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Acoustic correlates of Givenness in Icelandic: Revisiting the Radical Deaccentuation hypothesis

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This paper discusses whether there is a direct link between GIVENness-related deaccentuation[1] and ellipsis. The idea that ellipsis can only target already-deaccented material with "distinguished low-flat intonation" (Chomsky & Lasnik 1993: 564) is known as the *Radical Deaccentuation* (RD) account (see e.g. Tancredi 1992). Icelandic represents a challenge for RD, as it permits (clausal) ellipsis (Wood et al. 2016; 2020) yet does not seem to display deaccentuation (Nolan & Jónsdóttir 2001; Dehé 2009). We conducted a prosodic production experiment to investigate the acoustic correlates of post-focal GIVENness in pre-elliptic clauses in Icelandic to determine if Icelandic undermines the RD theory. We found that Icelandic exhibits prosodic attenuation in pre-elliptic clauses, such that pitch accents of given items are realized, yet they exhibit lower overall F0, and shorter duration. We also found a difference in prosodic constituency between all-new and pre-elliptic clauses, such that the given part in only the pre-elliptic condition is structurally integrated to the prosodic domain of the focused item. Our empirical findings are compatible with a weaker version of RD, namely one which treats 'deaccentuation' as a cover term for any acoustic effect related to the prosodic marking of GIVENness.

1 Introduction

The prevailing sententialist approach to ellipsis, namely the PF-deletion approach, treats ellipsis as a phonological operation that yields the non-pronunciation of a syntactic constituent (Merchant 2001; 2004) (see (1), where strikethrough represents unpronounced material). There are two views on the nature of this operation: it either applies before Vocabulary Insertion (Halle & Marantz 1993) and therefore functions to instruct Vocabulary Insertion to avoid exponing designated syntactic heads (Wilder 1997; Bartos 2000; 2001; Kornfeld & Saab 2004; Nunes & Zocca 2009; Aelbrecht 2010; Temmerman 2012; Saab & Lipták 2016; Saab 2022; among others), or it applies after Vocabulary Insertion and can therefore be characterized as an extreme phonological reduction mechanism that reduces the articulatory salience of an exponed item down to zero (i.e., to non-pronunciation) (An 2016; 2019; Weir 2012; 2022; Ionova 2020; Erschler 2022). In what follows, we refer to these views as the *non-exponence* and *phonological reduction* views, respectively.

(1)　　a.　Hilda has called someone, but I don't know who.
　　　　b.　Hilda has called someone, but I don't know who [$_{TP}$ ~~she has called~~].

For the majority of its ascendency, the PF-deletion approach has been coupled with a semantic theory of ellipsis licensing. Putting aside differences in their technical details, such theories state that ellipsis is semantically licensed in a phrase P when P is discursively redundant, or *given*, to a specified degree (Merchant 2001; Krifka 2006; Reich 2007; Weir 2014; Barros & Kotek 2019). For instance, Merchant (2001) builds on Schwarzschild's (1999) general theory of GIVENness, which defines a linguistic expression *E* as *given* if *E* is entailed by the discourse, see (2), by saying that elliptic phrases must be *e*-GIVEN, which is a more stringent form of GIVENness (involving mutual as opposed to one-way entailment; see (3)).

(2)　　*GIVENness* (Schwarzschild 1999: 151, formulation from Merchant 2001: 14)
　　　　A linguistic expression E counts as GIVEN iff it has a salient antecedent A and, modulo ∃-type shifting, A entails the Focus-Closure of E.

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[1] We use the term "deaccentuation" as it was used in the ellipsis-related literature. We simply take it as the non-existence of pitch accents in the information structurally given items, such that they are otherwise accented when they are not information structurally given. Prosodic cues to diagnose lack of accentuation involve multiple intonational cues as well as some other non-intonational prosodic cues, of which we will use F0 flattening (in which the lack of accentuation leads to high or low levelled flat intonation), and smaller pitch register hence presence of pitch accent compression (in which the lack of accentuation leads to a smaller F0 difference between the maximum F0 and the minimum F0). Deaccentuation in this paper is thus an intonational notion, however givenness may be marked beyond the intonational cues in prosody by some other acoustic cues such as duration, typically shorter duration for given items, although this is language-specific. Taking a broader and more liberal approach to the possible prosodic cues that mark givenness, we also use the term "attenuation" to refer to those cases in which given items exhibit diminished prosodic values (not only intonational cues such as loss of accents, or compressed F0, but also e.g., shorter duration).

(3)   *e-GIVENness* (modified from Merchant 2001: 26)
        A linguistic expression E counts as GIVEN iff it has a salient antecedent A and, modulo
        ∃-type shifting, A entails the Focus-Closure of E **and E entails the Focus-Closure of A**.

General theories of GIVENness such as Schwarzschild's were developed to explain patterns of deaccentuation in English. Thus, the motivation for developing more stringent notions of GIVENness for ellipsis (e.g., *e-*GIVENness) comes from the observation that ellipsis cannot apply to all deaccentable phrases:

(4)   a.   Abby called Chuck an idiot after BEN *insulted him*.[2]
        b.   *Abby called Chuck an idiot after BEN *did* ~~insult him~~.

(adapted from Merchant 2001: 27)

The view that one adopts about the nature of the relationship that obtains between (*e-*)GIVENness, deaccentuation, and ellipsis will depend on one's prior commitments.[3] For instance, if one advocates a non-exponence analysis of PF-deletion, then one is committed to viewing deaccentuation and ellipsis as only indirectly related: they are both licensed when semantically (*e-*)GIVEN, but ellipsis is an operation that suppresses Vocabulary Insertion whereas deaccentuation is an operation that targets already-exponed linguistic items. Conversely, if one advocates a phonological reduction analysis of PF-deletion, then one can (but need not) adopt the view that ellipsis is contingent on deaccentuation. According to this view, ellipsis occurs after deaccenting, and further phonologically reduces (down to zero) material that has already undergone phonological reduction by virtue of being deaccented. The two views described above are diagrammatically represented in (5).[4]

(5)   a.   *Non-exponence analysis*

(*e-*)GIVEN expression

deaccenting   ellipsis

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[2] In examples, italics represents deaccentuation and small caps represents sentence-level prosodic (nuclear) prominence.

