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Duration as a prosodic cue in TİD: Focus realization in the extended domain

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Prosodic prominence of focused units reflected through a variety of cues, is well documented in all modalities. Yet, the effect of focus in the extended domain is understudied in sign languages. This paper, building on an experimental study on Turkish Sign Language (TİD), investigates prosodic strategies used in narrowly focused and broad focus conditions in an extended prosodic domain. We measured the duration of the signs and the proportion of accompanying nonmanuals in both the pre-focal and post-focal domains, as well as in the focal domain. The results showed that (i) signs in narrowly focused conditions significantly differ from their counterparts in the non-focused and broad focus conditions, and an increase in duration is the focus strategy for signs, (ii) nonmanuals do not necessarily accompany focused signs, (iii) narrowly focused signs yield a decrease in duration as a compression effect in the pre-focal or post-focal domain. We argue that the compression effect cannot be analyzed as a result of givenness. Focus realization in TİD is a trade-off between boosting and deboosting strategies within the extended prosodic domain.

1 Introduction

A variety of cues used in focus prominence are well documented for both spoken and sign languages across modalities. Focus realization in the extended prosodic domain is well-studied for spoken languages. However, it remains unknown for sign languages. Drawing on data from Turkish Sign Language (TİD), an understudied language in the visual modality, our aim is to further expand the scope of investigation by including the pre-focal and post-focal signs, in order to demonstrate accompanying cues in these domains.

Focus, indicating the foregrounded units, is one of the main building blocks of information packaging. Interlocutors package information according to their communication needs, as illustrated in (1) and (2).[1] Rooth (1992) builds the analysis of focus on the semantics of questions and suggests that focus indicates the presence of alternatives in discourse. Questions denote a set of potential answers, including true and false answers (Hamblin 1973). The answers to wh-phrases carry focus marking; thus, Rooth (1992) links the denotations of alternatives in the questions with the indication of alternatives by focus in his analysis.

(1) A: Who ate the cookies?
B: JOHN ate the cookies.

(2) A: What did John eat?
B: John ate the COOKIES.

The alternative propositions as answers in (3) denote the focus semantic value for *Maya*. Focus indicated in B's response in (3) maps onto the wh-phrase in the question and signals other propositions that are potential answers to the question that can be true or false. Due to the close connection between questions that introduce the set of alternatives and focus that signals the alternatives, we discuss the notion of focus, its types, and realizations by following the question-answer paradigm throughout this paper.

(3) A: Who responded to the call?
B: MAYA responded to the call.
Alternative set:{Matt responded to the call, Zach responded to the call, Maya responded to the call, Vera responded to the call . . .}

Focus size and focus subtypes are other important issues relevant to the investigation of focus realization crosslinguistically. The focused part can map onto the whole sentence, which is called broad focus (BF), or sub-parts of the sentence, which is called narrow focus. The following example (4) illustrates BF in which the whole sentence is focused, and all the items are discourse-new. As

[1] Unless the cited authors conveyed focus marking specifically, we show focus using capital glossing for spoken languages. Small caps are used as a convention for glossing sign language.

seen in the alternative set in example (4), the question 'What's happening?' triggers a set of alternatives, one of which is the true answer.

(4) A: $\overset{\text{hs}}{\overline{\text{WHAT BE}}}$
'What is happening?'
B:[AYŞE PENCIL THROW]$_{\text{BF}}$
'Ayse is throwing a pencil.'
Alternative set:{Ayşe is throwing a pencil, Ece is eating a banana, Aslı is opening a box . . .}

In contrast to BF, a single unit in a sentence can be narrowly focused, and the alternatives differ only in the location of the focused item in the sentence. A narrow focus comes in two varieties: presentational focus (PF) and contrastive focus (CF). PF is triggered by wh- question *who* in sentence (5). In contrast to broad focus in (4), whose focal projection maps onto the whole sentence, the projection in (5) is restricted to the subject AYSE. The non-focal constituents in the post-focal domain in (5) are 'given' in that they are salient in the previous utterance, the question in this case.[2]

(5) A: $\overset{\text{hs}}{\overline{\text{WHO PENCIL THROW}}}$
Who is throwing a pencil?
B: [AYŞE]$_{\text{PF}}$ PENCIL THROW
'Ayşe is throwing a pencil.'
Alternative set: {Ayşe is throwing a pencil, Mete is throwing a pencil, Ece is throwing a pencil . . .}

CF is triggered by alternative questions or corrective statements. In contrast to the alternative set of PF, the contextually supplied value is identical to an element of the focus semantic value (Büring 2016: 38). As seen in (6), the alternative set includes 'Ayse is throwing a pencil' and 'Ayse is throwing a book', which are introduced in the question. The true answer PENCIL in B's response bears CF. Since the focus alternatives are mentioned in the alternative question in the CF condition, the focus in the answer in this condition is given, whereas it is new in the BF and PF conditions.

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[2] Givenness is not restricted to being mentioned explicitly in the context. As illustrated in the following examples, a constituent can be salient in a (i) linguistic and (ii) nonlinguistic context and hence given (Büring 2016: 18). In the current study, all the given constituents are explicitly mentioned in the previous utterance.

(i) A: The opposition wants to impeach the president.
B: I HATE politics$_{\text{Given}}$

(ii) [Seeing someone's new pack of cigarettes] I thought you QUIT smoking$_{\text{Given}}$

(6) A: AYŞE THROW WHAT (hs) PENCIL (hn) BOOK (hn)
What is Ayşe throwing, a pencil or a book?
B: AYŞE [PENCIL]$_{CF}$ THROW
'Ayse is throwing a pencil.'
Alternative set: {Ayşe is throwing a pencil, Ayşe is throwing a book . . .}

Focus is multifaceted, as it is realized through prosodic, morphological, syntactic strategies, or a combination of these strategies, which is expanded in Section 2. A focused constituent, discourse-new as in PF or given as in CF, is the most prominent constituent in its domain (Jackendoff 1972; Truckenbrodt 1995). Unless focused, a given constituent is non-prominent (Féry & Samek-Lodovici 2006). However, focus prosody is a combination of the acoustic correlates of the focused constituent in the focal domain and the non-focal given constituents in the neighboring domains, which is discussed in Section 2.1 based on different languages. However, focus has been investigated mainly in the focal domain and in one channel, namely in the nonmanual channel in sign languages, which is discussed in further detail in Section 2.2.

Hence, in this study, the investigation of focus builds on an extended prosodic context, including the focused sign and the non-focused given signs in the pre-focal and post-focal domains in Turkish Sign Language, whose details are presented in Section 3. Section 4 focuses on the results of the study, where we show that TİD mainly uses the manual channel and modulates duration for focus prominence in the extended domain. Furthermore, TİD uses different domains for focus types, namely decreasing duration in the pre-focal domain for presentational focus (PF) and in the post-focal domain for contrastive focus (CF). In Section 5, we discuss whether the compression strategy can be analyzed as a pure givenness effect, along with the patterns regarding focus subtypes and syntactic roles in terms of implication relations. Lastly, Section 6 raises questions about the role of nonmanuals in focus marking in the extended domain, and Section 7 concludes the paper.

2 Realization of focus

How focus is realized cross-linguistically is intriguing, as there are diverse grammatical tools across modules. Languages can mark focus in the syntactic domain as the fronted corrective focus *Marina* in Italian (7) (Bianchi 2013: 197), morphological domain as the Gùrùntùm focused subject that is accompanied by a focus marker like *á* (8) (Zimmermann 2011: 1180), and prosodic domain as in English (Breen et al. 2010) or an interface of these domains as the Bole displaced focused subject that is optionally accompanied by the particle *yé*. However, the particle signals the backgrounded information (9) (Zimmermann 2011: 1175).[3]

[3] See Büring (2009) and Féry (2013) for a unified prosodic account.

(7) Q: Gianni ha invitato Lucia.
John has invited Lucy
'John invited Lucy.'
A: [MaRIna]$_F$ ha invitato (non Lucia).
Marina (he) has invited (not Lucy)
'Marina he invited (not Lucy).'

(8) Q: Á kwá bà wúm kwálíngálá-ì?
fm who prog chew colanut-the
'Who is chewing the colanut?'
A: Á fúrmáyò bà wúm kwálíngálá
fm fulani prog chew colanut
'The Fulani is chewing colanut.'

(9) Q: À jìi kàpp-à mòrɗó yé lò?
3agr prog plant-nom millet prt who
'Who is planting the millet?'
A: À jìi kàpp-à mòrɗó yé Léngì
(3agr) prog plant-nom millet prt Lengi
'Lengi is planting the millet.'

Prosodic tools within an extended domain in spoken languages are discussed in Section 2.1. This is followed by a discussion of the grammatical tools available in sign languages across modules in Section 2.2. However, this paper limits the discussion of grammatical tools to the literature review, as its primary focus is on prosodic tools.

2.1 Prosodic strategies in spoken languages

In the prosodic domain, focus can be signaled by different phonetic and phonological features, resulting in a typology of focus realization (Kügler & Calhoun 2020). Irrespective of the classification of a language in this typology, these features must be analyzed within an extended prosodic context since crosslinguistic studies show that focus prominence is an aggregated reflection of these features in an extended domain. An acoustic feature such as duration or pitch can be modulated as a boosting strategy for the focused constituents and a de-boosting strategy for the surrounding non-focal given constituents. Focus prosody is realized as a trade-off between these boosting and de-boosting strategies.

In a production and perception study, Krahmer & Swerts (2001) revealed the importance of the extended prosodic context in the investigation of contrastiveness and newness. Target phrases with adjective-noun order (10) were elicited from Dutch speakers via a description task. The

results reveal that in (10)b, the adjective is contrastive and bears an accent, while there is no postnuclear accent on the given noun. In the perception phase of the study, the listeners could identify a contrastive adjective as in (10)b as perceptually more prominent than a non-contrastive new one as in (10)a. However, this distinction is lost if the adjective is heard without the given noun in (10)b. The results indicate that prominence is a cumulative reflection of acoustic cues, and listeners rely on boosting and de-boosting strategies in the larger domain.

(10) a. New-New: blue square
b. Contrastive-Given: yellow square

Focus prosody has been studied in an extended prosodic context in a number of languages. In a set of experimental studies on the prosody of focus in English, Breen et al. (2010) found that focused constituents were produced with increased duration, higher intensity, and higher f0 (**Table 1**). While the pre-focal given constituents were produced with shorter duration, lower intensity, and lower f0, the post-focal given constituents were even less prominent than the pre-focal ones. The comparison of narrow focus and broad focus conditions illustrated that when the object bears focus, it has a longer duration, higher intensity, and higher f0 than its counterpart in the broad focus condition.

