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Which stress is on response particles? An empirical study

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Abstract. Polar response particles (PRPs) have been the subject of a variety of studies in semantics and pragmatics, especially in languages like English and Farsi, where the same particles, *âre* 'Yes' and *na* 'No', can be used with two readings, namely the *polarity* and the *(dis)agreement* readings. While PRPs in response to the negative questions result in ambiguity, many scholars mention the important role of the prosodic saliency in the positive answers to the negative questions. This paper is an empirical effort to capture the focal stress on PRPs in Farsi. Two experiments were conducted with respect to the polarity and the bias of the question. The first experiment confirms the earlier studies for the presence of focal stress on the opposition answers to the negative questions, as well as the lack of such stress in response to the positive questions. The second experiment reveals the presence of focal stress in response to both positive and negative questions, when the questions necessarily express bias. I will propose that two types of focal stress, namely Contrastive Focus and Verum Accent, perform two different functions. In the first experiment, the contrastive focus helps to disambiguate PRPs when required, while the Verum accent in the second study is to indicate the conflict between the addressee's response and the speaker's (bias) expectation.

Keywords. response particles; focal stress; contrastive focus; verum accent

1. Introduction. Cross-linguistically, polar response particles (PRPs) are used in two different readings: namely *polarity*-reading and *(dis)agreement*-reading (Pope 1976). In the polarity reading, the particle marks the response as being either a positive or a negative proposition, while in the (dis)agreement reading the response particle agrees or disagrees with the (uttered) proposition in the initiatives, including assertions and polar questions. In some languages, like English, the same particles could be used in both readings, in that *Yes* can indicate the positive polarity reading as well as the agreement response (superscripted by ^{Pos} and ^{Agr} respectively), while *No* expresses the negative polarity reading (^{Neg}) and the disagreement (^{DAgr}) response. Thus, in response to the positive initiatives like a positive polar question (PPQ) in (1), both readings of each particle generate the same proposition. However, in response to the negative initiatives, like the negative polar question (NPQ) in (2), each reading of PRPs results in different propositions.

(1) A: Did John come to the party?
   a. B1: Yes^{Pos} / Yes^{Agr}, he did.
   b. B2: No^{Neg} / No^{DAgr}, he didn't.

(2) A: Did John not come to the party?
   a. B1: Yes^{Pos}, he DID.
   b. B2: Yes^{Agr}, he didn't.
   c. B3: No^{DAgr}, he DID.
   d. B4: No^{Neg}, he didn't.

Much of the previous research on PRPs investigated on the interchangeable use of PRPs with a positive or a negative proposition, namely the prejacent. Whether they had a syntactic approach

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(Kramer & Rawlins 2011, Holmberg 2013) or a semantic approach (Krifka 2013, Roelofsen & Farkas 2015), they all mentioned the important role of prosodic saliency in positive answers to the negative initiatives as (B1, B3) in example (2). Pope (1976) identifies a special tune, *rise-fall-rise* (RFR), on opposition[1] answers to both positive and negative assertions. Kramer & Rawlins (2011) also mention that (reverse) *no* is only acceptable with an *intonational peak* on the auxiliary. Krifka (2013) and Roelofsen & Farkas (2015) call the prosodic saliency in oppositions to the negative initiatives as *rejecting accent* and *verum accent* respectively, and they argue that such saliency indicates the markedness of the answer. Finally, in a series of generation and perception experiments of English, Goodhue & Wagner (2018) report the presence of fall-rise tune, called it *contradiction contour* (CC), exclusively on the positive answers to the negative initiatives. They claim that CC conveys contextual evidence for a negative proposition.

There are two points worth noting. First, the earlier studies indicated the importance of a single notation, i.e. the prosody in opposition answers to the negative initiatives, in a broad scale. It is not clear what type of focal stress this prosodic saliency is. In English, for instance, verum accent and contrastive focus are prosodically homophones, however, they are semantically different (Romero & Han 2004, Bill & Koev 2021). Second, the contrastive focus (à la Rooth 1992) is expected in the opposition answers to both PPQs and NPQs. However, the prediction was not born out by the empirical data (neither in Goodhue & Wagner 2018 nor in my data).

This paper is an empirical effort to find out more about the focal stress on PRPs. I will use Farsi, as the object language, in which particles *âre* 'yes' and *na* 'no' can be used in both polarity and (dis)agreement readings in response to positive (3) and negative (4) initiatives.

(3) A: Ali mehmuni raft?
Ali party went
'Did Ali go to the party?'

a. B1: *âre*^{Pos}/ *âre*^{Agr}raft.
yes yes went
'Yes, he did.'

b. B2: *na*^{Neg}/ *na*^{DAgr}na-raft.
no no NEG-went
'No, he didn't.'

(4) A: Ali mehmuni na-raft?
Ali party NEG-went
'Did Ali not go to the party?'

a. B1: *âre*^{Pos}/ *na*^{DAgr}raft.
yes no went
'Yes / No, he did.'

b. B2: *âre*^{Agr}/ *na*^{Neg}na-raft.
yes no NEG-went
'Yes / No, he didn't.'

Two experiments were conducted to investigate focal stress on PRPs. Experiment 1 controlled the prosody in both affirmation and opposition answers to PPQs and NPQs. The results show the presence of focal stress on oppositions to NPQs, but not to PPQs, which confirm the earlier empirical studies. Furthermore, Goodhue & Wagner (2018) report the higher frequency of CC on the opposition answers to the rising declaratives as compared to the polar questions, and suggest that the bias (strength) might play a role. Their suggestion was based on the intuition that rising declarative questions convey stronger evidence than polar questions. While they only offered contexts with contextual evidence for a negative proposition $\neg p$, they suspected if a context has (bias) evidence for p, the opposition answers might also bear CC.

[1] I call the answer in the same polarity of the question an *affirmation*, as (B1) in example (1) and (B2, B4) in example (2). The answer in the reverse polarity of the question is called the *opposition*, as (B2) in (1) and (B1, B3) in (2).