[3] A causal link between elliptic and prosodic strategies in marking GIVENness has been suggested or assumed in wider ellipsis literature (e.g., see Tancredi 1992; Rooth 1992; Chomsky & Lasnik 1993; Hobbs & Kehler 1997; Fox 1999; Wyngaerd & Zwart 1999; Gardent 2000; Hartmann 2000; Féry & Hartmann 2005; Hardt 2007; Abe & Tancredi 2013; Abe 2015; Ott & Struckmeier 2016; 2018).

[4] Here we consider only ordinary constituent ellipsis (specifically clausal ellipsis) which is known to be sensitive to syntactic and semantic restrictions. Some other types of ellipsis, such as left-edge ellipsis in English or conjunction reduction is arguably only phonologically conditioned (e.g., see Weir 2022 for English left-edge ellipsis), such that a strong radical deaccentuation analysis may be feasible for this type of ellipsis and would fit the pattern in (5b) in the main text. We thank the anonymous reviewer for bringing this into our attention.
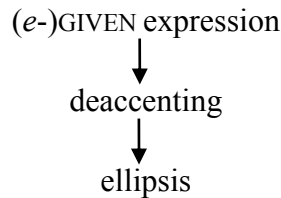
    b. *Phonological reduction analysis*

        (*e*-)GIVEN expression

              ↓

          deaccenting

              ↓
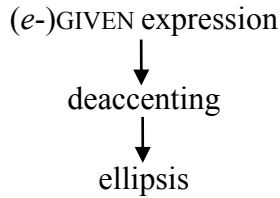
            ellipsis

The view represented in (5b) is known as *Radical Deaccentuation* (RD, Tancredi 1992). It states that ellipsis is the further phonological reduction of given information that already has a "distinguished low-flat intonation" (Chomsky & Lasnik 1993: 564).

    This paper assesses the viability of RD from the perspective of prosody. In Section 2, we present findings from the literature on the prosodic marking of GIVENness in intonation languages (e.g., German) to show that the strong version of RD represented in (5b) is actually a non-starter, as given linguistic expressions of the type that can undergo ellipsis (i.e., postfocal phrases) need not be deaccented. Therefore, we assess the viability of a weaker version of RD, one which is (tacitly) endorsed by Hartmann (2000; 2003), Abe (2015) and Ott & Struckmeier (2016; 2018), and which states the ellipsis can only apply to constituents that display at least some form of systematic prosodic marking of GIVENness (compare (6a) and (6b)).

(6)   a. *Strong Radical Deaccentuation* (SRD)

          (*e*-)GIVEN expression

               ↓

            deaccenting

               ↓

            ellipsis

    b. *Weak Radical Deaccentuation* (WRD)

            (*e*-)GIVEN expression

                 ↓

      systematic prosodic marking of GIVENness

                 ↓

             ellipsis
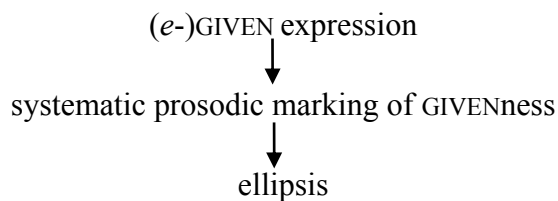
Although the prosodic profiles of intonation languages such as English and German given domains are compatible with WRD, serious doubts are cast on WRD's viability from Icelandic, another intonation language, which is reported to possess no systematic means of prosodically marking GIVENness (Nolan & Jónsdóttir 2001; Dehé 2009). Because these reports are impressionistic in nature, or are based on limited cues, we conducted a prosodic production experiment to determine if Icelandic indeed invalidates the WRD. Specifically, we recorded 10 Icelandic

speakers producing sentences in which clausal ellipsis is semantically licensed and therefore could—but crucially does not— occur (following Dayal & Schwarzschild (2010), we henceforth call these sentences *pre-sluices* or *pre-fragments*, depending on what form of clausal ellipsis could apply). This experiment is reported in Section 3. As reported in our discussion (Section 4), we discover that Icelandic speakers **do** systematically prosodically mark given pre-elliptic phrases, which partially goes against expectations based on previous reports. We therefore conclude in Section 5 that Icelandic does not invalidate the WRD. This entails that one cannot (yet) use arguments from the prosodic reflexes of GIVENness to determine whether (5a) or (6b) is the most feasible PF-deletion approach to ellipsis: one must instead rely on other data sources and/or purely conceptual arguments.

Our contribution is directly linked to the main theme of this special collection, i.e., to the experimental and corpus-based perspectives on (mis)matches under ellipsis. The Radical Deaccentuation hypothesis is based on the theoretical assumption that each elliptic clause involves deletion of some linguistic material. Since ellipsis is optional, each elliptic clause has a fully realized version. Elliptic clauses and their fully realized paraphrases often have the same meaning (hence they can be used interchangeably) (cf. Hobbs & Kehler 1997; Gardent 2000; Merchant 2001; Barros 2014; Griffiths 2019; Griffiths et al. 2023). In the RD hypothesis, the meaning correspondence between the elliptic clause (reconstructed meaning) and its pre-elliptic version is coupled with the assumptions by traditional generativist approaches about deriving clausal meanings: via compositional syntax. The observation that the elliptic clause and its pre-elliptic counterpart often "match" in their meaning leads to the conclusion that the elliptic clauses must have syntactic structures that are identical to their non-elliptic paraphrases. In this paper, we experimentally test the cross-linguistic applicability of the RD hypothesis. If the RD hypothesis is refuted, then the core premise that RD hypothesis is based on (i.e., the idea that there is a causal relation between elliptic clauses and their non-elliptic paraphrases) is no longer supported by the deaccentuation facts. If the RD hypothesis is not completely refuted (if we find some kind of prosodic marking of GIVENness in Icelandic), then the assumed link between prosodic marking of GIVENness and ellipsis may still be maintained; hence the idea that there should be a faithful correspondence between elliptic clauses and their non-elliptic counterparts, in terms of their prosody and syntax is indirectly supported.[5]