Language	**Prefocal Domain**	**Focal Domain**	**Postfocal Domain**
English (Breen et al. 2010)	shorter duration, lower intensity, and lower f0	increased duration, higher intensity, and higher f0	less prominent than the pre-focal domain
German (Féry & Kügler 2008)	shorter duration and lower f0	longer duration and increased pitch accent	deaccentuation
Hungarian (Genzel et al. 2014)	lower f0 and shorter duration	higher f0, greater pitch range, steeper fall, and longer duration	less prominent than the focal domain
Turkish (Atasoy 2022)	decreased maximum intensity	increased minimum intensity	decreased maximum and minimum f0, and maximum intensity

Table 1: Prosodic realization of focus in the extended acoustic context in spoken languages.

Féry & Kügler (2008) found similar prosodic features in their study on German. As seen in **Table 1**, narrowly focused constituents had a longer duration and increased pitch accent than their counterparts in the broad focus condition. The constituents in the pre-focal domain were less prominent, and deaccentuation was observed in the post-focal domain.

This pattern is not specific to Indo-European languages, and similar observations are noted for languages in different language families. Genzel et al. (2014) revealed that in Hungarian, which has a default syntactic position for focused phrases, a narrowly focused constituent had a higher f0, greater pitch range, steeper fall, and longer duration than its counterpart in the broad focus condition. When the narrowly focused constituent was marked with contrastive focus, the pre-focal and post-focal given constituents were less prominent.

Turkish presents a different strategy in that focus prominence is marked mainly via de-boosted acoustic cues of the surrounding constituents. In SOV order, when the object is the narrowly focused constituent, f0 of this constituent does not differ significantly from its counterpart in the broad focus condition (İpek 2011; İvoşeviç & Bekâr 2015; Gürer 2020). However, Atasoy (2022) showed that in the same condition, the maximum and minimum f0 of the post-focal verb were lower, indicating post-focal compression. Additionally, the maximum intensity of the pre-focal subject and post-focal verb were lower when compared to their counterparts in the broad focus condition. Hence, focus also affects the prosody of the pre-focal and post-focal domains in Turkish.

To sum up, focus affects the prosody of the narrowly focused constituent via boosting strategies and the non-focused given constituents in the pre-focal and post-focal domains via de-boosting strategies.[4] Hence, the prosodic realization of focus needs to be investigated, taking an extended acoustic context into account.

2.2 Focus in sign languages

Similar to spoken languages, sign languages use various strategies to convey focus, including syntactic marking, nonmanuals, focus particles, or modulations in manual signs. Some of these strategies are used together in focus marking.

Sign languages are observed to use fronting the focused item, doubling it, or changing the word order as syntactic marking strategies. As seen in (11) and (12), the corrective focus items ICE-CREAM in Sign Language of the Netherlands (NGT) and #K-N-O-F COVER (candy) in Russian Sign Language (RSL) are moved to the sentence-initial position without any accompanying nonmanuals (Kimmelman 2014). Yet, the author noted that these were the only observed examples of syntactic movement alone.

(11) [ICE CREAM]$_{FOC}$ WOMAN EAT
'No, the woman eats ice cream.' (NGT Kimmelman 2014: 95)

[4] A word of caution must be mentioned here. Not all languages modulate the phonetic cues in the extended domain in the same way. For example, in Lebanese Arabic, the focused constituent is accented accompanied by post-focal compression (Chahal & Hellmuth 2014, as cited in Kügler & Calhoun 2020). In Egyptian Arabic, on the other hand, the focused constituent is boosted with a pitch range in the absence of post-focal compression. A universal pattern does not exist, but the investigation should be extended to a larger prosodic domain to reveal potential strategies.

(12) [#K-O-N-F COVER]$_{FOC}$ BOY EAT
'No, the boy eats candy.' (RSL Kimmelman 2014: 95)

Similarly, TİD was also argued to use syntactic strategies like fronting (13), movement to the final position (14), or doubling the focused item (15) (Makaroğlu 2012), but the subtype of focus is not indicated. In contrast to NGT and RSL, it was argued that in-situ focused items would yield unacceptability in TİD (16). Doubling and fronting the focused sign at the same time was suggested to yield ungrammaticality (17). Yet, the author also reports that final doubling in (15) was unacceptable when the constituent bears CF as in (18). Note that the ungrammatical (18) exemplifies the same strategies with the grammatical sentence in (15). Since it is unknown which focus subtypes are exemplified in (13)–(17), the reported syntactic analyses are not conclusive and these patterns need to be further investigated.

(13) [YESTERDAY]$_{FOC}$ CHILD GARDEN BALL PLAY
'The child yesterday played with the ball in the garden.' (TİD Makaroğlu 2012: 67)

(14) CHILD GARDEN BALL PLAY [YESTERDAY]$_{FOC}$
'The child yesterday played with the ball in the garden.' (TİD Makaroğlu 2012: 67)

(15) CHILD [YESTERDAY]$_{FOC}$ GARDEN BALL PLAY [YESTERDAY]$_{FOC}$
'The child yesterday played with the ball in the garden.' (TİD Makaroğlu 2012: 67)

(16) *CHILD [YESTERDAY]$_{FOC}$ GARDEN BALL PLAY
'The child yesterday played with the ball in the garden.' (TİD Makaroğlu 2012: 67)

(17) *[YESTERDAY]$_{FOC}$ CHILD [YESTERDAY]$_{FOC}$ GARDEN BALL PLAY
'The child yesterday played with the ball in the garden.' (TİD Makaroğlu 2012: 67)

(18) *LAST NIGHT [ANKARA]$_{FOC}$ GO [ANKARA]$_{FOC}$
'Last night, I went to Ankara.' (TİD Makaroğlu 2012: 68)

In contrast to Makaroğlu (2012), Gürer & Karabüklü (2022) found systematic syntactic marking for focus only in numerical modifiers in NPs. Signers used noun and number 'CLEMENTINE TWO' sequence while answering a question triggering PF (19). Note that focus is projected over the whole noun phrase. In a corrective statement, a different pattern was observed. The numerical item preceded the noun 'TWO (PIECE) CLEMENTINE' while answering a yes/no question to correct the quantity 'MANY' in the question (20). In this example, only the numerical item bears focus. The authors noted that number and noun sequence was the most consistent pattern in the corrective statements. Taking number-noun or noun-number sequence as the default order is challenging since the focus projection is different in the PF and corrective CF conditions. The studies on linearization in NP also reported that both options in (19) and (20) were possible

(Nuhbalaoğlu & Özsoy 2014; Gökgöz 2020), without reporting the information packaging in these sentences. Hence, it will be challenging to argue for a syntactic movement operation in PF conditions (19) or the corrective statements (20).

(19) Q: VELI $\overline{\text{IX-3 WHAT IX-3}}^{\text{hs}}$
'What does Veli have?'
A: $\overline{\text{VELI}}^{\text{br, hn}}$ CLEMENTINE TWO_{F} EXISTENTIAL
'Veli has two clementines.' (TİD Gürer & Karabüklü 2022: 39)

(20) Q: ALI IX-POSS-3 CLEMENTINE $\overline{\text{MANY EXISTENTIAL}}^{\text{hft}}$
'Does Ali have many clementines?'
A: $\overline{\text{NO,}}^{\text{bl, bht}}$ IX-3 TWO $\overline{\text{PIECE}}^{\text{hn}}$ CLEMENTINE $\overline{\text{EXISTENTIAL}}^{\text{hn}}$
'No, Ali has two clementines.' (TİD Gürer & Karabüklü 2022: 40)

Nonmanuals are another strategy to convey focus in NGT (Crasborn & Van Der Kooij 2013). As seen in B's response in (21), the focal item IX is marked with the nonmanual head nod (hn) without being fronted.

(21) A: Who took the newspaper?
B: IX GIRL IX, $\overline{\text{IX}}^{\text{hn}}$ NEWSPAPER TAKE IX
'The girl took the newspaper.' (NGT Crasborn & Van Der Kooij 2013: 21)

Similarly, American Sign Language (ASL) uses fronting as a focus marking strategy. In (22), the focused item #M-A-R-Y is moved to the sentence-initial position (Wilbur 2000). In contrast to examples in RSL and NGT, the fronted focused item #M-A-R-Y is also marked with the nonmanual brow raise (br). Thus, in this example, ASL uses syntactic and nonmanual strategies to convey focus.

(22) $\overline{\text{\#M-A-R-Y}}^{\text{br}}$ #J-I-M LOVE TEASE *t*
'It's Mary who Jim loves to tease.' (ASL Wilbur 2012: 465)

ASL also uses nonmanual brow raise (br) without moving the focused item to sentence-initial position as in (23) (Schlenker et al. 2011). Furthermore, the authors discussed that their data included manual modifications like increased amplitude, speed acceleration, and longer holds, which are indicated by bold characters in (23). Similar patterns were observed in French Sign Language (LSF) with manual modifications and nonmanuals head nod (hn) and brow raise (br). In (24), the focal item B is suggested to be modulated by increased amplitude, speed acceleration, or longer holds and marked by nonmanual brow raise.

(23) Context: The signer teaches fingerspelling to his students.
br, blf
IX-1 WANT IX-2 FINGERSPELL A-C-E-D FINISH A $\overline{\mathbf{B}}$ E D
'I want you to fingerspell *ACED*, *ABED*.' (ASL Schlenker et al. 2011: 371)

(24) Context: The signer teaches fingerspelling to his students.
hn, br
IX-1 WANT IX-2 FINGERSPELL A-C-E-D THEN A $\overline{\mathbf{B}}$ E D
'I want you to fingerspell *ACED*, *ABED*.' (LSF Schlenker et al. 2011: 371)

Sign languages, as seen through the examples above, can either use one strategy or opt for simultaneous strategies to convey focus, such as syntactic marking, nonmanuals, and manual modifications. ASL seems to use three strategies: syntactic strategies, nonmanuals, and manual modifications. Other sign languages also seem to have manual modifications and nonmanuals together. Considering that examples of syntactic strategies used in NGT and RSL were observed in single cases (Kimmelman 2014), RSL seems to be the only one using only the manual modulations. Findings in the literature suggest crosslinguistic differences, even a spectrum in how simultaneous strategies are used and organized from one domain (RSL) to multiple ones simultaneously (ASL).

It is still unknown how simultaneous strategies are weighted when they co-occur. The most reported strategy crosslinguistically is nonmanuals like brow raise in ASL (Wilbur 2000; Schlenker et al. 2011), head nod, tilt, brow raise in DGS (Herrmann 2015; Waleschkowski 2009), head nod, head back tilt, brow raise, and body leans in NGT (Crasborn & Van Der Kooij 2013; Kimmelman 2014), and head movements in FinSL (Puupponen et al. 2015)[5]. The least studied domain is the prosodic marking of focus, especially the manual domain. Thus, the following section focuses on the findings on the manual domain and their interactions with nonmanuals.

2.2.1 Manual prosody

A few studies reported modulations in manual signs, mostly along with nonmanuals. Findings in the literature suggest that two crosslinguistic patterns appear for manual and nonmanual domains. Some sign languages encode focus both via modulations of manual signs and with nonmanuals, and some others via modulations of manual signs[6].