Experiment 2 was followed up on Experiment 1 by further investigating the effect of bias on focal stress. I offered PPQs and NPQs with particle *dige*, which necessarily expresses speaker's expectation for the uttered proposition. We found focal stress on the opposition answers to both PPQs and NPQs with *dige*. An explanation is required for the presence and absence of the focal stress on PRPs in both studies. Following the lexical ambiguity of PRPs (Roelofsen & Farkas 2015; Mohammadi 2022), I propose that the focal stress observed only in opposition answers to NPQs (in Experiment 1) is contrastive focus to disambiguate the readings. Conversely, the focal stress in oppositions to both PPQs+*dige* and NPQs+*dige* is verum accent that indicates the conflict between the speaker's expectation and the addressee's response.

The paper is structured as follows. Section 2 lays out the empirical landscape. I start with a brief introduction of the methodology in Section 2.1, followed by the procedure and the materials that are used in both experiments in Section 2.2. The design and the results of Experiments 1 and 2 are presented in Section 2.3 and 2.4 respectively. Section 3 presents the proposal, which suggests different types of focal stresses with respect to their functions. In Section 4, I compare my proposal to the prior empirical accounts. Section 5 is the conclusion, including a brief summary of the paper.

2. Empirical data.

2.1. METHODOLOGY. Earlier studies often model the intonational tunes by ToBI (To(nes), B(reak), I(ndices)) labelling conventions (Pierrehumbert 1980; Beaver & Clark 2008), in which the intonational tunes consist of strings of tones to shape the fundamental frequency (f0). The classic data transcription in the ToBI system is a time-consuming process, which requires a lot of training and it leaves the result to individual judgement. It was especially difficult to detect the focal stress in my study, since it may occurs on monosyllabic particles, and the particles appear at the beginning of the clause.

There is increasing interest in phonetics and related fields to use dynamic analysis, which reduce the data to a more manageable size,in addition to the potential of discovering patterns in speech contour by well-knows statistical approaches (Wood 2017; Wieling 2018; Sóskuthy 2021). Such analysis offers a series of measurements with temporal/spatial structure, which facilitates the discovery and analysis of complex patterns without relying on individual judgement. Generalized additive mixed models (GAMMs) are non-linear regression models that illustrate time-varying speech data by capturing variation not only in the trajectory height but also in the shape. The models also smooth the shapes, fitting separated curves of each (group) variable as well as allowing random effects that take care of dependencies among grouped data points.

The goal of this paper is to capture the prosodical saliency on PRPs, and by that I specifically mean an increase of pitch range (and/or duration). This could be fully satisfied by dynamic analysis. To be clear, I do not have any *phonological* claim about the (ToBI) prosodical specification of PRPs, and I therefore leave it for future investigation.

In both experiments, I used different simulations to explore the reliability of different setups with GAMMs in my datasets. I started with a simple model and gradually developed it to more complex ones, until eventually arriving at the optimal model. I used 'ML' estimation, *Maximum Likelihood*, which is required for comparison between models with different fixed effects. I also set the smooth process for each level of our factor parameter with *Thin Plate* regression spline. Finally, the best *knit* parameter for the size of the basis dimension was 5 in my model (for more details about the technicalities and parameters see Wieling 2018; Sóskuthy 2021).

2.2. MATERIAL AND PROCEDURE. Both experiments consist of a series of a scene-setting followed by a short conversation. The contexts were set up properly with respect to the conditions (e.g. for an affirmation or an opposition answer to a positive or a negative question). The dialogue included three pairs of question-answer, one of which was our target and two of them were distractors by WH-Qs, assertions, and exclamations. I divided the trials into six lists (Latin-square), in which stimuli were pseudo-randomized and participants had three tokens of each condition. Example (5) is a sample stimulus of NPQs with an opposition answer by particle *na*.

(5) *Sara thinks that Ali didn't go to the party last night, but she is not sure. She is talking with Leila, who was in the party. Leila knows that Ali was actually there.*

Sara: How was the party?
Leila: Awesome! You missed it.
Sara: I know. Did Ali not come?
Leila: *na umad*. I saw him.
no came.
Sara: When did you see him?
Leila: Just before the dinner.

Participants were divided evenly with almost the same number of men and women in each group. They were asked to read the scene carefully and then record the dialogue as natural as possible. Because of the Corona pandemic, I couldn't record my data in a lab, as they were all shut down for a long period. I also did not run the experiments online, since I didn't want any risk of noise or low quality in my data. I recorded the data in person with the same device (MacBook Pro 2019) and PRAAT application (version 6.1.53, set on monotone 44100Hz). The recording sessions were all in the same room, facilitated for the experiment.

Data were collected from 36 participants, 22 women 14 men (average 34 years, above 18). All participants were native Farsi speakers born and raised in Tehran, Iran. Due to Corona restrictions, participants were scheduled to come to the recording session one by one. They were each instructed individually, and the first trial was the test recording. The dialogues started with a non-target question, which was used as a warm up to let the participant feels comfortable with her/his voice. Participants were free to rerecord if they were not satisfied with their work.

Six participants were filtered out due to noise or lack of natural intonation. The naturalness was controlled by the monotonic intonation in the whole recording. It was controlled by the lack of proper intonation on the surprise expressions, e.g. *râst migi*! 'Really!', *če bahâl*! 'Awesome!', *hurâ*! 'hurrah!' in the dialogue. Participants had two 5min-breaks between recording 18 stimuli, and the sessions last ca. 40 minutes.

2.3. EXPERIMENT 1.

2.3.1. DESIGN. The Experiment investigated the focal stress on PRPs in affirmation and opposition answers to both PPQs and NPQs. It aims to answer two questions: (i) Do the speakers use focal stress systematically (in a specific response type/particle/reading)? (ii) Does the polarity of the question affect the stress? The experiment had a 2x2x2 design with the following factors:

- **Antecedent type**: PPQs, NPQs
- **Response type**: Affirmation, Opposition
- **Response particle**: *âre, na*

Note that I ended up to six conditions, since in response to PPQs, *âre* cannot accompany $\neg p$ to oppose and *na* cannot be used in affirmation to express p (see example (1)). PRPs were extracted from the whole recording tracks. Then, 15 data points of f0 trajectory from each particle were automatically collected by a script in PRAAT. The final dataset consists of 8370 measurement points from 558 trials.