2 The prosodic marking of givenness and ruling out the SRD

In this section, we outline how GIVENness can be prosodically marked. We will show that, in phrases of the type that could undergo ellipsis (in particular, postfocal phrases), GIVENness can

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[5] Not all accounts of ellipsis that assume parallelism and a causal link between the elliptic clauses and their non-elliptic paraphrases (i.e., the deletion accounts) are based on the RD hypothesis. Therefore, refuting or supporting the RD hypothesis with experimental evidence does not altogether refute or support other deletion accounts of ellipsis.

be prosodically marked without resorting to complete loss of accentuation. This immediately invalidates the strong version the Radical Deaccentuation (SRD), which claims that ellipsis is contingent on deaccenting.

2.1 Deaccentuation as a marker of GIVENness

In intonation languages such as English, German and Icelandic, stressed syllables of content words are often produced with a pitch event on or near the stressed syllable. This is called pitch accent, which leads to the perception of intonational prominence of that stressed syllable (Pierrehumbert 1980; 't Hart, Collier & Cohen 1990). Pitch accent can be acoustically measured, exhibiting cues such as a specific tonal event (accent type), longer syllable or segment duration of the accented syllable, larger F0 difference between the maximum F0 and the minimum F0 (i.e., widened pitch register) in the area of the pitch accent, and also louder speech (Lehiste 1970, also see Grice et al. 2020 for English and its varieties). In broad-focus contexts (in which all the items in an utterance are new and not contrasted), each pitch accent in an intonational phrase (i.e., a clause-size prosodic unit) exhibits a downstep relation in English, German, and Icelandic, such that each pitch accent is realized with a pitch height that is relatively lower than the preceding one. This is schematically represented in the hypothetical example in (7), in which each stressed syllable (marked with x) is accompanied with a pitch peak, which is progressively lower towards the end of the utterance:

(7)   Downstep of pitch accents in broad focus context (for English, German, and Icelandic)
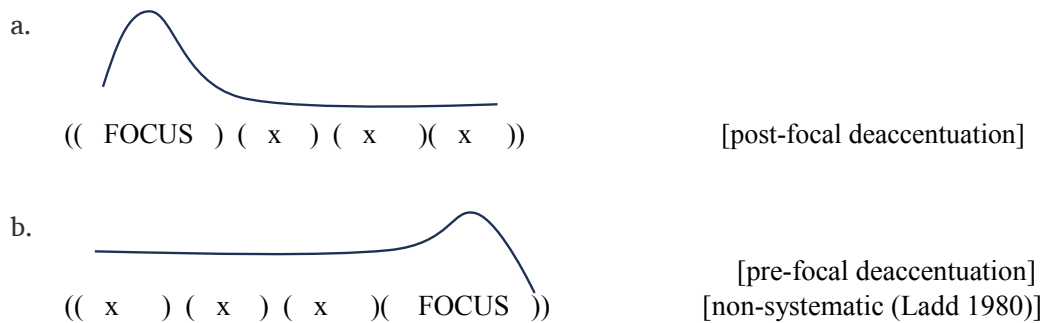

((x) (x) (x)(x))
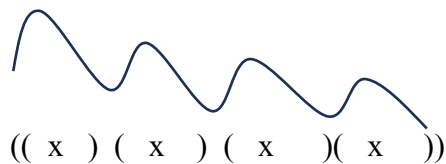
The lack of accentuation on a stressed syllable in a prosodic position that is accented as a default is considered as deaccentuation. Deaccentuation leads to the weakening of suprasegmental cues on an item in such a way that there is another prosodic unit that is perceived as more prominent and hence accented. Prosodic prominence is a relational notion, in which a portion of speech is produced/perceived as prosodically more prominent than the other parts (Ladd 1978; 1980; 2008; Gussenhoven 1983; Selkirk 1995; and see Ladd & Arvaniti 2023 for an overview). In this sense, GIVENness related deaccentuation is often considered as part of the strategy for marking focus related prominence.

In languages such as English and German, deaccentuation-related low level flat intonation (often acoustically manifesting itself as lower mean F0 and/or less difference between maximal and minimal F0 values) is often observed in the post-nuclear / post-focal area (which is also referred to

as post-focal pitch compression) (Ladd 1978; 1980; 1996; Xu 2011; Xu and Xu 2005). Linguistically given items that linearly precede the semantic focus in an utterance do not systematically exhibit deaccentuation. In the pre-focally given area accent realization and prosodic phrasing is usually retained as if the sentence is uttered in broad focus context (Baumann et al. 2021; Baumann & Grice 2006; Féry & Kügler; 2008; Féry & Ishihara 2009). Although not as common as post-focal deaccentuation, pre-focal intonational reduction is possible (also known as *pretonic accent* Ladd 1980). In pre-focal deaccentuation, the pitch range difference is as small as post-focal deaccentuation, but unlike post-focal deaccentuation, the pitch level (i.e. the overall mean F0 (fundamental frequency) of the area under discussion) is much higher (leading to a high plateau in the intonational contour). The hypothetical stylised intonational contours in (8) illustrate the visualisation of the intonational contours in the pre-focal area (8b) and post-focal area (8a), in which both areas exhibit deaccentuation, hence downstep across the intonational phrase is not retained.

(8)   Deaccentuation before (b) and after (a) focus with a High tone (for English and German)

      a.

          ((FOCUS   ) (x   ) (x   )(x   ))   [post-focal deaccentuation]

      b.