[5] Although some scholars argue that nonmanuals are prosodic markers, the role of nonmanuals is an ongoing discussion. We acknowledge that not all nonmanuals belong to the domain of prosody, and their functions need to be tested systematically to uncover their role in a given structure. We refer the reader to Wilbur's (2021) recent discussion on the role of nonmanuals. Thus, we will first focus on the distributions and patterns of nonmanuals before committing to any analysis in this study.

[6] The division of labor between manual and nonmanual domains is also observed in other typological differences between sign languages. As first proposed by Zeshan (2006), sign languages exhibit a similar pattern in encoding negation. Specifically, some sign languages, such as ASL, are proposed to be nonmanual dominant, and they can use headshake alone to mark negation. In contrast, languages such as HKSL or TİD are proposed to be manual dominant, which requires both manual and nonmanuals. Considering TİD is manual dominant for negation, this typological

If we replicate **Table 1** for sign languages in **Table 2**, the crosslinguistic distinction mentioned above becomes clear. For example, ASL and LSF use both manual and nonmanual channels, while RSL opts for the manual channel only. In the manual domain, scholars observed the following strategies: modulations of focused signs via longer duration, larger movements, more repetitions, and higher signing space in NGT (21) (Crasborn & Van Der Kooij 2013; Kimmelman 2014), increased amplitude, speed acceleration, and longer hold times in ASL (23) and LSF (24) (Schlenker et al. 2011), longer durations in focused items compared to non-focused counterparts, more repetitions, use of space as contrastive localization in Catalan Sign Language (LSC) (Navarrete González 2021).

Language	**Channel**	**Focal Domain**
American Sign Language (Schlenker et al. 2011)	Nonmanual	br, blf
	Manual	increased amplitude, speed acceleration, longer hold
French Sign Language (Schlenker et al. 2011)	Nonmanual	br, hn
	Manual	increased amplitude, speed acceleration, longer hold
Sign Language of the Netherlands (Crasborn & Van Der Kooij 2013; Kimmelman 2014)	Nonmanual	hn
	Manual	longer duration, larger movements, more repetitions, higher in signing space
Catalan Sign Language (Navarrete González 2021)	Nonmanual	br, bf, bl, ht, hn, h trust
	Manual	longer duration, repetition of movement, use of signing space
Russian Sign Language (Kimmelman 2014)	Nonmanual	not correlated
	Manual	increased amplitude, speed acceleration, longer hold
Turkish Sign Language (Karabüklü & Gürer 2024)	Nonmanual	not correlated
	Manual	longer duration

Table 2: Realization of focus across channels in sign languages.

pattern might be expanded to focus marking. Although this proposal is appealing and needs further investigation, we also want to highlight that Pfau (2016) and Gökgöz (2011; 2021) discussed that the dominance distinction for negation is not always clear cut, and languages, including TİD, show variation in negation marking.

To illustrate, the duration of the same sign PIZZA was measured in different conditions in Catalan Sign Language (LSC) such as non-focus (25), PF (26), CF (27), and corrective focus (28). As seen through examples (25)–(28), LSC does not only use duration to distinguish non-focused signs (PIZZA - 177 ms. in (25)) from focused signs, but also to distinguish focus subtypes. All focused signs were longer than the non-focused counterparts. The longest among the focused signs were the CF marked ones (642 ms), followed by the corrective marked ones (366 ms) and the PF marked ones (270 ms), respectively. The author also reported that focused signs were marked with the following nonmanuals: (i) brow raise (br) in information and corrective focus, (ii) brow frown (bf) in corrective focus (28), (iii) body leans (bl), head tilt (ht) in parallel, selective, and corrective focus, (iv) head trust (h trust) in corrective focus, and (v) head nod (hn) in selective focus.

(25) Context: Your friend says that Mary ate the pizza, but you know that she also ate the salad.
MARY PIZZA ONE EAT NO, **SALAD**$_{F}$ ADD
'Mary didn't eat (only) a pizza, (she) also ate a salad.'
(LSC - non-focused, Navarrete González 2021: 86)

(26) Context: You tell your friend what Mary ate.
MARY [**PIZZA**]$_{F}$ EAT
'Mary ate a pizza.' (LSC - PF, Navarrete González 2021: 86)

(27) Context: Your friend is not sure if it was a pizza or burger that Mary ate. You clarify it.
blf, br
[**PIZZA**]$_{F}$ MARY EAT
'Pizza, Mary ate.' (LSC - CF, Navarrete González 2021: 86)

(28) Context: Your friend says that Mary ate pizza and a burger, but you correct him.
MARY EAT OTHER NOTHING, GOAL [**PIZZA**]$_{F}$ THAT'S-IT
'Mary only ate pizza, nothing else.' (LSC - corrective, Navarrete González 2021: 86)

As for the second pattern, RSL was shown not to use nonmanuals to mark focus (Kimmelman 2014). When nonmanuals occur in data, they do not only accompany the focused constituents but also the non-focused ones. For instance, brow raise (br) in (29) spreads over the whole sentence, including focused and non-focused items. To mark focus, signers only modulate the manual sign with more repetitions, longer durations, slower signing rate, or higher signing space (Kimmelman 2014).

(29) B: br
IX BOY [PLAY-GUITAR]$_{FOC}$
'The boy plays guitar.' (RSL Kimmelman 2014: 115)

Similar to RSL, TİD was shown to mark focal units with longer durations in the manual channel (Karabüklü & Gürer 2024). Although TİD was argued to mark focus with nonmanuals like brow raise, eye blink, or squint (Gökgöz & Keleş 2020), Karabüklü & Gürer (2024) showed no significant effect of focus in the production of nonmanuals. Their data had 22% occurrences of nonmanuals with both focused and non-focused signs in total. Following their findings, we propose TİD patterns with RSL in terms of focus realization in a single channel.

Studies on the manual channel differed in how they measured duration. Some studies treated it as a subcategory besides other strategies like holds, repetitions, or longer paths. For instance, Navarrete González (2021) reported duration along with repetitions or longer paths, yet these other categories, such as longer paths or holds, may be used to lengthen the duration of focal signs. Patterns become complex as not all signs allow the same strategy. Path movements lengthen with longer paths, while trilled movements rely on repetition. Thus, observing the patterns and testing how focus affects its domains is difficult. In contrast to studies treating duration as a subset of manual prosodic modulations, Karabüklü & Gürer (2024) treated duration as a superset, which was affected by repetitions, longer paths, or holds in their measurements. Since this treatment provides a parsimonious account and better captures the effect of focus, we will also treat duration as a superset category in our analysis.

Sign language literature has extensively focused on the effect of focus on focal items investigating the manual and nonmanual channels as illustrated in **Table 2**. Yet, none of the studies, up to our knowledge, investigated the effect of focus in the extended prosodic domain. As known from spoken language literature, focus marking is the orchestration of the boosting effect in focal items and the deboosting effect in non-focal items. Thus, to complete the paradigm and better understand the nature of focus marking, we investigate the effect of focus not only in focal items but also in the surrounding non-focal items in TİD. Building on previous studies in TİD, we measure the duration of manual signs and the occurrences of nonmanuals in the focal and non-focal positions.

3 Focus marking in TİD in the extended prosodic domain

Studies on TİD reported various focus realizations in the manual and nonmanual channels. TİD was suggested to mark focus through nonmanuals (Gökgöz & Keleş 2020) whereas in another study, focus was found to have an insignificant effect on nonmanuals (Karabüklü & Gürer 2024). Only one study investigated the effect of focus on manual signs (Karabüklü & Gürer 2024) and suggested an increase in duration as the strategy of the manual channel. Yet, no studies in sign language literature investigated the effect of focus on the extended prosodic domain. TİD may opt to use deboosting strategies along with the prominence of the focused unit. Additionally, nonmanuals have always been discussed in consideration of focal signs, and how they are affected in the extended domain is unknown.

3.1 Methodology

The current study aims to reveal the trade-off strategies for focal and nonfocal signs in TİD. The narrowly focused signs are compared to the baseline BF condition in the manual and nonmanual channels. Building on the findings and the discussions for focus marking, we formulated our research questions as follows:

- **RQ1:** What is the default, unmarked, prosodic contour in the broad focus condition?
- **RQ2:** Given that narrow focus is realized via an increase in duration in TİD, do narrowly focused CF and PF signs differ from their counterparts in the broad focus condition regarding duration?
- **RQ3:** Is there a decrease in duration in the pre-focal domains of PF and CF conditions?
- **RQ4:** Is there a decrease in duration in the post-focal domains of PF and CF conditions?

As for nonmanuals in TİD, while some studies proposed possible nonmanuals for focus such as eyebrow raise, eye blinks, or squint (Gökgöz & Keleş 2020), some studies also showed that focus was not a significant factor in nonmanual production (Karabüklü & Gürer 2024). More studies are needed to understand better how manual and nonmanual channels are modulated in the extended domain of focus in TİD.

- **RQ5:** Given that narrow focus is not necessarily accompanied by nonmanuals when compared to their non-focused counterparts, does a narrow focus differ from its counterpart in the broad focus condition in terms of nonmanual usage?

To answer these questions, we designed a controlled elicitation study using question-answer sets. Participants took the study with a Deaf research assistant in the lab. The recorded data were annotated and analyzed for the duration of manual signs and co-occurring nonmanuals.

3.2 Participants

20 participants (17 female, age $M = 34$, $SD = .34$, range = 23–50) living in Istanbul participated in the study. 10 of whom were Deaf of Deaf (DoD) who were born to Deaf parents and exposed to sign language from birth. The rest were Deaf of Hearing (DoH) born to hearing parents. All DoH participants self-reported that they were first exposed to TİD at the age of 7 when they began primary school. Participants signed a consent form and were paid a small amount of money as compensation for their participation.

3.3 Design and materials

We designed the study including the following parameters: (i) focus size: broad focus vs. narrow focus; (ii) focus type: contrastive focus (CF), presentational focus (PF); (iii) focus position: the

syntactic role of the focused item (subject, object, or verb). The syntactic position was fully crossed with the narrow focus types (PF and CF) since the whole sentence is focused in the broad focus (BF) condition. Hence, the design was 3 (focus types) × 3 (syntactic roles) design represented with 3 different events as in **Table 3**.

Conditions	**Focus Type × Syntactic Roles**		
a.	$[S]_{PF}$	O	V
b.	S	$[O]_{PF}$	V
c.	S	O	$[V]_{PF}$
d.	$[S]_{CF}$	O	V
e.	S	$[O]_{CF}$	V
f.	S	O	$[V]_{CF}$
g.	[S	O	$V]_{BF}$

Table 3: Study Design with focus types—presentational focus (PF), contrastive focus (CF) and broad focus (BF)—and syntactic roles—subject (S), object (O) and verb (V).

To elicit focus, we used the question-and-answer construal following Rooth's (1992) analysis. Broad focus structures were elicited with 'What is happening?' questions (30) and focus projects over the whole sentence. Wh- questions for each syntactic position were used to elicit PF (31). CF was targeted with alternative questions (32). There were three target sentences for all conditions.