2.3.2. RESULTS. The summary of the GAMMs shows a significant difference between affirmations and oppositions ($\beta = 4.49$, CI = 95%, $p < .001$). The model's explanatory power is substantial ($R^2 = 0.75$). The optimal random effect structure was one with by-participant intercepts.

```
Family: gaussian
Link function: identity

Formula:
F0 ~ ResponseType + s(MeasurementNo, by = ResponseType, bs = "tp",
    k = 5) + s(ParticipantID, bs = "re")

Parametric coefficients:
                     Estimate Std. Error t value Pr(>|t|)
(Intercept)           190.3968     8.2476  23.085  < 2e-16 ***
ResponseTypeOpposition   4.4882     0.5946   7.548 4.91e-14 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                                          edf Ref.df      F p-value
s(MeasurementNo):ResponseTypeAffirmation  3.167  3.635  19.57  <2e-16 ***
s(MeasurementNo):ResponseTypeOpposition   3.673  3.936 138.67  <2e-16 ***
s(ParticipantID)                         28.962 29.000 793.71  <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.745   Deviance explained = 74.6%
-ML =  38225  Scale est. = 716.02    n = 8100
```

Figure 1 is the general smooth-plot and the difference-plot of the data, illustrating the shape and the height difference of f0 trajectory for each response types. The prosodic pattern of PRPs in affirmations (the blue track) has less rising as compared to their counterparts in oppositions (the red track) with enhanced pitch rise. Statistically, the f0 magnitude excursion in affirmation is 9Hz (184-193Hz), while it is 26Hz (179-205Hz) for oppositions.[2] Furthermore, the diff-plot shows that the trajectories are different slightly at the beginning of the measurement (time slap 2-3) and largely from the middle to the end of the measurements (time slaps 7-15). It shows that the response type is significantly difference in both height and shape.
To make sure that the morpho-phonological[3] characteristics of the particles did not intervene the results, I provide the f0 trajectory of *âre* and *na* in affirmation and opposition responses sepa-

[2] The patterns are suggestive of H^* (in affirmations) and $L+H^*$ (in oppositions) interpretations. However, I leave any phonological claim for further studies.

[3] Although the phonological properties of the particles are out of the scope of this study, it is worth mentioning that *âre* and *na* have CVCV and CV patterns respectively. The former starts with a glottal stop consonant and the latter has a nasal start that cause the difference in their f0 tracks (in the start and the end points of the articulations). However, the plots of each particle (Figures 2 and 3) share the same pattern with the plot of both particle (Figure 1), in which the affirmation and opposition tracks differ similarly in the shape and the height.

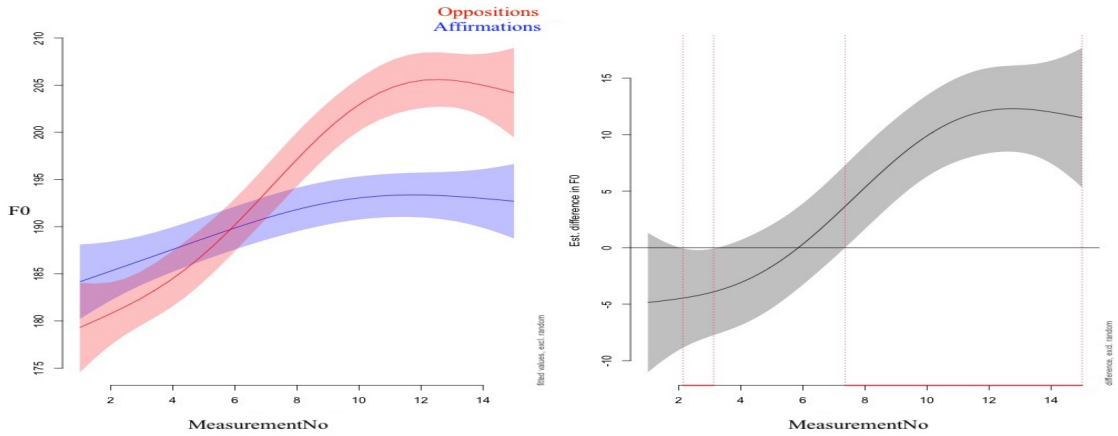

Figure 1. Non-linear smooth and different plots of Affirmation and Opposition responses. The pointwise 95%-confidence intervals are shown by shaded bands. The red line (and the vertical dotted lines) on the x-axis of difference-plot (on the right) shows the significant difference at the beginning and the end of the pitch tracks.

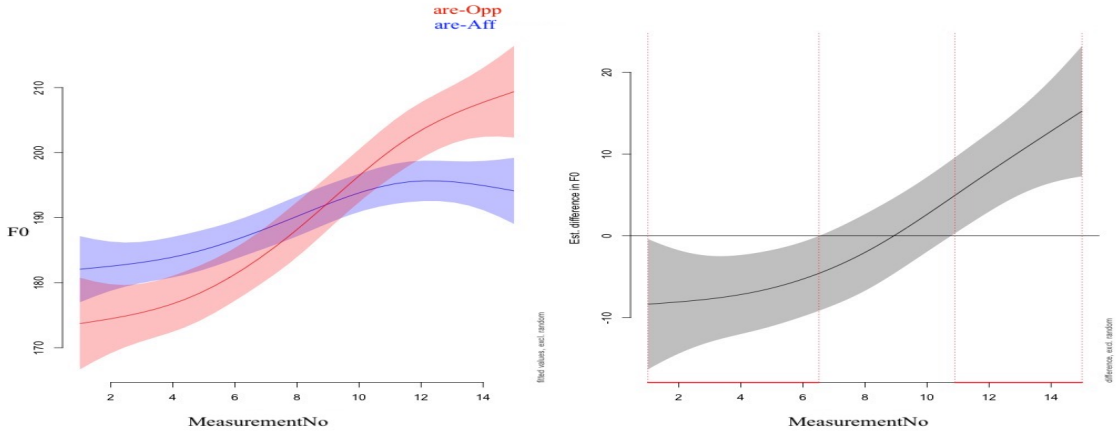

Figure 2. Non-linear smooth and difference plots for Affirmation (red track) and Opposition (blue track) responses of particle *âre* to PPQs and NPQs (shaded-band is 95%-confidence intervals).