                                        [pre-focal deaccentuation]

          ((x   ) (x   ) (x   )(FOCUS))   [non-systematic (Ladd 1980)]

For intonation languages, the consensus is that focused items often exhibit a nuclear pitch accent, and GIVENness is often cued with loss of prosodic prominence and deaccentuation (Chafe 1976; Ladd 1978; 1980; 2008; Gussenhoven 1983; Terken & Hirschberg 1994; Selkirk 1995; Schwarzschild 1999; Wagner 2005; Baumann 2006; Cole et al. 2010; Baumann & Kügler 2015). This idea has been recently challenged by acoustic research. Recent findings based on acoustic analysis of data gathered through experiments on intonation languages such as English and German shows that deaccentuation in the post-focal area is not systematically present (Kügler & Féry 2017; Wagner & McAuliffe 2019; Kügler & Calhoun 2020 and references therein). This is surprising especially for the post-focal area, which has been thought to be deaccented as a grammatical means to mark focus (such that prosodic dephrasing/deaccenting in this area lends more prominence to the focused item that immediately precedes it). A degree of accentuation has been experimentally shown to be still present post-focally, even though it is much more diminished than its non-given (broad focus) counterpart. This has been illustrated by Kügler & Féry (2017) for German, based on experimental evidence, as shown in **Figure 1**.
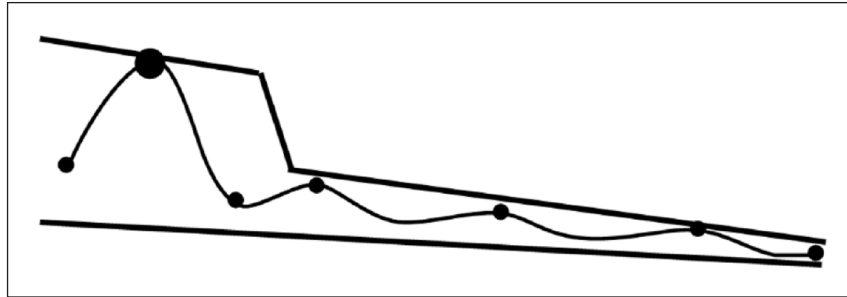
Figure 1: Downstep of the compressed pitch accents in the post-focal/post-nuclear region, small dots represent post-focal accents on the given area. (Kügler & Féry 2017: 283, Fig.10).

The finding that post-focal GIVENness does not always lead to a complete flattening of the intonational contour in this area,[6] coupled with the fact that given items in the pre-focal area do not show any systematic deaccentuation, pose a challenge to any account that assumes a procedural and causal link between ellipsis and deaccentuation. One may therefore conclude that deaccentuation and ellipsis are not inter-linked and the SRD accounts should be abandoned all together. However, such an approach would then miss the long-observed discourse relational dependencies that seem to converge in marking both ellipsis and deaccentuation in a non-trivially similar manner. In fact, even in cases such as German, in which accentuation is not completely lost, there are some cues of GIVENness in the form of compressed pitch range. Therefore, the observed post-focal prominence is at best "weak prominence" (Kügler & Féry 2017: 283). This can be inspected in the visualisation provided in **Figure 1**, in which the area after the nuclear pitch accent (all the steps of the downstep that come after the accent marked with a large point) exhibits pitch peaks with a much narrower register, and the overall accentuation is markedly compressed. In other words, although one may not speak of deaccentuation as an intonational cue for GIVENness in intonation languages, prosodic attenuation (pitch compression and other diminished cues such as shorter duration, smaller F0 register etc.) may still be considered as a correlate of information structural GIVENness. Therefore, one may still maintain a weakened version of the RD approach, (WRD as schematised in (6b)), in which the subject matter prosodic correlate is not complete loss of accentuation, but the presence of diminished prosodic cues, and lack of nuclear prominence in the post-focal area (see Ott & Struckmeier 2016 for a similar discussion).

WRD would allow us to make a more crosslinguistic generalisation, in which languages that lack pitch accent placement in their grammars, and non-intonation languages that do not

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[6] In Kügler & Féry's (2017) data, 37% exhibited flat intonation, with no stepping event (downstepping or upstepping), i.e., total deaccentuation as we know it and 63% of the given items in the post-focal area exhibited a stepping event. This entails that, even though complete flattening of the given item in post-focal area is present, it is not systematically employed by the speakers as a grammatical device to mark information structural GIVENness.

mark information structural notions based on accent-related events (such as phrase languages, or most tone languages) may as well be included, as long as they systematically exhibit a form of prosodic attenuation in especially post-focally given area.[7]

What would still be problematic even for WRD is a language that does not exhibit any GIVENness related prosodic attenuation at all. If such a systematically non-deaccenting language, in which no instance of deaccentuation of information structurally given items is observed, productively exhibits ellipsis, this would then mean that ellipsis is possible in a language without prosodic marking of GIVENness. Such a language would require us to completely de-link ellipsis and prosodic attenuation in marking GIVENness.

Without empirical support from experimental data, the validity of any RD-based hypothesis, which is initially based on impressionistic observations or native speaker intuition, remains questionable. To fill this gap in the literature, we carried out a production experiment to investigate the prosodic profiles of pre-elliptic clauses in Icelandic.

We specifically investigated Icelandic, because although it is an intonation language, Icelandic has been suggested to be one such language, in which GIVEN items are observed not to be systematically deaccented and are produced in the same way as their non-given counterparts (Nolan & Jónsdóttir 2001; Dehé 2009 and see Section 3 for a more detailed description of the Icelandic intonation). We carried out a production experiment on Icelandic to test whether there is any acoustic or intonational cue that systematically marks GIVENness. If we find that speakers of Icelandic do not prosodically distinguish utterances in broad focus and narrow focus contexts (of pre-elliptic clauses), then our results will provide strong evidence against WRD, simply because Icelandic productively allows clausal ellipsis (Wood et al. 2016; 2020). If we find prosodic attenuation in the post-focally given parts in pre-elliptic clauses, then a WRD account can still be maintained.

The following section provides an overview of the previous literature's findings about the lack of deaccentuation in Icelandic and motivates the need for a systematic investigation of pre-elliptic clauses, which leads to the currently reported case study. In sections 3.1 and 3.2, we present the details of the study and methodology respectively. Section 3.3 reports the results of our case study.