(30) A: $\overset{\text{hs}}{\overline{\text{WHAT BE}}}$
'What is happening?'
B: $[\text{ECE BANANA EAT }]_{BF}$
'Ece is eating a banana.'

(31) A: ECE $\overset{\text{hs}}{\overline{\text{WHAT EAT}}}$
'What is Ece eating?'
B: $[\text{ECE}]_{\text{PREFOCAL}}$ $[\text{BANANA}]_{PF}$ $[\text{EAT}]_{\text{POSTFOCAL}}$
'Ece is eating a banana.'

(32) A: ECE $\overset{\text{hs}}{\overline{\text{WHAT EAT}}}$ $\overset{\text{hn}}{\overline{\text{BANANA}}}$ $\overset{\text{hn}}{\overline{\text{STRAWBERRY}}}$
'What is Ece eating, a banana or a strawberry?'
B: $[\text{ECE}]_{\text{PREFOCAL}}$ $[\text{BANANA}]_{CF}$ $[\text{EAT}]_{\text{POSTFOCAL}}$
'Ece is eating a banana.'

We used GIF images describing these events like 'eating a banana,' 'throwing a pencil,' or 'opening a box' in all stimuli. The filler items were composed of yes/no, how many, or where questions presented as GIF images similar to the target sentences. The stimuli included 21 target items and 54 filler items.

3.4 Procedure

A Deaf research assistant accompanied the participants during the elicitation process. Participants were asked to look at the GIF images and answer the Deaf research assistant's questions. Participants did not see the questions, and the assistant did not see the images to make the elicitation process as natural as possible. To observe any syntactic marking strategies, we did not instruct the signers on any specific word order. Participants were asked to answer only in full sentences and were free to use any possible word order. Otherwise, they were reminded to provide complete sentences. All the characters in the target and filler trials were given mock TİD name signs. A short trial session was conducted with the participants to familiarize them with the characters and the procedure. The participants had a chance to ask questions during the trial session and started the real session when they were ready.

After the first session, the participants repeated the session once again with a new randomized order of stimuli. They took a 15-minute break between the two sessions. During the break, they filled out the background questionnaire. The first session lasted approximately 20 minutes; the second lasted approximately 15 minutes. Three cameras recorded all the sessions: one for the participant, one for the assistant, and one for the whole scene.

3.5 Statistical analysis

3.5.1 Data annotation

There were two phases in the annotations of data for duration. First, another Deaf research assistant annotated all target sentences in ELAN software (Crasborn & Sloetjes 2008). Then, the authors annotated each target sentence for focus position, size, and type. Duration information of focused and non-focused items was obtained from the extracted eaf files based on the beginning and ending points of the signs in milliseconds. Duration due to the transition movements from one sign to another was excluded. During the exclusion, Kita et al. (1998)'s coding system was used to decide which part would be considered a transitional movement. Their coding system includes three phases: (i) the preparation phase, where hands depart from their resting state and move to the place of articulation and the handshape of the sign is formed; (ii) the expressive phase, where the handshape and the location are established, and the movement is realized, and (iii) the retraction phase where hands move to the initial phase of the next sign or to the resting position. Frame 1 shows the place and handshape for the sign AYSE. **Figure 1** shows the three phases in the sign AYSE where Frame 2 shows the preparation phase, Frames 3 and 4 show the

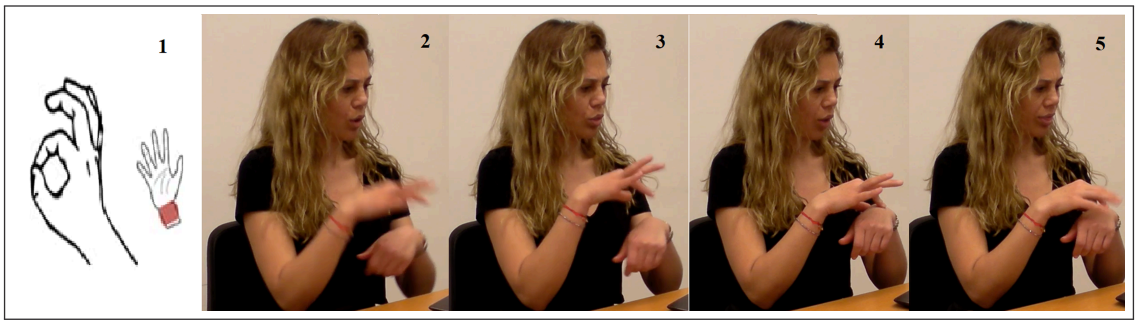

Figure 1: Three phrases of a sign: 2. the preparation phase, 3–4. the expressive phase, 5. the retraction phase.

expressive phase, and lastly, Frame 5 shows the retraction phase. For this sign, the duration from Frame 3 to Frame 4 was considered in the analysis.

As for the annotations of nonmanuals, an ELAN template was used to annotate all occurring nonmanuals in the target trials (Kentner et al. 2022). All nonmanuals observed in the data include head nod, brow raise, squint, and their combinations. We annotated the appearance of the given nonmanual, repetition of the nonmanual, direction of its movement, and degree. The template provided a consistent schema for each articulator's (head, brows, and eyelids) annotation.

If a participant dropped an argument in their answer, that item was coded as missing for both duration and nonmanual analysis. We obtained 840 utterances as responses. Except for 15 target sentences, all the sentences appeared in SOV order. Considering TİD being a SOV (Sevinç 2006) and head-final language (Gökgöz 2011), participants mostly used the default order irrespective of the position of the focused sign in the sentences. As for the remaining cases, 3 were OSV, 8 were SVO, 2 were OVS, 1 was VSO, and 1 was SVOV. They were responses to both focus types, CF and PF. A specific syntactic role, subject, object, or verb was not consistently marked with focus in these marked word orders in that the syntactic item that underwent movement did not always correspond to the focused item. Hence, it is not possible to make generalizations based on this small set of sentences with the marked word order. Since the responses were dominantly in SOV order (98%), we only analyzed the effects of focushood on duration and nonmanuals.[7] After excluding 12 missing items, 2508 data points were analyzed for duration and nonmanuals.

3.5.2 Data analysis

We used R (R Core Team 2021) to organize and analyze the data using a series of linear mixed-effects models created with the lme4 package (Bates et al. 2015). We labeled each measurement based on the factors participant, item, syntactic role, focus type, focal state, focus position, session

[7] Consistent SOV word order in the data might be due to the length of the target sentences, and it needs to be tested in future studies to determine whether signers will produce different word orders for focus in longer and/or complex sentences.

and age of acquisition. The name ‘focal state’ was used for the factor that identified whether a measurement was from a pre-focal, post-focal, or focused constituent, and the name ‘focus type’ was used for the factor that identified whether a measurement was from a sentence in BF, CF or PF conditions.[8]

Although we did not specify any hypotheses regarding the age of acquisition, we included it as a factor in our design and models of the data. This is because most sign language users are born to hearing parents who are not fluent signers (Zorzi et al. 2022), and their first exposure to sign language is delayed compared to those born to deaf parents. Moreover, signers who were deaf children of hearing parents and deaf children of deaf parents were shown to yield distinct results in linguistic studies (Mayberry & Eichen 1991; Mayberry et al. 2002; Lilo-Martin et al. 2020). Therefore, it was likely that the performance of our models will be improved by the inclusion of this factor. Additionally, having an equal number of participants belonging to each age of acquisition group allowed us to compare their performances.

Treatment contrast was used for the factors with two levels: age of acquisition (child of deaf parents = 0, child of hearing parents = 1), session (first session = 0, second session = 1), and nonmanual occurence (occurred = 1, did not occur = 0). We used the utility provided by lme4 which creates ‘n-1’ dummy variables for factors with three or more levels by default for the factors: focus position (object = 0, and dummy variables for subject and verb), focus type (BF = 0, and dummy variables for CF and PF), syntactic role (object = 0, and dummy variables for subject and verb), and focal state (focused = 0, and dummy variables for pre and post-focal constituents).

Random intercepts for participants and items were included in the models to account for individual differences and the possible effects of the different visual stimuli that accompanied each item.

For the duration analysis, we used standard linear mixed-effect models, while we used generalized linear mixed-effect models of the binomial family for the nonmanual analysis. We used forward-stepwise selection and assessed model performance using likelihood ratio tests (Barr et al. 2013). Differences in the χ^2 values, degrees of freedom from the compared models, and the p-values from the likelihood-ratio tests are reported.

We estimated marginal means and computed pairwise comparisons with our final models of duration and nonmanuals with the help of the emmeans package in R (Lenth 2019). Satterthwaite’s Method was used for degrees of freedom in t-tests. Differences in estimated marginal means, t-ratios, and p-values from the pairwise comparisons are reported.

[8] Although we are aware of the fact that BF is about the size of the focus projection and not a focus subtype, we used such a naming convention for convenience during the data analysis.

All code used to organize, visualize, and analyze the data, along with its description, is provided in the supplementary materials. Files related to the duration models are in Supplementary Material A, while those concerning nonmanuals are in Supplementary Material B.

4 Results

4.1 Duration

The factors syntactic role ($\chi^2(2) = 558.7$, $p < .001$), focal state ($\chi^2(2) = 69.85$, $p < .001$), and focus type ($\chi^2(2) = 9.32$, $p < .01$) all significantly improved model performance as main effects. Two-way interactions of focal state and focus type ($\chi^2(2) = 8.932$, $p = .0115$), focal state and syntactic role ($\chi^2(2) = 8.552$, $p = .0139$), syntactic role and focus type ($\chi^2(4) = 25.45$, $p < .001$) have also significantly improved model performance, while the three-way interaction of these factors did not ($\chi^2(2) = 0.655$, $p = .7207$).

The factors age of acquisition ($\chi^2(1) = 3.948$, $p = .047$) and session ($\chi^2(1) = 38.14$, $p < .001$) have also improved our model as main effects. As explained in the previous section, age of acquisition was not directly addressed by our research questions but had potential to improve our models. Session was also one such factor, and therefore was also included in the models.

The two-way interaction of age of acquisition and syntactic role has also significantly improved model performance ($\chi^2(2) = 17.72$, $p < .001$), while the two-way interactions of age of acquisition with the other factors did not. Two-way interactions of the factor session also did not improve model performance. Finally, adding a main effect of focus position and its two-way interaction with syntactic role did not improve model performance ($\chi^2(2) = 2.211$, $p = .331$), but we have kept these two terms in the model formula for the contrasts that they allow in post-hoc pairwise comparisons. **Table 4** shows the final duration model with which the pairwise comparisons were computed.

Dependent variable	Model formula
Duration	Duration ~ Syntactic Role + Focus Type + Focal State + Age of Acquisition + Session + Focus Position + Syntactic Role:Focal State + Focus Type:Focal State + Syntactic Role:Focus Type + Age of Acquisition:SyntacticRole + FocusPosition:SyntacticRole + (1|Participant) + (1|Item)

Table 4: The final model of duration.