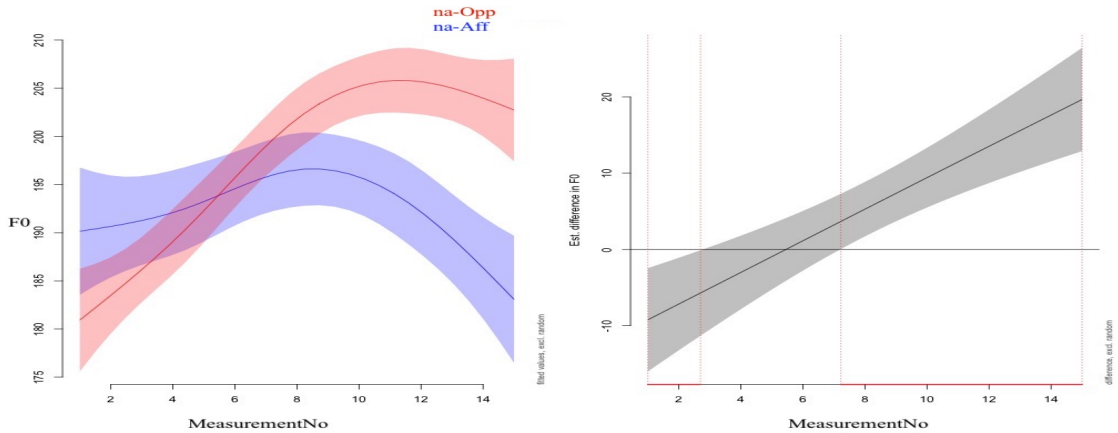

Figure 3. Non-linear smooth and difference plots for Affirmation (blue track) and Opposition (red track) responses of particle *na* to PPQs and NPQs (shaded-band is 95%-confidence intervals).

rately in Figures 2 and 3. While the phonological characteristics of each particle affect the patterns on the surface, the shape and the height differences are still presented in the same vein. In other words, what is consistent in our data is the significant difference between affirmation and opposition answers for both particles. That is the Affirmation trajectories of both particles have small pitch rise as compared to their Oppositions with higher raise.

Finally, Figure 4 represents the effect of the question's polarity on the focal stress in Opposition answers with particle *na*. Notice that, on one hand, the data from the affirmation answers above shows no focal stress, and the polarity doesn't change anything in Affirmations. On the other hand, particle *âre* cannot be used in opposition answers to PPQs (see example (3)). Therefore, to investigate the polarity effect, we are left with particle *na*, which can be used in oppositions to both PPQs and NPQs. The result shows that the effect of question's polarity is statistically significant (β = 6.33, CI = 95% , p = 0.002). The excursion magnitude in PPQs (190-210Hz) and NPQs (170-210Hz) has 20Hz difference.

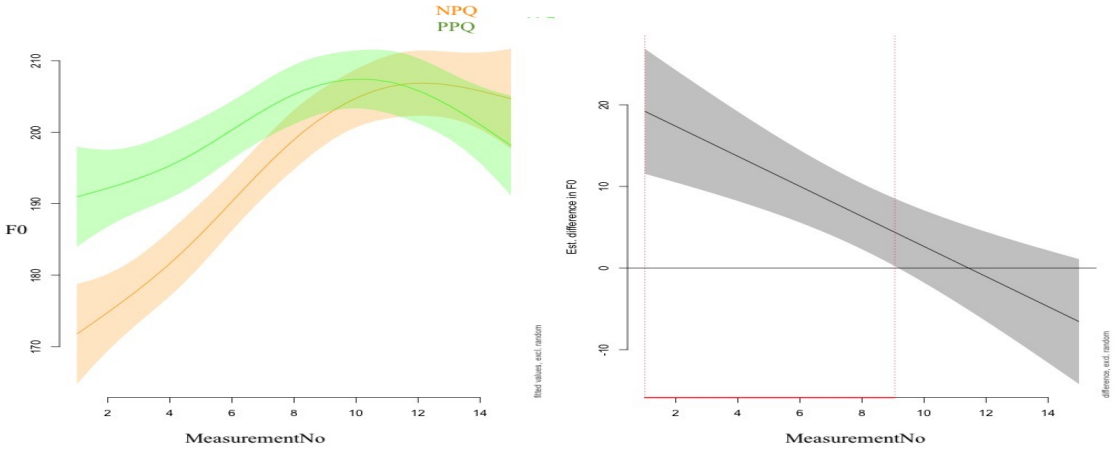

Figure 4. Non-linear smooth and difference plots of Oppositions with particle *na* to NPQs (orange track) and PPQs (green track). Shaded-band is 95%-confidence intervals.

Regarding our research questions, (i) the speakers use focal stress on opposition answers and on both *âre* and *na* particles. (ii) The focal stress was observed only in response to NPQs (but not to PPQs). While the result was predicted and observed in earlier studies, we cannot still know what kind of focal stress it is. On one hand, if it indicates the contrast (à la Rooth 1992) between the propositional answer and the proposition in the question, why it is not observed in oppositions to PPQs? On the other hand, if it indicates the presence of contradicting (contextual) evidence for $\neg p$, (à la Goodhue & Wagner 2018), we would expect to see it in contexts, which are biased towards p too. This is the missing data that will be controlled in the follow up experiment. Note that Goodhue & Wagner's stimuli were in contexts with evidence for $\neg p$ for both PPQs and NPQs. Besides, while they report higher frequency of CC in response to negative rising declaratives as compared to polar questions, they did not provide positive rising declaratives.

To complete our discussion and to figure out the type and the job of the focal stress on PRPs, we need to check the opposition answers to both PPQs and NPQs, biased towards a positive and a negative proposition respectively. In the next experiment, we will see if bias affects the presence/absence of focal stress.

2.4. EXPERIMENT 2.

2.4.1. DESIGN. Experiment 2 focused on the effect of bias on the prosodical saliency in PRPs. We were looking to see if the speakers use focal stress more frequently/strongly when the antecedent is biased. While NPQs are (often) assumed to be biased in comparison to PPQs, I take them both as weakly biased questions in the sense that the speaker can cancel the potential bias by saying '*I have no idea*'. To answer our research question, we need stronger form of bias, in that one cannot cancel the bias implicature. I implemented bias by particle *dige* that obligatorily expresses speaker's expectation towards the uttered proposition.