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[7] Post-focal prosodic attenuation is linked to the prosodic head directionality which is also language specific (see Kügler & Féry 2017 for German). In English and German, nuclear accent is the rightmost prominent pitch accent in an intonational phrase. For this to be the case in utterances with narrow focus, and in which narrow focus is not the rightmost item, then reduction of accentuation in the area that follows (rather than precedes) focus-encoding item is often diminished (see Féry 2013 for a formalization of this). In languages in which the intonational phrase level prominence is not the rightmost pitch accent but the left-most one (e.g., Hungarian), then one expects that post-focal attenuation is not observed at all. In such cases, one may speak of pre-focal attenuation if there are any intonational phrase internal items that precede the narrowly focused item (this is hard to construct e.g., in Hungarian, which is a focus fronting language).

3 Intonational and acoustic properties of post-focally given material in Icelandic

Icelandic is an intonation language in which the information structurally focused item in a narrow focus context receives a high tone (H* or H) often as part of a bitonal pitch accent (i.e., H*+L or L*+H) (Dehé 2006; 2009; 2010; Árnason 2009; 2011; Dehé & Rommel 2024).[8] Similar to German, Dutch, and English, Icelandic exhibits a downstep of pitch accents across the intonational phrases and utterances (Dehé 2006; 2009; Árnason 1998; 2011) in broad focus contexts and in narrow focus contexts in which there are multiple pre-focal pitch accents. The rightmost pitch accent is often perceived as the nuclear accent (the accent that is perceptually the most prominent accent at the sentence level) (Dehé 2009). Since Icelandic has fixed word-initial stress (with very few exceptions) (Árnason 1985 among others), the post-lexical pitch accents occur word-initially.

Regarding the post-focal area, Icelandic has been suggested to lack deaccentuation, such that post-focally positioned lexical items (in particular lexical nouns) have been observed to exhibit accents (Nolan & Jónsdóttir 2001; and Dehé 2009). For instance, Nolan & Jónsdóttir (2001) reports the results of a production task carried out on English (4 speakers) and Icelandic (4 speakers), in which the accentuation profiles of discourse new information are compared to linguistically given (either textually given in the immediately preceding context, or contextually accessible) items in the post-focal area. They report that while English native speakers regularly deaccent arguments that bear accessible or textually given information, 3 out of 4 Icelandic speakers do not deaccent the Icelandic counterparts of these arguments. Regardless of the interspeaker variation, Nolan & Jónsdóttir experimentally show the availability of given but accented post-focal material in Icelandic. The token in (9) illustrates a case of textually given post-focal item in the second conjunct, in which the argument *epli* 'apple' is repeated in the second conjunct and it is therefore given (Nolan & Jónsdóttir 2001).

(9) Ég gaf   henni **epli**, en   hún borðar ekki **epli**.
     I   gave her   apple but she eats   not   apples
     'I gave her an apple, but she doesn't eat apples.'

The experimental findings of Nolan & Jónsdóttir's (2001) production study are restricted to the measurements of the maximum F0 points for each target word (final word and penultimate word). They do not measure the difference between the maximum F0 and minimum F0 in each word. While sole maximum F0 points may be an indication of the height a H tone reaches in each word, it cannot be informative regarding whether there are other additional intonational cues marking GIVENness, such as pitch compression (leading to high level plateaus without any

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[8] But see Dehé (2009: 18) for instances of L* marking narrow focus. Since we consistently observed a H tone on the target syllables in our data, we only focus on H* pitch accents.

pitch accent). By contrast, a difference between maximum F0 and minimum F0 within each word informs us about the F0 register of each pitch accent, and hence about whether a pitch accent is produced with compression or not. Nolan & Jónsdóttir (2001) found no significant difference between the highest pitch points on narrowly focused words and the post-focal words that follow them in most of their speakers. However, this does not cancel out the possibility that there is a post-focal flattening of intonation, in which the flat contour is not low but a high plateau. Such an F0 flattening at a high F0 level would be something similar to the pre-focal deaccentuation discussed in (7b) and also elicited by Dehé (2009) as shown in (10A) below and **Figure 2**, in which the linguistically given pre-focal Subject, *Hildur*, does not receive an accent, however, exhibits a high level F0, which is impressionistically as high as the accent of the focused *Ástu*.
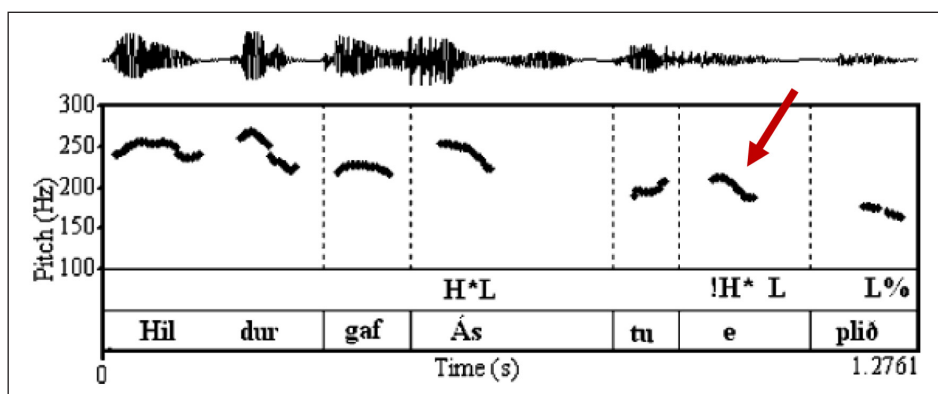
Figure 2: Accent on the textually given argument *eplið* 'the apple' in the post-focal position under narrow focus context. (Dehé 2009: 21, Fig.7).