Our first research question was concerned with the default, unmarked, prosodic contour in the BF condition. We addressed this question by computing pairwise comparisons of subjects, objects, and verbs in the BF condition. The comparisons showed that BF subjects had significantly longer duration than BF objects ($\beta = 0.163$, $SE = 0.025$, $t = 6.48$, $p < .0001$), and BF verbs had

significantly longer duration than BF subjects ($\beta = 0.119$, $SE = 0.025$, $t = 4.732$, $p < .0001$), yielding a V-shaped contour. The mean duration values for each syntactic role can be seen in **Figure 2**.

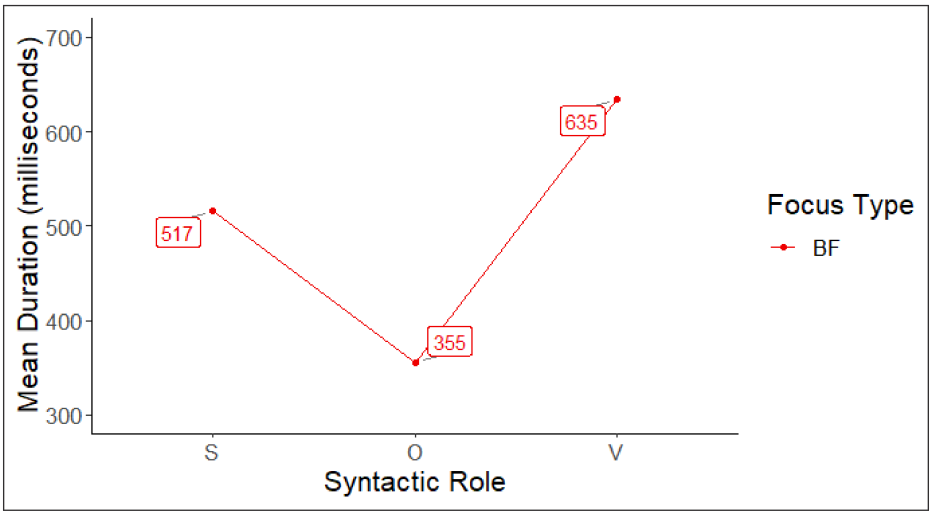

Figure 2: Mean duration by syntactic role—subject (S), object (O), and verb (V)—in the broad focus (BF) condition.

The next set of pairwise comparisons we computed was to check for an effect of focus on sign duration averaged across the other factors. This was not in our research questions, but we wanted to see if our experiment replicated Karabüklü & Gürer (2024)'s results of an overall increase in duration for focused signs. As stated before, we used a factor with three levels in our model that identified an element as pre-focal, focused, or post-focal. Instead of the binary distinction of focused and non-focused, we did this to allow the comparisons necessary to address our questions about the extended domain. Therefore, we report the comparisons of pre- and post-focal elements with their focused counterparts for each syntactic role.

Both CF ($\beta = 0.153$, $SE = 0.02$, $t = 8.04$, $p < .001$) and PF subjects ($\beta = 0.097$, $SE = 0.02$, $t = 5.11$, $p < .001$) were significantly longer than non-focused subjects. CF objects were longer than non-focused objects—when focus was on the verb ($\beta = 0.082$, $SE = 0.02$, $t = 3.93$, $p = .001$) when focus was on the subject ($\beta = 0.063$, $SE = 0.02$, $t = 3.01$, $p = .031$). However, a similar difference was not found for PF objects. CF verbs were significantly longer than non-focused verbs ($\beta = 0.054$, $SE = 0.02$, $t = 2.86$, $p = .004$), while such a difference was not found for PF verbs. **Figure 3** shows the distribution of the duration measurements of focused and non-focused subjects, objects, and verbs in sentences that include either a CF-marked sign or a PF-marked one. Overall, it seems that both narrow focus types lengthen subjects, but only CF lengthens all syntactic roles.

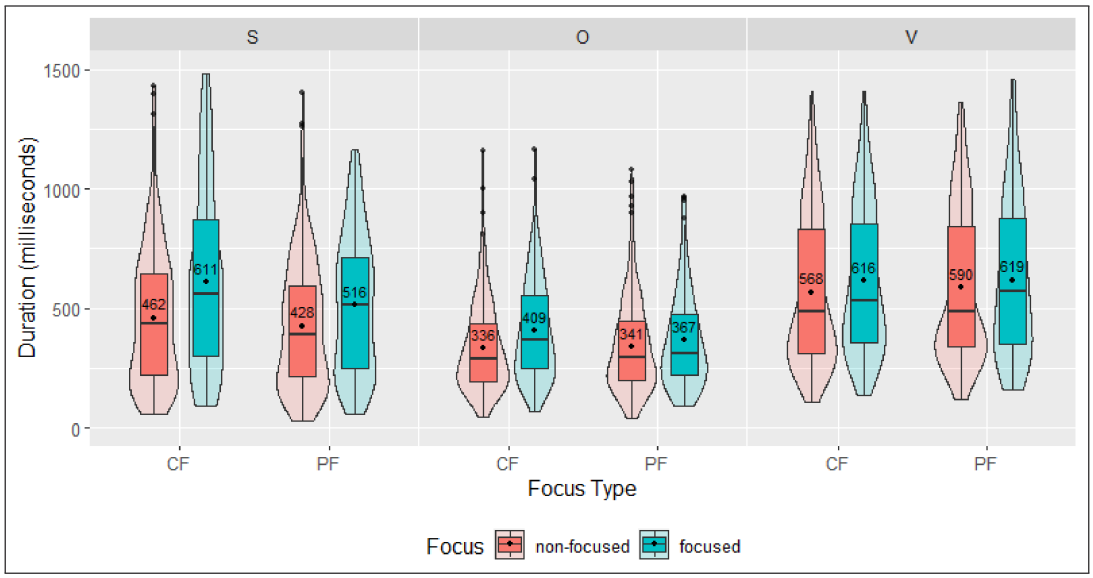

Figure 3: Duration of focused and non-focused signs by focus type—contrastive focus (CF) and presentational focus (PF)—and syntactic role—subject (S), object (O) and verb (V). Numbered dots indicate mean duration.

Our second research question was concerned with whether narrowly focused CF and PF signs were different from their BF counterparts in terms of duration. To address this question, we computed pairwise comparisons of the duration of elements that bear BF, CF, or PF within each syntactic role. Comparisons showed that BF subjects were significantly shorter than CF subjects (β = –0.115, SE = 0.024, t = –4.78, p <.001), while for PF subjects, we did not find the same effect. CF subjects were also significantly longer than PF subjects (β = 0.110, SE = 0.020, t = 5.30, p <.001). BF objects were significantly shorter than CF objects (β = –0.050, SE = 0.023, t = –2.11, p = .034), while we have not found the same effect on PF objects. We have not found similar differences for verbs either in the CF or the PF condition. **Figure 4** illustrates these comparisons along with the distribution of the data for each group.

Our third and fourth research questions were concerned with whether there was a decrease in duration for pre- and post-focal elements in sentences that include a CF or PF marked sign. To test whether narrow focus yielded a compression effect on pre- and post-focal elements, we compared BF elements with pre- and post-focal elements of the same syntactic role for each focus position and focus type. For example, we compared BF subjects to pre-focal subjects when the objects were marked with CF, and so on.

Figure 5 illustrates the PF and BF comparisons, while the BF and CF comparisons are illustrated in **Figure 6**. In sentences that include a PF marked sign, pre-focal subjects were significantly shorter than BF subjects both when the object was focused (β = 0.092, SE = 0.023, t = 3.97, p <.001) and when the verb was focused (β = 0.092, SE = 0.023, t = 4.001, p <.001).

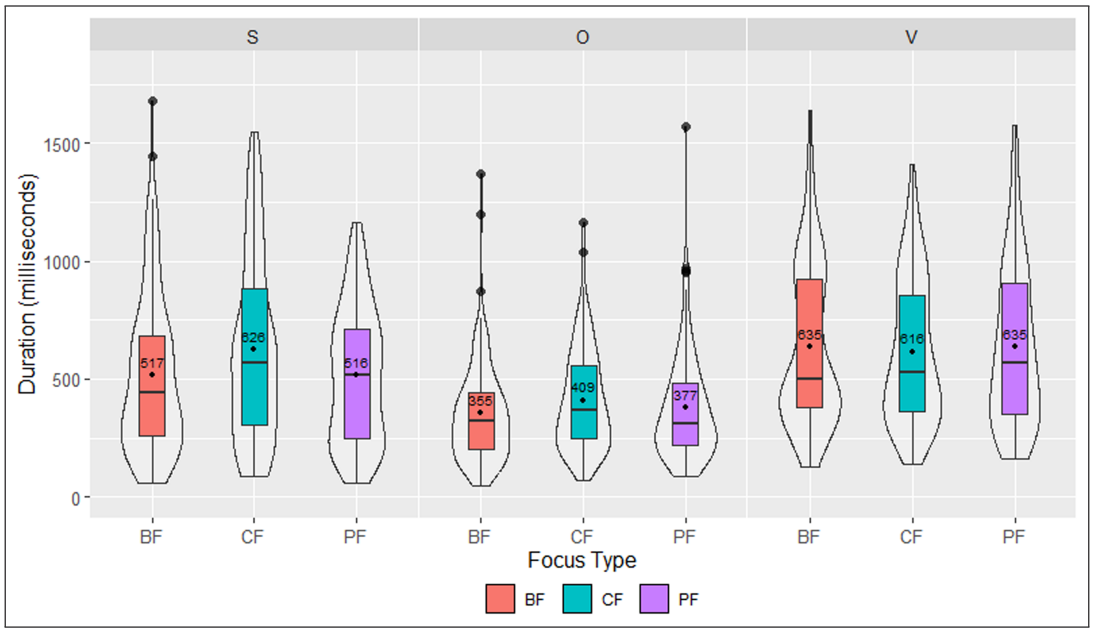

Figure 4: Duration of focused signs by focus type—broad focus (BF), contrastive focus (CF), and presentational focus (PF)—and syntactic role—subject (S), object (O), and verb (V). Numbered dots indicate mean duration.