I stipulate PPQs and NPQs as weakly biased (WB) questions, while the same forms with particle *dige* are taken as strongly biased (SB) questions. The contexts were set up regarding the conditions. The experiment is a 2x2x2 design with the following factors.

- **Bias type**: WB, SB (by the means of particle *dige*)
- **Antecedent type**: PPQs, NPQs
- **Response particles**: *âre, na*

Two conditions, namely weakly and strongly biased PPQs with '*âre*, $\neg p$' are semantically ruled out (see example (3)), and I ended up with six conditions. In this experiment, I ignored affirmation responses and provided only opposition responses, since the data in the prior experiment shows no focal stress in affirmations. The dataset consists of 8100 measurement points from 540 trials, multiple 15 data points of their f0 trajectory.

2.4.2. RESULTS. I fitted the model for f0 trajectory of opposition responses to weakly vs strongly biased questions, which shows statistically significant difference (β = -1.63, CI = 95%, p = 0.005). The model's explanatory power is substantial (R^2 = 0.79).

```
Family: gaussian
Link function: identity

Formula:
F0 ~ BiasType + QType + s(MeasurementNo, by = BiasType, bs = "tp",
    k = 5) + s(ParticipantID, bs = "re")

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 192.4550     9.0524  21.260  < 2e-16 ***
BiasTypeWB   -1.6296     0.5754  -2.832  0.00464 **
QTypePPQ      8.0918     0.6103  13.259  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                              edf Ref.df       F p-value
s(MeasurementNo):BiasTypeSB  3.524  3.869  150.22  <2e-16 ***
s(MeasurementNo):BiasTypeWB  3.436  3.821   50.42  <2e-16 ***
s(ParticipantID)            28.971 29.000 1021.31  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.791   Deviance explained = 79.2%
-ML =  37962  Scale est. = 670.44    n = 8100
```

Interestingly, whilst Figure 5 of negative questions shows slight difference in respect to the bias strength (f0 magnitude excursion WB NPQs=21Hz (180-201Hz) and SB NPQs=30Hz (175-205Hz)), there is a significant difference between SB and WB forms in PPQs (f0 magnitude excursion WB PPQs=7Hz (193-200Hz) and SB PPQs=22Hz (187-209Hz)) as in Figure 6. That is

the oppositions to WB PPQs bear no focal stress, while their counterparts in SB PPQs show different prosodical pattern. Taken together, the result of this experiment confirms the earlier data for the presence of focal stress on PRPs in the opposition answers to WB NPQs and the lack of stress in the oppositions to WB PPQs. Furthermore, it reveals the presence of focal stress on PRPs in the opposition answers to both PPQs+*dige* and NPQs+*dige*, when they are strongly biased towards the uttered proposition.

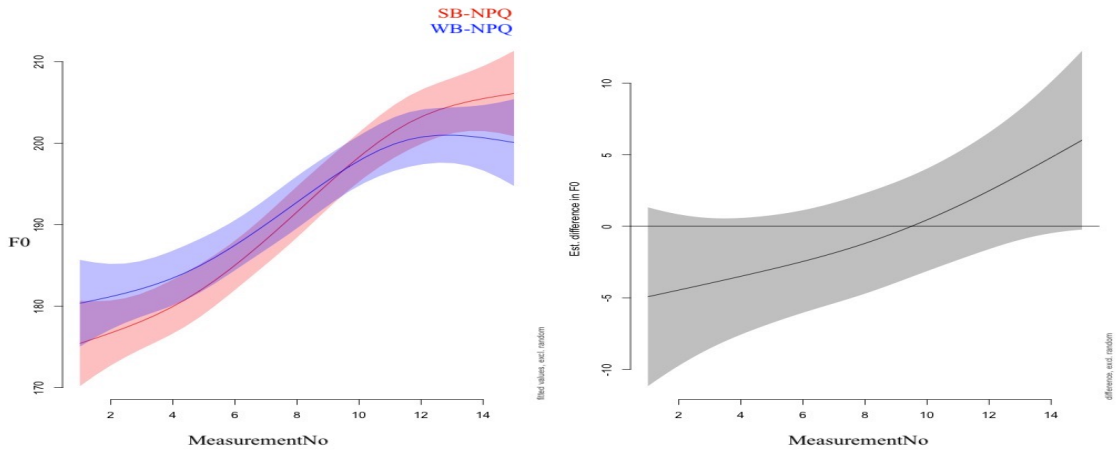

Figure 5. Non-linear smooth and different plots of opposition answers with *âre* and *na* to SB (red track) and WB (blue track) NPQs. The pointwise 95%-confidence intervals are shown by shaded bands.

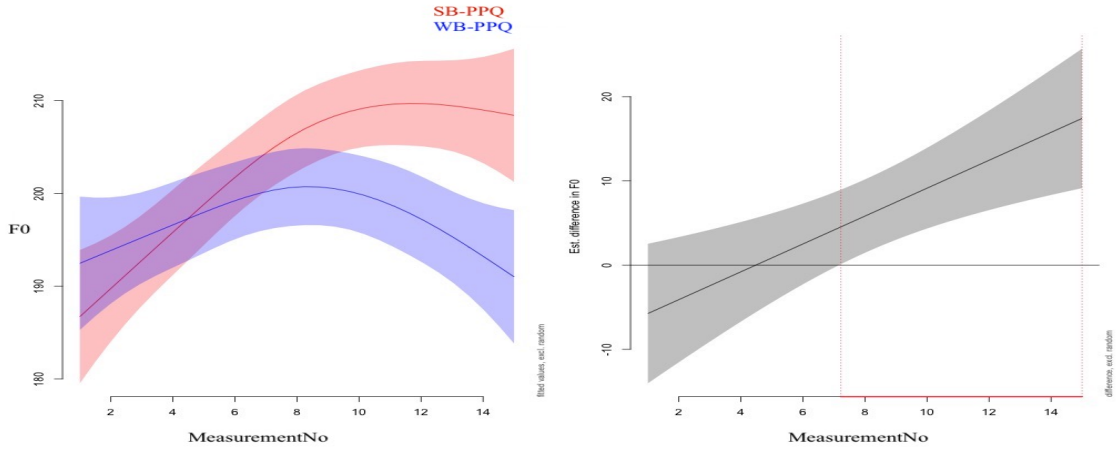

Figure 6. Non-linear smooth and different plots of opposition answers with *âre* to SB (red track) and WB (blue track) PPQs. The pointwise 95%-confidence intervals are shown by shaded bands.