Based on the impressionistic analysis of the speech data gathered through controlled reading tasks from 18 native speakers of Icelandic, Dehé (2009: 20) finds evidence both supporting and contradicting the claim that Icelandic post-focal content words are systematically accented. Consider the example in (10), in which the narrowly focused argument *Ástu* is followed by a textually given NP, i.e., *eplið* 'the apple'. The intonational contour of the post-focal *eplið* in **Figure 2** (from Dehé 2009: 21, Figure 7), shows that there is a downstepped high pitch accent (!H*L) aligned with the initial syllable of the textually given *eplið*.

(10) Q: Hverjum gaf Hildur eplið?   (Dehé 2009: 20–21)
          'To whom did Hildur give the apple?'

      A: Hildur gaf   [Ástu]$_{Foc}$ eplið.
          Hildur gave   Ásta   apple.DEF
          'Hildur gave the apple to Astá.'   [2 out of 5 speakers did not deaccent]

The particular realisation in **Figure 2** confirms Nolan & Jónsdóttir's (2001) claims regarding the lack of post-focal deaccentuation in Icelandic. However, Dehé (2009) also reports that for the token given in (10), only 2 out of 5 speakers accented the post-focally given argument. The other 3 speakers deaccented the given *eplið*. A similar inter-speaker variation has also been observed for the other lexicalisations of the experiment that represent the same condition. Another finding of Dehé (2009) that differs from Nolan & Jónsdóttir's (2001) observations is that the high pitch accent on the post-focal item in Dehé's data exhibits an overall lower F0 than the focused word that precedes it. While Dehé (2009) observed a downstepped accent on the post-focal item, Nolan & Jónsdóttir (2001) find that the post-focal accents are as high as the preceding focused material. From the data reported in Dehé (2009) one cannot conclude whether this downstepped accent in the post-focal area is also meaningfully compressed or whether it follows the regular downstep observed within the intonational phrase in Icelandic.

To summarize this subsection, based on the two empirical studies discussed in this section, one may conclude that Icelandic does not systematically deaccent linguistically given items. However, since these studies are limited to the impressionistic analysis of intonational properties of the data, or the experimental analysis of restricted cues (only maximum F0 points), one cannot draw sound conclusions regarding other potential cues (such as changes in duration, or pitch compression) that could possibly play a role in systematic marking of GIVENness. Nolan & Jónsdóttir's (2001) data do not constitute pre-elliptic clauses, therefore a conclusion regarding the elidability of (non-)deaccented items is harder to draw, too. Although Dehé's (2009) data is closer to our stimuli, in the sense that they are pre-fragmentary utterances, both Nolan & Jónsdóttir's (2001) and Dehé's (2009) stimuli includes only one lexical item after the narrow focus. This lexical item is also the last item in the utterance, which makes it harder to draw conclusions regarding the durational influence of the intonational phrase level boundary phenomena (due to pre-boundary lengthening).

To be able to make a robust generalisation regarding the acoustic properties of the post-focally linguistically given items in Icelandic, and interpret these properties in relation to weak and strong RD hypotheses, a systematic comparison of given items in pre-elliptic clauses to all-new items is required. In the following, we present the details of the case study that we carried out to fulfil this requirement.

3.1 The study

We conducted a prosodic production experiment to determine whether Icelandic is indeed a 'non-deaccenting' language. We asked native speakers of Icelandic to articulate a variety of pre-elliptic utterances and we then measured the prosodic properties of three lexical items (i.e., words) in the post-focal domain of each test item (see (11) for an abstract representation of a test condition, using English). To determine whether clauses that are eligible for ellipsis in Icelandic systematically show signs of GIVENness-related prosodic attenuation, we compared the prosodic

properties of these target words when they linearly follow an information-structurally new item (*who* in (11)) and are therefore given (the *post-new* condition) to when they comprise part of the broad focus domain and are therefore not given (the *all-new* condition). Thus, *post-new* and *all-new* comprise the levels of the predictor variable INFO-STRUCTURE. The prosodic properties we measured (i.e., the outcome variables) were duration, mean fundamental frequency (F0), and the difference between the maximum and minimum F0 points on each target word (F0 register).

(11)   Someone cooked a potato for Henry before midnight, but I don't know WHO cooked a **potato** for **Henry** before **midnight**.   (where the target words are boldfaced)[9]

Adopting the default assumption that, like other intonation languages, Icelandic displays GIVENness-related prosodic attenuation, we expected to obtain the following results:

[P1]   *Duration*:
       A main effect of INFO-STRUCTURE on duration, i.e. shorter post-new words
[P2]   *Mean F0*:
       A main effect of INFO-STRUCTURE on mean F0, i.e. lower F0 mean on post-new words
[P3]   *F0 register (F0max – F0min) (to assess the presence of pitch compression)*:
       A main effect of INFO-STRUCTURE on F0 register, i.e. smaller F0 register on post-new words

In addition to INFO-STRUCTURE, our experiment contained the factor ELLIPSIS-TYPE. This factor has two levels, *pre-fragment* and *pre-sluice*.[10] Test items in the *pre-fragment* condition would produce a fragment response if clausal ellipsis is semantically licensed and applies (see (12)), whereas test items in the pre-sluice condition would produce a sluice if clausal ellipsis is semantically licensed and applies (see (11)).[11]

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[9] We henceforth refer to target words as *T-Words*. T-Word1 is always a common noun direct object, T-Word2 is always a proper noun complement of the first P, and T-Word3 is always the common noun complement of the final P.

[10] As an anonymous reviewer points out, ellipsis in the nominal domain (i.e., noun-phrase ellipsis) is also a possible testing ground to assess the validity of the predictions of WRD. We purposefully chose to restrict our experiment to pre-clausal ellipsis cases simply because in those cases we will have a longer phonological string (i.e., an entire clause) to acoustically analyze, as opposed to NP ellipsis, in which only a single noun is predicted to have deaccentuation.

[11] The main text assumes that Icelandic permits both sluicing and fragmentary responses. This is correct (Wood et al. 2016; 2020); see (i) and (iiB).