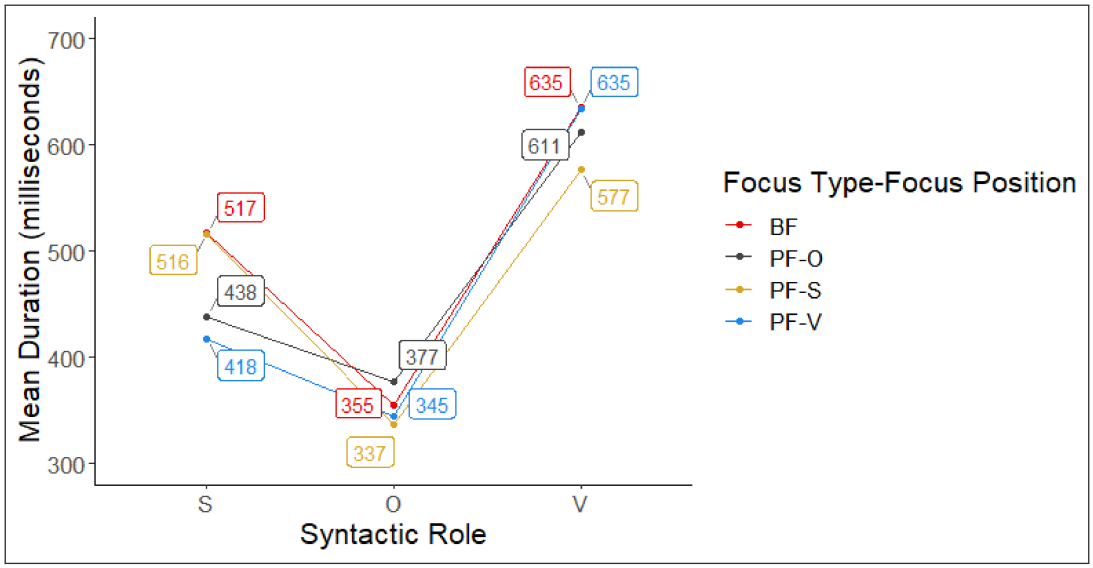

Figure 5: Mean duration by focus type—broad focus (BF) and presentational focus (PF)—and focus position—subject (S), object (O) and verb (V).

We did not find a similar difference for subjects in sentences that include a CF marked sign. However, in sentences that include a CF marked sign, post-focal verbs were significantly shorter than BF verbs when the subject was focused ($\beta = 0.083$, $SE = 0.023$, $t = 3.612$, $p = .006$). No

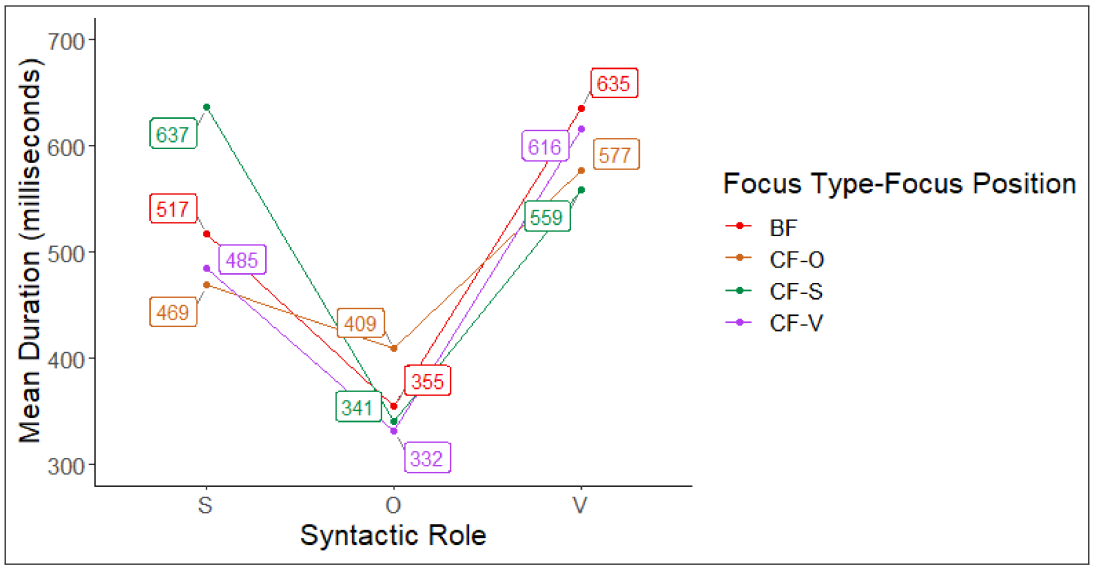

Figure 6: Mean duration by focus type—broad focus (BF) and contrastive focus (CF)—and focus position—subject (S), object (O) and verb (V).

such difference was found for verbs when the object was focused, nor when the sentence included a PF-marked sign. Therefore, it seems that PF yields compression on pre-focal subjects, while CF yields compression on post-focal verbs.

Although the effect of the session was not one of our initial research questions, since the factor session has significantly improved our model, we computed the pairwise comparison of the two sessions of the experiment. This showed that signing duration was significantly longer in the first session of the experiment ($\beta = 0.048$, $SE = 0.008$, $t = 6.205$, $p < .001$). However, as stated before, interactions of session with the factors of focus and focus type did not improve the model. Therefore, we have no evidence of a link between this speed-up and focus realization.

Our models were also significantly improved by the inclusion of the factor age of acquisition and its interaction with syntactic role but not by its interaction with focus or focus type. Therefore, we computed the pairwise comparison of the two age of acquisition groups. This showed that sign duration was significantly shorter for Deaf of Deaf participants than Deaf of Hearing participants ($\beta = -0.172$, $SE = 0.082$, $t = -2.090$, $p = .0496$). However, because the interactions of age of acquisition with focus or focus type did not improve the duration model, it cannot provide any direct evidence of a difference in focus marking strategies between the two age of acquisition groups.

4.2 Nonmanuals

The factors syntactic role ($\chi^2(2) = 269.08$, $p < .001$), focus type ($\chi^2(2) = 6.5235$, $p = .0383$), and session ($\chi^2(1) = 6.5235$, $p = .0383$) have improved model performance as main effects.

For an analysis of focus, we used a factor that differentiated between only focused and non-focused elements in these models (0 = non-focused, 1 = focused). However, focus as a main effect did not improve model performance ($\chi^2(1) = 0.818, p = .3658$), nor did its interaction with syntactic role ($\chi^2(3) = 3.2767, p = .3509$) or its interaction with focus type ($\chi^2(1) = 0.1594, p = .6897$). This is also apparent from **Figure 7**, as we see hardly any difference in the distribution of nonmanuals in focused and non-focused elements. For this reason, we omitted focus as a factor from the final model since it introduced an extra parameter into the model without contributing to the analysis.

In addition, age of acquisition did not significantly improve the model as a main effect ($\chi^2(1) = 1.2721, p = .2594$), but its two-way interaction with focus type did ($\chi^2(2) = 11.312, p = .0034$). Moreover, the two-way interaction of syntactic role and focus type ($\chi^2(4) = 9.5907, p = .0479$) also significantly improved model performance. This led us to add the three-way interaction of syntactic role, focus type, and age of acquisition into the model, which has also significantly improved the model ($\chi^2(2) = 13.893, p = .03$). **Table 5** shows the final nonmanual

Dependent variable	Model formula
Nonmanual occurrence	NMM ~ Syntactic Role + Focus Type + Session + Age of Acquisition + Syntactic Role:FocusType + Age of Acquisition:FocusType + Syntactic Role:Age of Acquisition + Syntactic Role:Age of Acquisition:FocusType + (1|Participant) + (1|Item)

Table 5: The final model of nonmanual occurrence.

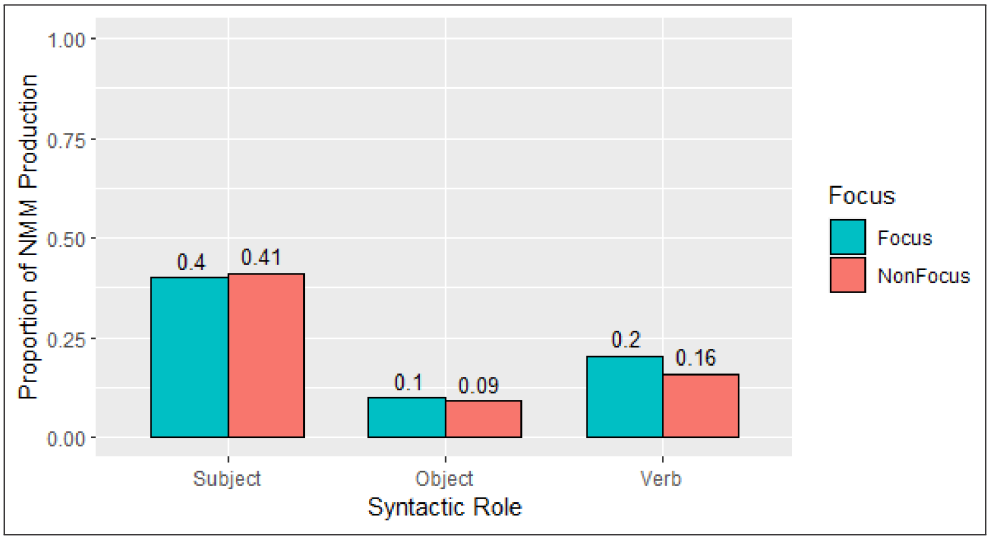

Figure 7: Proportion of nonmanual occurrences in focused and non-focused signs by syntactic role—subject (S), object (O), and verb (V).

model with which the pairwise comparisons were computed. All estimates from the nonmanual model are on the log odds ratio scale.

For our fifth research question, we observed that narrow focus is not necessarily accompanied by a nonmanual. We further inquired whether there was any other way in which narrow focus and BF behaved differently with regard to the nonmanual usage. To address this question, we explored how differences in the factors of syntactic role and focus type affected nonmanual usage.

As shown in **Figure 8**, a higher proportion of nonmanuals occurred with subjects in our experiment. Therefore, we computed pairwise comparisons of nonmanual occurrence in subjects, objects, and verbs. Significantly more nonmanuals occurred in subjects than objects ($\beta = 2.32$, $SE = 0.182$, $t = 10.44$, $p < .001$) and verbs ($\beta = 1.20$, $SE = 0.135$, $t = 8.76$, $p < .001$), and significantly fewer nonmanuals occurred in objects than verbs ($\beta = –1.12$, $SE = 0.188$, $t = –4.89$, $p < .001$). These results are in line with Karabüklü & Gürer (2024)'s findings on TİD.

Figure 8 also shows that more nonmanuals occurred with subjects in sentences that included a CF-marked sign, both when the subject was focused and when another element was marked with CF. Therefore, we computed all comparisons for the three focus types within each syntactic role and found that significantly more nonmanuals occurred ($\beta = 0.533$, $SE = 0.165$, $t = 3.24$, $p = .003$) with subjects in sentences that included a CF marked sign, than with subjects in sentences that included a PF marked sign, regardless of whether the subject was narrowly focused or not.