3. Proposal. In this section, I propose that the focal stress on PRPs in response to the weakly and strongly biased questions are two different types of focal stress with different jobs. In short, on one hand, in response to WB questions, it is the contrastive focus that helps to disambiguate the PRPs with different readings via the set of alternatives. On the other hand, SB questions necessarily indicate speaker's expectation (as the biased answer) that conflicts with the addressee's

belief (as the true answer), correspondingly we have the verum accent that indicates the conflict.[4]

The result of both experiments, and the proposal for the types of the focal stress are summarized in Table 1. The *Response* column includes different possible PRPs only in opposition answers, and the *Prosody* column shows the presence and absence of the prosodical saliency in our data. In the *Bias* column, the diamond $\diamond$ signals the possibility of the bias implicature in WB questions, and the square $\square$ indicates that the bias implicature necessarily presents. The *Possible Alternatives Set* column includes the potential alternatives raised by contrastive focus (CF) (following the lexical ambiguity in Mohammadi 2022, Roelofsen & Farkas 2015). Finally, the *Focal Stress* column is the proposal for the type of focal stress with respect to the empirical data.

Bias	**QType**	**Response**	**Prosody**	**Bias**	**Possible Alternative Set**	**Focal Stress**
WB	PPQs	$na^{Neg}(\neg p)$	no saliency	$\diamond$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\neg p\}$	-
		$na^{DAgr}(\neg p)$	no saliency	$\diamond$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\neg p\}$	-
	NPQs	$\hat{a}re^{Pos}$(p)	salient*	$\diamond$	$\{\hat{\text{a}}\text{re}^{Pos}, \hat{a}re^{Agr}\} = \{\text{p}, \neg p\}$	CF
		na^{DAgr}(p)	salient*	$\diamond$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\text{p}, \neg p\}$	CF
SB	PPQs+*dige*	$na^{Neg}(\neg p)$	salient	$\square$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\neg p\}$	verum
		$na^{DAgr}(\neg p)$	salient	$\square$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\neg p\}$	verum
	NPQs+*dige*	$\hat{a}re^{Pos}$(p)	salient	$\square$	$\{\hat{\text{a}}\text{re}^{Pos}, \hat{a}re^{Agr}\} = \{\text{p}, \neg p\}$	verum
		na^{DAgr}(p)	salient	$\square$	$\{\text{na}^{Neg}, na^{DAgr}\} = \{\text{p}, \neg p\}$	verum

Table 1. The summary of the data from Experiments 1 and 2, and the proposal.

Let's start with the proposal for CF on PRPs in response to WB forms. I argue that CF can not only explain the presence of the focal stress in response to NPQs, but also its absence in response to PPQs. Following Rooth (1992), the set of alternatives for contrastive focus contains various possible replacements in the similar domain of the focused expression.[5] The alternative set includes both the focused constituent and the contrasted item(s).

Mohammadi (2022) claims that PRPs in Farsi are feature markers, which are lexically ambiguous between the two different readings (following Roelofsen & Farkas 2015). I propose that the alternative set of PRPs consists of different entries/readings of the similar particle (as it is presented in the Table).[6] When the antecedent is a negative initiative, the PRPs in the set result in a list with two propositions, $\{p, \neg p\}$ (which cause the ambiguity in bare forms). However, in case of a positive antecedent, PRPs in both readings generate the same proposition, resulting a singletone set $\{\neg p\}$ (see examples (3) and (4) in Section1).

[4] The proposal supports the suspicion in the literature that verum accent is different from contrastive polarity focus.

[5] The contextual restrictions could be applied later in pragmatics.

[6] Notice that CF on a single constituent could signal different alternative sets depends on the context. For instance, $[eat]_F$ could raise sets of $\{eat, ate\}$: tense-wise, $\{eat, has\ eaten\}$: aspect-wise, $\{eat, \neg eat\}$: polarity-wise. In my proposal, CF on PRPs triggers a (presuppositional) feature-wise set, resulting in two different readings of the same particle, i.e. $\{na^{Neg}, na^{DAgr}\}$ for $[na]_F$ and $\{\hat{a}re^{Pos}, \hat{a}re^{Agr}\}$ for $[\hat{a}re]_F$ (see Mohammadi 2022). This is similar to focused pronoun in example (i), where CF indicates the alternatives with different gender feature (contrasting unknown gender vs. male), while CF in (ii) indicates the alternatives with different person feature (singular vs. plural):

(i) A: Matin comes for dinner.
  a. B: Is he your colleague?
  b. A: $[They]_F$ is my colleague.

(ii) A: Matin and Sara come for dinner.
  a. B: Is he your colleague?
  b. A: $[They]_F$ are my colleagues.

Now, we can explain the presence and absence of focal stress in oppositions to NPQs and PPQs respectively regarding the CF requirement. On one hand, there is no CF on PRPs in response to PPQs, since there is nothing to contrast with in a singletone set. On the other hand, we have CF on oppositions to NPQs, signaling the contrast between the two possible readings of the same particle. While the compositional semantics of CF as in (6) steers the reading towards the opposition answer, it helps to disambiguate the meaning.[7]

Note that PRPs in the polarity reading mark the prejacent answer as a positive or a negative proposition, while the (dis)agreement readings indicate an answer in the same or reverse polarity of the question. Here, ϕ is the prejacent proposition that PRPs in either of the readings returns (for more information about PRPs see Krifka 2013, Roelofsen & Farkas 2015, Mohammadi 2022). While NPQs as in (6) make the negative proposition $\neg q$ salient, the focused particle is in congruent with it, i.e. $C = \neg come(a)$ (for C variable see Rooth 1992). The semantic derivation of CF as in (6).a is felicitous with a positive prejacent, while it fails to occur with a negative answer as in (6).b:

(6) A: Did Ali not come? B: $[\hat{a}re]_F$

a. $[\![\phi]\!] = [\![\ \hat{\text{a}}\text{re}^{Pos}]\!]$ meaning *he came*
$[\![\phi]\!]^o = \lambda w.come_w(a)$
$[\![\phi]\!]^f = \left\{ \begin{array}{l} are^{Pos}, \\ are^{Agr} \end{array} \right\}$
$= \left\{ \begin{array}{l} \lambda w.come_w(a), \\ \lambda w.\neg come_w(a) \end{array} \right\}$

$C \in [\![\phi]\!]^f$ ✓
$C \neq [\![\phi]\!]^o$ ✓

b. $[\![\phi]\!] = [\![\ \hat{\text{a}}\text{re}^{Agr}]\!]$ meaning *he didn't come*
$[\![\phi]\!]^o = \lambda w.\neg come_w(a)$
$[\![\phi]\!]^f = \left\{ \begin{array}{l} are^{Pos}, \\ are^{Agr} \end{array} \right\}$
$= \left\{ \begin{array}{l} \lambda w.come_w(a), \\ \lambda w.\neg come_w(a) \end{array} \right\}$

$C \in [\![\phi]\!]^f$ ✓
$C \neq [\![\phi]\!]^o$ ✗

Therefore, the semantic of CF (à la Rooth 1992) ensures that the focus happens only in oppositions, regardless of the particle and the reading. Consequently, the speaker figures out the opposition answer by PRPs via the pragmatic reasoning. For instance, take focused bare $[\hat{a}re]_F$ in response to (6): regarding the derivation of contrastive focus above, CF is acceptable when the prejacent is opposite to the antecedent. Since we have a NPQ with a negative salient proposition, the answer $[\hat{a}re]_F$ is only felicitous with $\hat{a}re^{Pos}$, meaning *he did*.

On the other hand, the unfocused PRPs can result in an affirmation answer unambiguously with the help of Maxim of Quantity (and CF derivation). The Quantity implicatures arise when the speaker uses one form, while she could have used a more informative form.[8] In such cases, the addressee reasons that the speaker has the authority over the topic, and she is as cooperative

[7] The earlier studies also mention that speakers tend to interpret focused bare PRPs as an opposition answer rather than an affirmation answer. It has been observed in empirical data in Kramer & Rawlins (2011), Claus et al. (2017), and Goodhue & Wagner (2018) as well as predicted in the theoretical studies of Krifka (2013) and Roelofsen & Farkas (2015).

[8] It is worth looking at Manner implicature that has a great deal in common with (non-)scalar Quantity implicature. Broadly speaking, Manner implicatures arise when the speaker uses one form while she could have used a less complex but equally informative one. However, Quantity implicatures arise when the complexity of the alternative is held fixed, but it is more informative. I claim for (non-scalar) Quantity implicature, since semantically $\hat{a}re$ is not as informative as $[\hat{a}re]_F$. On one hand, as we saw, the compositional derivation of CF on $[\hat{a}re]_F$ ends up one reading of the particle (in oppositions). On the other hand, unfocused $\hat{a}re$ could be either of the readings and generates two proposi-

as possible. Thus, when the speaker didn't use the more informative form, the addressee can reasonably infer that the speaker doesn't believe it is true. While the scalar Quantity implicatures arise from a set of alternatives with a canonical scale of informativeness, non-scalar Quantity implicatures involve forms that are not associated with a scale, but the hearer can still reason that the form is less informative than it could have been.[9]

Assuming that the speaker is as cooperative as possible, the addressee would disambiguate unfocused PRPs with the help of the Max.Quantity. Let's review a response particle *âre* to (6). An unfocused *âre* felicitously generates p and $\neg p$ (by $\hat{a}re^{Pos}$ and $\hat{a}re^{Agr}$ respectively), while the focused $[\hat{a}re]_F$ only results in p (by $\hat{a}re^{Pos}$ via CF derivation in (6)). Thus, *âre* is less informative than $[\hat{a}re]_F$. Given that the speaker had a choice to use the more informative focused form, by not doing so she indicates that she doesn't believe it is true (non-scalar Quantity implicature). Removing p from the alternatives, we are left with $\neg p$, thus, the speaker means $\hat{a}re^{Agr}$, *he didn't*.

Taken together, the disambiguity of focused PRPs are semantically derivable, while the ambiguity of unfocused particles is a matter of missing the pragmatic reasoning over the maxim of Quantity. In other words, the addressee (often) derives the semantics of the focused particles correctly (observed in empirical data in Goodhue & Wagner 2018), while she might miss the (non-scalar) implicature. Correspondingly, the addressee cannot conclude that the bare unfocused particle is an affirmation and reports the ambiguity. It is worth noticing that the proposal not only explains the presence and absence of CF, but also argues in favor of a different class of alternatives. That is with an alternative set of $\{\hat{a}re,\ na\}$, generating $\{p, \neg p\}$, one would expect CF in oppositions to PPQs too, since the set is the same for oppositions to both PPQs and NPQs. However the empirical data shows no focal stress in oppositions to PPQs (thus, the lexical ambiguity hypothesis would provide the proper set).

Turning to the data in strongly biased forms, I propose that the focal stress on the opposition answers to both PPQs+*dige* and NPQs+*dige* is verum accent, as the overt realization of the VERUM operator (cf. Romero & Han 2004, Gutzmann et al. 2020). Bill & Koev (2021) define the operator in (7), that works as an identity function, presupposing the existence of conflicting evidence:

(7) $[\![VERUM]\!]_c(p) = p$, provided that there is conflicting evidence about p in context c

The bias implicature (expressed by particle *dige*) necessarily exists in both positive and negative questions ($\Box$), in the sense that the bias implicature cannot be canceled. The answer proposition as the addressee's belief conflicts the biased answer as the speaker's expectation. The bias implicature fulfills the conflicting presupposition in VERUM, and triggers the verum accent. On the other hand, in WB forms the bias implicature is optional ($\Diamond$) and cancelable. That is one can ask PPQs or NPQs, even when she explicitly mentions that she is ignorant about the possible answer.

tions. Therefore, the focused particle is more informative and directly leads to one reading, while the unfocused form is less informative by proposing two possible readings.