(i)   Jón   sá   einhvern,   en ég   veit ekki hvern.
       John.NOM saw someone.ACC but I.NOM not   know who.ACC
       'John saw someone, but I don't know who.'   (Wood et al. 2016: 55, ex.7)

(ii)   A: Jón   sá   bílinn.   B: Rútuna   líka.
          John.NOM saw car.the.ACC   coach.the.ACC too
          'John saw the car.'   'The coach, too.'   (Wood et al. 2016: 55,56, ex.8)

(12) A: Who cooked a potato for Henry before midnight?
      B: HAROLD cooked a **potato** for **Henry** before **midnight**.

We included ELLIPSIS-TYPE as a factor because Güneş & Lipták (2021) suggest that, in English, Hungarian and Dutch, the *wh*-remnant in sluicing (i.e., *who* in …*but I don't know who*) exhibits a default nuclear accent, as opposed to a focus-related pitch accent. If this is also true for Icelandic, then the post-*wh*-area in our pre-sluice test items in the *post-new* condition might not exhibit complete deaccentuation, as the syntactically-defined nuclear accent position may shift when other items follow the *wh*-word. In contrast to sluicing remnants, the remnants of fragmentary responses are known to be focused, and therefore bear a focus-related pitch accent (see Weir 2014 and the references therein). Thus, we expect to observe:

[P4] *Influence of ELLIPSIS-TYPE*
      An interaction effect between INFO-STRUCTURE and ELLIPSIS-TYPE for all three outcome variables, i.e. a difference in the prosodic profiles of the pre-sluice and pre-fragment test items, but only in the *post-new* condition.

The experiment had a 2×2 within-item, within-subject design. Sample items for each condition are presented in (13):

(13) a. [*all-new, pre-sluice*]
          Ég velti   því   fyrir mér hver eldaði **kartöflu** fyrir **Sigríði** fyrir Midnight.
          I   wonder about.it for   me who cooked a.potato for   Sigríður before **miðnætti**.
          'I wonder who cooked a potato for Sigríður before midnight.'

      b. [*post-new, pre-sluice*]
          Einhver eldaði kartöflu fyrir Sigríði fyrir   miðnætti, en ég veit ekki hver
          someone cooked a.potato for Sigríður before midnight But I   don't know who
          eldaði **kartöflu** fyrir **Sigríði** fyrir **miðnætti**.
          cooked a.potato   for   Sigríður before midnight

      c. [*all-new, pre-fragment*]
          A: Hvað gerðist?
             What happened?

          B: Þorvaldur eldaði **kartöflu** fyrir **Sigríði** fyrir **miðnætti**.
             Þorvaldur cooked a.potato   for   Sigríður before midnight.

      d. [*post-new, pre-fragment*]
          A: Hver eldaði kartöflu fyrir Sigríði fyrir   miðnætti?
             Who cooked a potato for Sigríður before midnight?

B: Þorvaldur eldaði **kartöflu** fyrir **Sigríði** fyrir **miðnætti**.
　 Þorvaldur cooked a potato for Sigríður before midnight.

The experiment employed 4 lexical sets. Almost all target words (i.e., the boldfaced words in (13)) were minimally trisyllabic and all exhibited initial stress with no lexically-specified long vowels. Lexical words, as opposed to function words were chosen to ensure the prosodic freedom and lack of potential prosodic effects of subcategorization frames that function words may possibly have. Function words are also often prosodically weak (unless information structurally contrasted) and mostly do not inherently exhibit lexical stress which is essentially required in prosodic word formation (Selkirk 1996).

We restricted the number of target words to three in each token. This is because in the post-new case if there were to exist accentuation, and resulting downstep, three steps is ideal to observe the transitions in the downstep. In two-word condition or one-word condition, one cannot reliably attribute the observed prosodic properties to downstep, hence to accentuation. For instance, in the single post-new word scenario (which is similar to Dehé's (2009) data) the prosodic properties (e.g., longer duration on the stressed vowel) on the single post-focal item may be attributed to the utterance final intonational phrase boundary which is known to have a lengthening effect on the final word. All in all, a longer linguistic string after the narrowly focused item is ideal to assess the presence of any prosodic event, or the lack thereof in the post-focal area – also see Kügler & Féry (2017) for similar motivations for including multiple post-focal phrases when investigating deaccentuation in German. We avoided including more than three lexical items in the post-focal area simply because longer sentences would run the risk of leading to production errors or exhibiting uncontrolled prosodic behaviour due to production planning of elongated utterances (see e.g., Krivokapić (2012) for the role of utterance length in prosodic production planning).

The syntax remained constant across lexical sets. The items in (13) present the first lexical set—the remaining three sets are exemplified below:

(14)　LS2: Hrafnhildur/hver pantaði **eftirrétt** fyrir **Kormák** í **háskólanum**.
　　　　　Hrafnhildur/who ordered a.dessert for Kormákur at the.university

　　　LS3: Bergmundur/hver keypti **samloku** fyrir **Gíslínu** eftir **ráðstefnuna**.
　　　　　Bergmundur/who bought a.sandwich for Gíslína after the.conference

　　　LS4: Hansína/hver fékk **myndavél** frá **Ragnheiði** á **tónleikunum**.
　　　　　Hansína/who got a.camera from Ragnheiður at the.concert

The experiment included 3 repetitions of each test item, meaning 48 test items in total. The test items were accompanied by 150 fillers (50 unique filler items, 3 repetitions of each), yielding a 1:3 ratio of test to filler items.

The speech production experiment included the recordings of 10 native Icelandic speakers (6 females), ranging in age from 20 to 56 at the time of the experiment (October 2018). Participation was voluntary and unpaid. Recording occurred in a quiet studio at the Reykjavik University in Iceland, using a professional table-top microphone and Audacity 2.2.2. The average total duration of each recording session was 25 minutes. All participants were uninformed about the study's aim. The first author was present at each recording session. Stimuli were presented to participants as slides in a presentation software (one item per slide) on a laptop screen. Participants were permitted to repeat items and controlled the transition between slides. The participants were instructed to read the content of each slide content silently and to familiarise themselves with the utterance before producing that slide's target item. Furthermore, they were instructed to speak as naturally as possible, with a normal speech rate. Before the experiment round, the participants completed a practice round (2 practice tokens). Stimuli were presented to each participant in a different pseudo-randomized order, with no consecutive test items.