In our duration analysis, we found a significantly shorter sign duration, hence a faster signing rate in the second session of the experiment. We wanted to see whether the two sessions also differed with respect to nonmanual usage. Computing the comparison of the

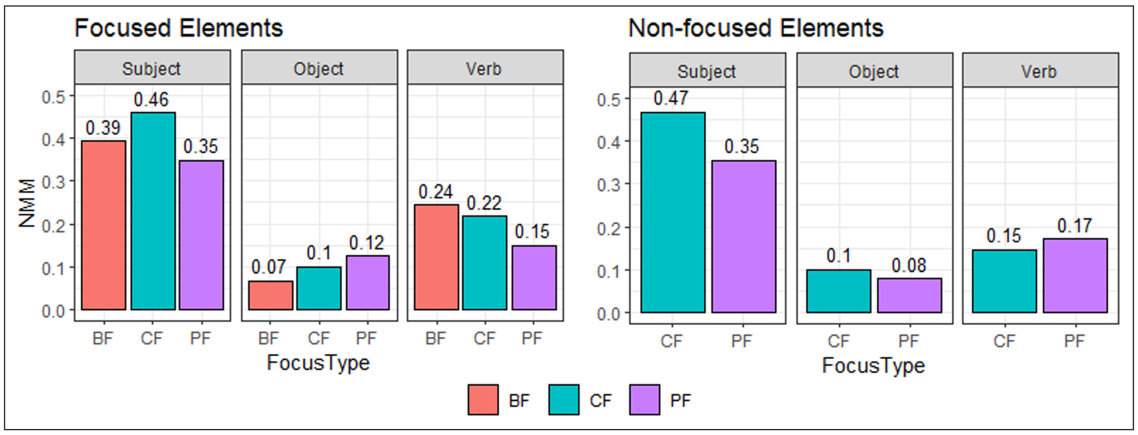

Figure 8: Proportion of nonmanual occurrences in focused and non-focused signs by syntactic role—subject, object, and verb—and focus type—broad focus (BF), contrastive focus (CF), and presentational focus (PF).

two sessions with the nonmanual model showed that significantly more nonmanuals occurred with signs in the first session of the experiment ($\beta = 0.264$, $SE = 0.107$, $t = 2.464$, $p = .0138$). Finding that fewer nonmanuals occurred during the session where the signing rate was higher, we can say that a faster signing rate was accompanied by fewer nonmanual usage. However, we cannot be sure that the low nonmanual usage was directly caused by the faster signing rate.

Visualizations of the data also showed varying behavior for the two age of acquisition groups with regard to nonmanual usage. Therefore, we computed additional pairwise comparisons of these, which are available in Supplementary Material C, along with the relevant plots.

5 Discussion

5.1 Focused signs in the focal domain: Increase in duration as a boosting effect

We investigated the prosodic strategies used for the focused sign, restricting the scope to the focal domains across two research tracks: the focused signs were compared to their (i) non-focused given counterparts in other narrowly focused conditions and (ii) discourse new counterparts in the BF condition. The first comparison illustrates how focused signs are realized compared to non-focal given signs. The results in 4.1 showed that an increase in duration was the boosting strategy for focused signs when narrowly focused signs were compared to their non-focused counterparts, consistent with the findings of Karabüklü & Gürer (2024). Only the focused constituent triggered alternatives in narrowly focused conditions, and the other signs were given. Hence, one could alternatively suggest that the difference in duration was due to the information status of the sign, i.e., given vs. discourse-new, in addition to the focusing effect.

That is why the second research track was crucial to our investigation. This track was based on the first two research questions, discussed in Section 3.1: namely, how narrowly focused constituents differed from their counterparts in the BF condition and how prosody was realized in the BF condition.

In the BF condition, all the constituents were discourse-new and equally prominent from a semantic point of view, triggering alternatives. Hence, the baseline BF condition was a litmus test for focus prominence in narrowly focused constructions. The results in Section 4.1 showed that the PF condition was on par with the BF condition in that the focused PF subject, object, or verb did not differ significantly from their discourse-new counterparts in the BF condition. As for the CF condition, CF subjects and objects were significantly longer than their BF counterparts. However, the same contrast was not observed with CF verbs. Both the BF and the narrowly focused conditions are discourse-new, but CF signs are still significantly longer than their counterparts in the BF condition. Hence, the difference observed for the focused and non-focused signs cannot be attributed to the givenness effect.

Although the CF condition was the marked focus type, the verb length did not differ significantly. The first hypothesis is that this is due to the phrase final lengthening effect (Wilbur 1999). Signs in phrase-final position in sign languages undergo phrase-final lengthening, and hence, there is no significant difference between the two. However, a CF marked sign was still significantly longer than its non-focused counterpart in the same position. Hence, the phrase final lengthening cannot account for the lack of a difference between the CF and BF conditions, the discussion of which we leave for further investigation.

As for the contour of the BF condition, which is part of our second research track, the current study further indicates that the BF condition had the same V-shaped contour with narrowly focused constructions in that the verb had the longest duration followed by the subject and the object, respectively. This indicates that TİD preserves the contour of the sentence but modulates the duration of the narrowly focused signs.

To sum up, increasing duration is the significant focus strategy in TİD when the scope of the investigation is restricted to the focal domain. This manual prosodic strategy differentiates focused signs from non-focused given signs and their counterparts in the BF condition. However, there is an asymmetry between the CF and PF conditions, which will be discussed in detail in Section 5.4

5.2 Extended prosodic domain: Decrease in duration as a compression effect

As formulated in research questions 3 and 4, the study aims to extend the prosodic investigation of focus to the pre-focal and post-focal domains. As the discussion in the previous section has shown, comparing focused signs to their counterparts in the BF condition indicates that PF-marked focal signs are not marked with the focus strategy in TİD, namely an increase in duration as a boosting effect. Additionally, unless the focused sign is the subject, a PF sign does not significantly differ from its non-focused counterpart. At first glance, this casts doubt on the validity of the increase in duration as the main narrow focus marking strategy in TİD. However, the main argument of this study is that focus marking is not necessarily restricted to the focused sign itself, and the extended prosodic domain needs to be investigated for alternative deboosting strategies.

The results showed that when the object was marked with PF, the immediate pre-focal subject was significantly shorter in duration than its counterpart in the BF condition. When the verb was marked with PF, the same compression effect in duration was still observed on the long-distance pre-focal subject. Additionally, there was no significant difference between the immediate and long-distance pre-focal subjects regarding compression in duration. We suggest that a manual sign bearing PF is not necessarily marked with a boosting strategy, namely an increase in duration, but through a deboosting strategy in the immediate and long-distance pre-focal domains.

As for the CF condition, it was marked by an increased duration on the focused sign, but pre-focal compression was not observed. The results further showed that when the subject was marked

with CF, there was a compression effect on the verb in the long-distance post-focal domain. This indicates that although shorter duration is used as a deboosting strategy for non-focused given signs in both narrow focus conditions, the PF condition applies the compression effect in the pre-focal domain and the CF condition in the post-focal domain. In a sense, the same strategy bifurcates into two tracks based on the focus subtype. The analysis of the strategies in the focal, pre-focal, and post-focal domains clearly shows that the prosody of focus is an aggregation of the strategies in these domains.

Although the analysis can account for the results in the focal, pre-focal, and post-focal domains discussed so far, a loose end still needs to be addressed. Contrary to the expectations, the non-focused given object does not undergo the compression effect (i) in the pre-focal domain when the verb is focused (ii) in the post-focal domain when the subject is focused. How does the object override this effect if compression is the trade-off focus strategy in pre- and post-focal domains? As illustrated in **Figure 6**, in all conditions, the object has the shortest duration. The duration of the object may be the threshold level. We suggest that TİD preserves the scaling in duration, the reference line, by not applying further compression on the object.

5.3 Compression due to focus or givenness?

As the main contribution of this study, we propose that the decrease in duration in the non-focal domains is a deboosting strategy for non-focused given constituents and a complementary strategy to an increase in duration with the focused signs. This analysis, in turn, naturally raises questions about the trigger of this compression effect, especially given that constituents marked as given are non-prominent (Féry & Samek-Lodovici 2006). Studies in the sign language literature also showed that the duration of signs gets shorter when they are repeated and given in context (CSL, Lin et al. 2024; ASL, Martinez del Rio 2023; TİD, Keleş 2024; ISL, Stamp et al. 2024). Then, is shorter duration due to focus as suggested in the current study, or pure “givenness”?

As shown in the results, there are also categorial restrictions that draw the line between the focus subtypes in that the PF condition triggers compression in the pre-focal domain and the CF condition in the post-focal domain. Consider the following configurations in **Figure 9**. When the verb bears PF, there is a compression effect on the subject in the long-distance domain. However, this effect is not observed on the subject when the verb bears CF.

Figure 9: Presentational focus (PF) and contrastive focus (CF) configurations in the environment of given (G) constituents.

Note that the subject is given in both conditions. If the compression effect were due to givenness, one would expect the same compression effect in both conditions. However, the effect is observed only in the PF condition. Hence, we suggest that the decrease in duration as a deboosting strategy is not due to givenness but to focus prominence, which is realized as an aggregation of prosodic effects in the extended domain.

5.4 Implication relations

The results show that only a narrowly focused PF subject is significantly longer in duration than its non-focused counterpart, while it does not differ from the BF condition in any position. As for the CF condition, a narrowly focused CF is significantly longer than its non-focused counterpart in all positions, and it differs from the BF condition in all positions except for the verb. Hence, in addition to an asymmetry for the focus subtypes of CF and PF, there is one for the syntactic roles, i.e., subject vs. non-subject. Two questions arise: (i) Why does the PF subtype not use the focus strategy for prominence on the focused sign? (ii) Why is focus prominence not expressed in all positions in both subtypes? In other words, what is special about the subject?

We will begin with the first question. As repeated in (33) and (34), for ease of reference, wh-questions are used to elicit both PF and BF. The only difference is the size of the focus projection: broad versus narrow.

(33) A: $\overset{\text{hs}}{\overline{\text{WHAT BE}}}$
'What is happening?.'
B:[AYŞE PENCIL THROW]$_{\text{BF}}$
'Ayse is throwing a pencil.'
Alternative set:{Ayşe is throwing a pencil, Ece is eating a banana, Aslı is opening a box . . .}

(34) A: $\overset{\text{hs}}{\overline{\text{WHO PENCIL THROW}}}$
Who is throwing a pencil?
B: [AYŞE]$_{\text{PF}}$ PENCIL THROW
'Ayşe is throwing a pencil.'
Alternative set: {Ayşe is throwing a pencil, Mete is throwing a pencil, Ece is throwing a pencil . . .}

Hence, the first hypothesis is to expect the PF condition to be on par with the 'unmarked' BF condition, in contrast to the CF condition. However, the discussion in Section 5.2 further shows that the PF condition differs from the BF condition in the pre-focal domain via pre-focal compression. That is why the term 'unmarked' condition will be a misnomer for the PF condition because it differs from the 'unmarked' BF condition in the extended prosodic domain. Additionally, the subject and non-subject distinction still needs an explanation.

Based on similar asymmetries in spoken languages, Zimmermann (2011: 1994) and Skopeteas & Fanselow (2010: 170–171) suggest two implication relations, as illustrated in (35).