Hence, while both forms are equally brief (as the Maxim of Manner required), the plain form is ambiguous (contrary to the Maxim), and the speaker should utter the prejacent to disambiguate. Thus, Maxim of Manner needs the longer form, while Maxim of Quantity can explain the short form.

[9] Example (i) is Grice's (1975) sample of non-scalar Quantity implicature, which implicates John didn't meet his mother/wife/girlfriend at the bar last night.

(i) John met a woman at the bar last night.

Thus, the presupposition of VERUM is shaky in plain polar questions, especially in PPQs as the most neutral type of questions. The data also didn't show focal stress in oppositions to PPQs.

Last but not least, the potential of bias implicature in NPQs might pose suspicious in that the focal stress in oppositions to NPQs could be ambiguous between verum accent and CF. Based on the data from Experiment 2, the f0 excursion patterns on the oppositions in NPQs and NPQs+*dige* represent small pitch difference, which is suggestive for having two separated pitch tracks. That is the smaller pitch rise (represented by * in the Table 1) is CF, while the enhanced pitch rise is verum accent, that matches the forms in WB and SB questions respectively. Notice that the difference is not significant, and the distinction needs further phonological studies.

4. Prior experimental studies. In this section, I will compare the data from Experiment 1 and 2 with the empirical findings in Goodhue & Wagner (2018). It is worth reminding an important methodological difference between the two studies. Goodhue & Wagner used ToBI system to annotate the data and they made distinction between CC (%H L* L-H%), rise-fall (L*+H L-H%) and declarative-fall (H* L-L%). I, on the other hand, used GAMMs to capture the presence and absence of prosodical saliency as the increase of pitch range. I do not claim for any phonological similarity between what I call contrastive focus or verum accent with either of the mentioned ToBI patterns. However, the pitch tracks in my data are suggestive for H* (with small pitch rise) on the affirmations, and L-H* (with enhanced pitch rise) on the oppositions.

Goodhue & Wagner (2018) suggest that what Pope (1976) observed as rise-fall-rise (RFR) tune is actually CC, and they made distinction between 'actual' RFR and CC. They assume that RFR necessarily involves some sort of implication about focus alternatives, while CC necessarily involves a sense of contradiction. Moreover, they stipulate the possibility of verum accent and rise-fall tune for emphasizing the truth of an assertion regardless of whether it has the same or opposite polarity of the question.

They explain the presence and absence of CC in their data by the CC requirement for the contextual evidence for $\neg p$. Goodhue & Wagner worked on polar questions (both PPQs and NPQs) and negative rising declaratives (NRDecs) as the initiative types. They also offer contextual evidence for $\neg p$ in all of their trials (in response to both positive or negative initiatives). I will discuss the following findings from their study: **(i)** the presence of CC in the positive answers with *No* to PPQs, **(ii)** the absence of CC in negative (opposition) answers to PPQs, **(iii)** the presence of CC almost exclusively in positive (opposition) answers to the negative antecedents, **(iv)** the higher frequently of CC in response to NRDecs rather than to NPQs.

There are some points about (i) worth considering. First, the positive answers with *No* to PPQs (e.g. *Did John come*? #*No, he did*.) is not felicitous, with or without CC. Although the authors show the unacceptability in their first experiment, they report the presence of CC for such answers in their production experiments. Second, if CC is available on *No, p* to PPQs, (regarding the contradicting evidence in the context), one would expect to see it on *Yes, p* too, since CC was observed on both particles equally in response to NPQs. However, there was no CC on *Yes* in PPQs. Finally, if the contradicting evidence allows *No, p* to PPQs, one would expect *Yes,*$\neg p$ to be felicitous too. While their data truly shows its unacceptability, the authors didn't offer any explanation. I leave the discussion about (i) for further studies, while the data from my Experiments in Farsi shows the unacceptability of such answers.

We can have a look at Goodhue & Wagner's data through my proposal and explain their findings. I believe what they call CC is actually verum accent and what they consider verum or rise-

fall are CF. The authors explained (ii) and (iii) by suggesting CC' sensitivity to the contextual evidence for $\neg p$. I suggest that the lack of focal stress in (ii) is due to the singleton set of the alternatives in contrastive focus. As for (iii), the focal stress in oppositions to NPQs (as WB forms) and NRDec (as SB forms) are CF and verum accent respectively.

Finally, what they report in (iv) as the higher rate of CC in NRDecs is in line with the enhanced pitch rise in my data from the Experiment 2, which exists in both strongly biased PPQs+*dige* and NPQs+*dige*. They suggest that there might be a gradient correlation between the likelihood of producing CC on p and the strength of the contextual evidence for $\neg p$. That is the stronger the evidence for $\neg p$ the more likely that an intonation reserved for disagreement to produce CC. Therefore, one would make the intuitively plausible assumption that NRDecs convey stronger evidence for $\neg p$ rather than NPQs. Their explanation is in the same vein with my claim, in the sense that the stronger the bias (as in NRDecs and questions with *dige*) the more likely for the focal stress as the verum accent to indicate the conflict.

5. Conclusion. This paper investigates focal stress on PRPs in response to polar questions. The first experiment was conducted to check the effect of the polarity of the question on the prosody of PRPs. The idea was that the answers that are in opposition to the questions are predicted to (pragmatically) carry contrastive focus (à la Rooth 1992), independent from the polarity of the antecedent. The results partly match the prediction, in which there was focal stress on PRPs in opposition answers, but only in response to the NPQs, but not to the PPQs. The second experiment controlled the effect of the bias in the question (by the means of discourse particle *dige*) on the prosodical saliency of PRPs. Interestingly, the focal stress was observed in opposition answers to both PPQs+*dige* and NPQs+*dige*. I propose the presence of two different types of prosodical saliency, namely *contrastive focus* and *verum accent*. The contrastive focus in the opposition answers to NPQs is required to disambiguate the reading of the particle, while the verum accent appears to indicate the conflict between the speaker's expectation (as the biased answer) and the addressee's belief (as the true answer).

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