same speakers produced, as non-exhaustive biclausal utterances generated mostly continuation rises L* LH% while exhaustive biclausal utterances did not.

In the listening task, where all stimulus recordings had been carefully produced with focus prosody on the item under narrow focus, our second set of participants appeared to be generally satisfied with almost all options, presumably at least in part because the stimuli were produced (by the first author) with focus prosody clearly marking the object, regardless of its position and regardless of the final contour. Within this overall high ratings, listeners gave the highest ratings to final contours that correctly conveyed monoclausal-finality (L* L%) vs. biclausal-mediality (H* LH%) Furthermore, among these recordings in which H* LH% was employed for biclausal-mediality, the highest ratings went to those with raising in an exhaustive context, and vice versa, suggesting that participants were connecting prosody, syntax, and exhaustivity all in one.

7   Conclusions

In our questions from the initial puzzle, we sought to find out whether the exhaustivity reading of an object affects its likelihood to be raised or remain in situ, when under narrow focus, or if the use of raising for narrow focus makes it impossible to convey (non-)exhaustivity. What we found was that participants are primarily concerned with making sure the object sounded narrowly focused. This meant that in the forced-choice task, when prompted to consider syntax, they achieved this through movement, and did not appear to consider how exhaustivity might be interpreted as a result. In the listening task, they were satisfied with the focus prosody produced on the object, and were apparently able to consider syntactic variation as a marker of exhaustivity, not just focus.

Our second set of questions asked whether the exhaustivity reading of an object affects the final contour of the clause, and whether the use of e.g. L% (declarative, completeness) vs. LH% (interrogative, incompleteness) can be leveraged for this purpose.

From our production results, it appears the answer is yes: LH% was the dominant final tone (in either the L* LH% or H* LH% combinations) for non-exhaustive contexts, and not for exhaustive contexts. However from our listening results, the answer would be no: participants rated LH% on top regardless of exhaustivity.

And lastly, we set out to explore whether these effects are seen in forced choices between syntactic options, in lab-style production of prosody, in ratings of recorded speech, or some combination of these tasks. Our results suggest that indeed, the choice of task affected whether participants attended to syntax vs. to prosody, and to the related concepts of exhaustivity vs. focus vs. utterance-finality. In the forced-choice syntax task, participants seemed to only consider narrow focus in raising objects. In the production task, participants varied their prosody based on exhaustivity. And in the listening task, where focus prosody was provided in the recordings, participants slightly preferred when raising reflected exhaustivity.

From the results of our experiments, it is clear that Gujarati speakers take at least three factors into consideration when producing and rating syntax and prosody. These are clause-(non-)finality, the location of narrow focus, and the interpretation of exhaustivity. No single factor appears to be sufficient to explain all of the patterns seen in the results of the written, spoken, and listening tasks. However, it is not clear whether these three factors are fully independent. Notably, we see this as due to the fact that there is ambiguity in what a particular word order or a particular intonational contour is conveying, leading to variability within and across speakers. We have seen evidence that object raising can convey narrow focus, exhaustivity, or both. We have also seen that IP-final falling contours (those ending in L%) can convey monoclausal-declarative-finality, exhaustivity, or both.

As of yet, the results presented in the current paper are based on only ten speakers total - five speakers per task - and thus remain tentative until tested across a wider pool. Current expansions of our experiment to more participants, along with conceptual extensions, will hopefully help to further tease apart these intersecting factors.

Acknowledgments

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8 Appendix

Type	Context (gloss only)	Target (Gujarati & gloss)
Monoclausal Exhaustive	'There was an argument between Raj and Shoaib about which film awards Shahrukh had won in his career. Raj, being Shahrukh's biggest fan, said:'	*šāhrukhe filmfer vāramvār jityu che* 'Shahrukh has won Filmfare frequently.'
Monoclausal Exhaustive	'Sachin asked Saurav whether Roger had played more times in Wimbledon or if he had played more times in the US Open. Saurav said:'	*rôjare vimbaldan vāramvār ramyu hatu* 'Roger had played Wimbledon frequently.'
Biclausal Exhaustive	'Sachin likes cricket and football, but no one ever has seen him play football. So when his father told his uncle that Sachin likes both, his uncle said:'	*sacinne kriket ghani vār ramtā joyo pan futbôl ramtā nathi joyo* 'I've seen Sachin play cricket many times but never seen him play football.'
Biclausal Exhaustive	'Sachin asked Wasim who Vidya worked with more in movies. Wasim said:'	*vidyāe sanjay sāthe vāramvār filmomā kām karyu pan rāhul sāthe nahi karyu* 'Vidya has worked in films frequently with Sanjay, but she hasn't with Rahul.'
Biclausal Non-exhaus.	'Asha's friend Imran never goes to the supermarket. He likes the open market. So when Asha asked Imran where he got such fresh vegetables, he answered:'	*hum gobi vāramvār bajārmāthi lai āvu ane dudhi pan tyāmthi lai āvu* 'I get cauliflower frequently from the market, and I also get bottle gourd from there.'
Biclausal Non-exhaus.	'Radhika has lived her whole life in Mumbai. As such she can speak four languages. One day, her American uncle asked her what languages she speaks in school. She answered him:'	*skulmā hum ingliš vāramvār bolti pan hindi marāthi ane gujrāti bhi bolti* 'At school I frequently speak English, but I also speak Hindi, Marathi, and Gujarati.'

Table 2: Target sentences (arbitrarily shown here with objects raised above the time adverb) and their contexts, arranged by stimulus type. All contexts and target sentences were presented entirely in Gujarati; the English glosses were not included.