(35) a. If a noncanonical grammatical strategy is used in order to mark information focus (on a grammatical category α), it is also used to mark contrastive focus on α, but not vice versa.
b. If a noncanonical structure occurs with focus on non-subjects, it is expected to occur with focus on subjects too. (…) Non-canonic structures for the expression of focus occur either (a) equally for subjects and non-subjects, or (b) for subjects but not for non-subjects, or (c) for neither structural category.

Note that the same implication relations can account for the results of the current study. First, TİD expresses focus via an increase in duration compared to non-focused signs. The CF condition uses this boosting strategy across all positions. Although restricted to a single position, the PF condition also uses this strategy. In other words, in line with (35)a, a strategy that marks presentational focus implies the usage of the same strategy in the CF condition.

As for the subject and non-subject asymmetry, in line with (35)b, the marker of focus occurs equally for subjects and non-subjects in the CF condition, for subjects but not for non-subjects in the PF condition. In line with the previous analyses (Skopeteas & Fanselow 2010; Zimmermann 2011), we suggest that this has to do with the default information packaging for the subjects. Subjects serve as the pivot for the rest of the sentence; hence, subjects are default topic phrases in a sentence. In contrast to the default packaging option, the focus marking strategy is realized obligatorily when information packaging entails them to function as focus. That is why focus marking shows an asymmetry between the non-canonically packaged subject and the non-subject arguments in the PF condition.

6 Role of nonmanuals in TİD

As we laid out in the background, sign languages show two crosslinguistic patterns: conveying focus via (i) both manual and nonmanual strategies or (ii) only manual strategies. For TİD, the results showed that focushood does not significantly affect the production of nonmanuals. By confirming Karabüklü & Gürer's (2024) findings, our results also showed that TİD does not use the nonmanual channel to mark focus; thus, it falls into the second category by patterning with RSL. Although the nonmanuals observed in the data do not clearly mark focus, their possible function is unknown. Acknowledging that they appeared in only 22 % of the entire data set, we will discuss the possibility of them being boundary markers in the following subsection. We will also highlight how the findings in the nonmanual domain differ characteristically from those in the manual domain in sign language literature.

6.1 Are nonmanuals boundary markers?

In contrast to the focushood, the syntactic role of the constituents was a good predictor for the distribution of nonmanuals. A nonmanual most likely accompanies the subject, the verb is the second candidate, and the object is the least likely candidate. Considering these occurrences, one possible function of nonmanuals is signaling prosodic groupings among the constituents. With regard to this possibility, nonmanual head nod (hn) appears as in (36) in the data, and when contrastive focus is on the verb, the signer marks the subject and the verb with a head nod.

If the nonmanuals signal prosodic groupings, then (36)b is a possible grouping of (36)a. The subject and the verb are wrapped in different phonological phrases (PPh), and the object ends up in the same phonological phrase as the verb, and there are two phonological phrases. The other alternative is to have the object wrapped up in a different phonological phrase, as in (36)c, and there are three phonological phrases. At this point, we do not have conclusive evidence to decide on one of these two options.

(36) a. $\overline{\text{ECE}}^{\text{hn}}$ BANANA $\overline{\text{EAT}_{\text{CF}}}^{\text{hn}}$
'Ece is eating the banana.'
b. $(\text{ECE})_{\text{PPh}}$ $(\text{BANANA EAT})_{\text{PPh}}$
c. $(\text{ECE})_{\text{PPh}}$ $(\text{BANANA})_{\text{PPh}}$ $(\text{EAT})_{\text{PPh}}$

The literature shows that speech or signing rate influences the number of prosodic groupings, and faster rates decrease the number of phonological phrases (Nespor & Vogel 1986; Wilbur 2009). In line with the literature, the results further indicate that when the signers signed faster in the second session, the number of nonmanuals decreased significantly. The example in (37)a illustrates the same sentence signed by the same signer in the second session. Note that the only nonmanual that appears in the sentence accompanies the subject.

(37) a. $\overline{\text{ECE}}^{\text{hn}}$ BANANA EAT_{CF}
'Ece is eating the banana.'
b. $(\text{ECE})_{\text{PPh}}$ $(\text{BANANA EAT})_{\text{PPh}}$
c. $(\text{ECE BANANA EAT})_{\text{PPh}}$

If (36)b is the default grouping in TİD, then at a faster signing rate, the subject is in a phonological phrase to the exclusion of the object and the verb, as illustrated in (37)b. Note that in this scenario, we end up with two phonological phrases in each instance. Then, we do not observe the expected signing rate effect in this scenario. If (36)b is the default grouping at a normal signing rate, then one can assume that (37)c is the one at a faster signing rate. However, it is not clear why the nonmanual appears with the subject in (37)c. If (36)c is the default grouping at a normal signing

rate in TİD, namely, each sign is wrapped up by a phonological phrase, then in a fast signing rate, the verb and the object are grouped in the same phonological phrase excluding the subject, as in (37)b. The only nonmanual accompanies the subject because the subject is wrapped up within a separate phonological phrase. Then, the grouping in (36)c can be the default phrasing pattern in TİD in that in the presence of a nonmanual accompanying the verb, each sign ends up in a separate phonological phrase.

Although this analysis is appealing in that it accounts for the TİD data so far, some issues still need to be addressed. First, we do not have additional evidence to suggest (36)c as the default grouping in TİD. A possible track of investigation is to examine boundary cues, such as holds and modulations of the manual signs, at the transition points to identify the boundaries of the phonological phrases. Secondly, if nonmanuals mark the edges of phonological phrases, why do they appear with a limited frequency, accounting for only 22% of the data? In the absence of the nonmanuals, how do signers mark the edges of the phonological phrases? These issues need further investigation and are left for future research.

6.2 Reconsidering nonmanuals in the extended domain of focus

When we examine focus marking in the nonmanual domain, we realize a distinction from spoken language typology in terms of the extended domain of focus. To lay out the scene, nonmanuals have always been reported as binary, either occurring with the focal sign or not, as seen in Section 2.2. All the studies arguing that nonmanuals are focus markers showed that they only spread over the focal item and do not appear over the non-focal items.

Considering the findings in spoken languages and our findings in the manual domain, a predicted pattern for nonmanuals is that they would appear throughout the entire focus domain. Then, focus would shape their appearance by boosting or deboosting their intensity or amplitude in the extended domain. In contrast to this expectation, most studies reported them as spreading over the focal item and resetting at its boundary.

There is only one recent study (Stamp et al. 2024) that provides indirect evidence for the hypothesis raised in this section. Although the main goal was not focus marking, the study showed that nonmanuals can also be deboosted. Authors investigated reduction in repetitions with motion capture, and repetitions were analyzed as re-introduction or maintenance strategies. Stamp et al. (2024) found that Israeli Sign Language (ISL) signers reduced the duration of manual signs and the distance covered by nonmanuals, such as head movement, when they were repeated in the discourse. Signers reduced signs and decreased the distance of head movements significantly in re-introduction and maintenance compared to introduction. If we regard the discourse strategies of re-introduction and maintenance as indicators of givenness, the results of the study indicate that both manual and nonmanual domains in ISL are affected by givenness. Their findings suggest that signers also modulate the prosodic features of nonmanuals. Yet, these findings do not show

whether the nonmanuals were boosted for focus marking or deboosted in the pre- and post-focal domains. Further investigation will not only shed light on how sign languages use the nonmanual domains for focus, shaping it via boosting and de-boosting, but also show how different sign languages shape both domains for focus marking.

7 Conclusion

This study investigated the effect of focus in an extended prosodic domain in the simultaneous structure of TİD. We designed a controlled production study to elicit focused and non-focused items with question-answer sets. The results showed that TİD modulates prosodic cues, affecting not only focused signs but also the given signs in the pre- and post-focal domains. TİD signers marked the focused signs by increasing the sign duration as a boosting effect while they reduced the duration of pre- and post-focal signs as a deboosting effect. Furthermore, focus types are distinguished via these strategies. CF is marked by boosting focused signs in all syntactic positions and deboosting the non-focal signs in the post-focal domain. In contrast, PF is marked by boosting focal signs only in the subject position and deboosting non-focal signs in the pre-focal domain. Our findings showed that the orchestration of boosting and deboosting strategies in focus realization is not modality-specific.

As the first experimental study investigating focus marking in the extended domain, these findings shed light on the prosodic layout of the simultaneous structure of sign languages. In sign language literature, prosodic features are generally associated with the nonmanual channel. Yet, our findings contributed to these discussions by showing that duration, as a suprasegmental feature, can shape prosody in the manual channel. Furthermore, the low occurrence of nonmanuals in the data highlights that in TİD, the manual channel is the primary domain to encode focus.

In terms of sign language typology, studies in the literature suggest three groups. Sign languages use (i) syntactic strategies, manual modulations, and nonmanuals like ASL, (ii) manual modulations and nonmanuals like NGT or LSF, and (iii) manual modulations only, like RSL. Our results show that TİD uses manual modulations only by patterning with RSL, considering the findings on consistent marking of focus in the manual channel and not in the nonmanual channel. It would be intriguing to investigate whether a marked word order for information packaging in syntax influences the occurrence of nonmanuals in the prosodic domain or if a fixed word order leads to more diverse strategies within the prosodic channels. Future research will reveal how focus marking strategies interact across various modules, including syntax, manual and nonmanual channels of prosody, and morphology.

Abbreviations

ACC = accusative, AGR = agreement, ASL = American Sign Language, bf = brow frown, blf = body lean forward, bht = backward head tilt, bl = brow lowering, br = brow raise, BF = broad focus, CF = contrastive focus, DAT = dative, DEM = demonstrative, DoD = Deaf of Deaf, DoH = Deaf of Hearing, FinSL = Finnish Sign Language, DGS = German Sign Language, F(OC) = focus, f0 = fundamental frequency, FM = focus marker, G = given, hbt = head backward tilt, hn = head nod, hs = head shake, ht = head tilt, h trust = head trust, ISL = Israeli Sign Language, LSC = Catalan Sign Language, LSF = French Sign Language, NGT = Sign Language of the Netherlands, NMM = nonmanuals, NOM = nominative, O = object, PF = presentational focus, PROG = progressive, PRT = particle, PL = plural, PPh = phonological phrase, RSL = Russian Sign Language, S = subject, SG = singular, TİD = Turkish Sign Language, V = verb.

Data availability

Data and analysis scripts are available at the following link.

Supplementary Material A, B, C: https://osf.io/zf3g7/?view_only=1fcd848ebe01410a93235b9219fb8ff2

Ethics and consent

The study was approved by İstanbul Bilgi University's ethics committee, and the approval number of the project is 2021-40014-27.

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Competing interests

The authors have no competing interests to declare.

Authors' contributions

The study was first developed by Aslı Gürer and Serpil Karabüklü. The data was collected by Aslı Gürer and Kasım Burak Çavuşoğlu. The data was processed by Aslı Gürer and Serpil Karabüklü, and analyzed by Kasım Burak Çavuşoğlu. Data visualizations were done by Kasım Burak Çavuşoğlu. The article was written and revised by all authors.

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