Audacity 2.2.2 was used to extract each target utterance as a .wav file. Each sound file was parsed into syllables, words, and sentences using PRAAT (Boersma 2001) by a trained native speaker of Icelandic. 30% of all parsed tokens were second checked by the first author for the accuracy of the interval boundary placement for words and syllables, with no inaccuracies found during this check. Data extraction was performed using ProsodyPro (Xu 2013). 480 observations (each of three T-Words) entered the statistical analysis. For impressionistic analysis, time-normalized mean F0 line plots of test utterances were generated for each lexicalization. Hypothesis testing statistical analysis was carried out by fitting linear mixed-effect regression models (LMEMs) to the data, using the *lmertest* package in R (Kuznetsova et al. 2017). All LMEMs display a maximal fixed effect structure and the best fitting random effect structure, as determined manually through maximum likelihood testing (lmerTest's *anova* function). All LMEMs have anova-coded predictor variables. The model estimates, t values (generated by Satterthwaite's method), and p values reported below were generated using lmerTest's *summary* function.

3.2 Results

3.2.1 Duration

Figure 3 presents the mean durations of each T-word in all conditions and lexicalizations.

A summary of the best fitting LMEM for the duration data is presented in **Table 1**. In this model, the mean durations of each individual T-Word are averaged over, as we are not interested here in variation between the T-Words themselves. The model summary shows that there was a main effect of INFO-STRUCTURE, but no main effect of ELLIPSIS-TYPE and no interaction effect. This confirms our prediction that our target words in pre-elliptic utterances exhibit a shorter

duration when given as opposed to broad focused (recall [P1]) and strongly suggests that, more generally, Icelandic employs shortened duration to prosodically mark GIVENness.[12]
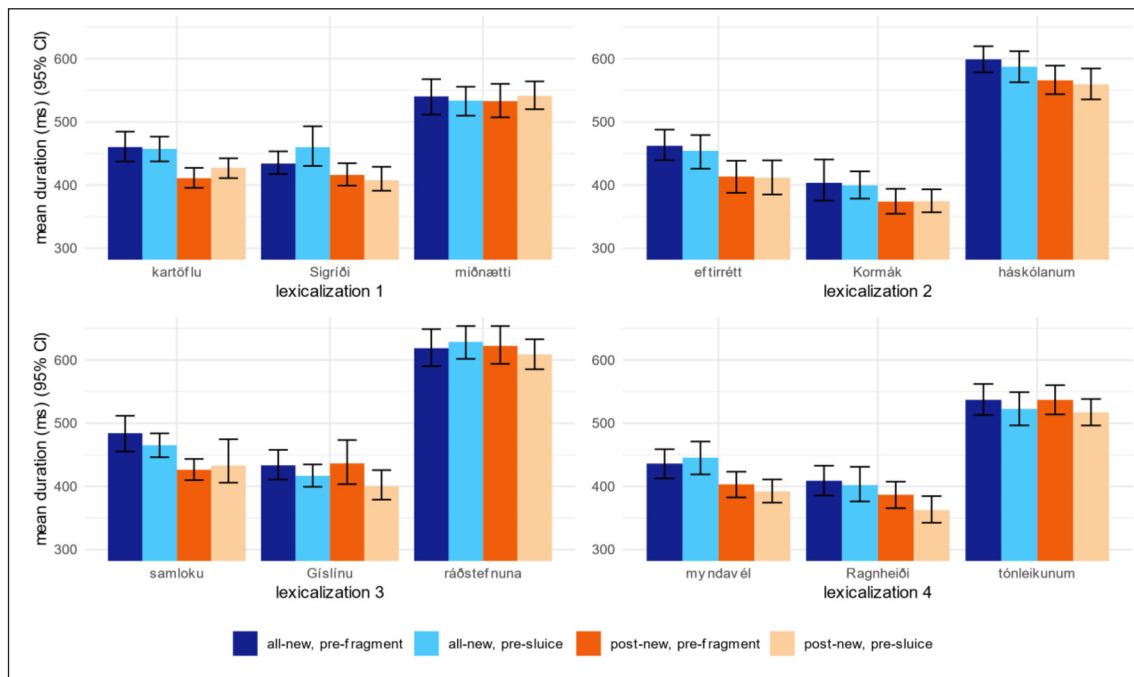
Figure 3: Mean duration (in milliseconds) for each target word in each lexicalization.

Formula = duration ~ ellipsis-type * info-structure + (1 | speaker)				
Contrasts	**Estimate (β)**	**SE**	**t**	**p**
all-new – post-new	25.01	5.48	4.59	< 0.01
prefrag – presluice	–6.70	5.48	–1.28	0.22
(all-new_prefrag – post-new_prefrag) – (all-new_presluice – post-new_presluice)	5.80	10.91	0.53	0.60

Table 1: Summary of interaction model (duration).

[12] Dehé (2010) also investigates the role of duration in distinguishing focused and non-focused (pre-focal) items, and compares the prominent syllable duration in each target word. The results show that there is a positional effect on syllable duration, such that duration gets longer on the prominent syllables of earlier words than later words. No interaction with focus is reported. This is not compatible with our results. The difference in duration we report in the current paper is not earlier words vs. later words (e.g., Word1 vs. Word3). We find a difference of all words in the same position but with different information structural statuses (e.g., in a comparison of W1-ALL-NEW and W1-Post-NEW, the latter is found to be shorted). We note that a one-to-one comparison between our duration-related findings and Dehé's (2010) findings may lead to inaccurate conclusions simply because syllable behaviour and word-level durational behaviour may possibly not be directly correlated.

The absence of a main effect for ELLIPSIS-TYPE or an interaction effect shows that the duration of our T-Words is the same regardless of whether they follow a prominent *wh*-word or a prominent non-*wh* DP. Therefore, [P4] is not borne out for duration.

3.2.2 Mean F0

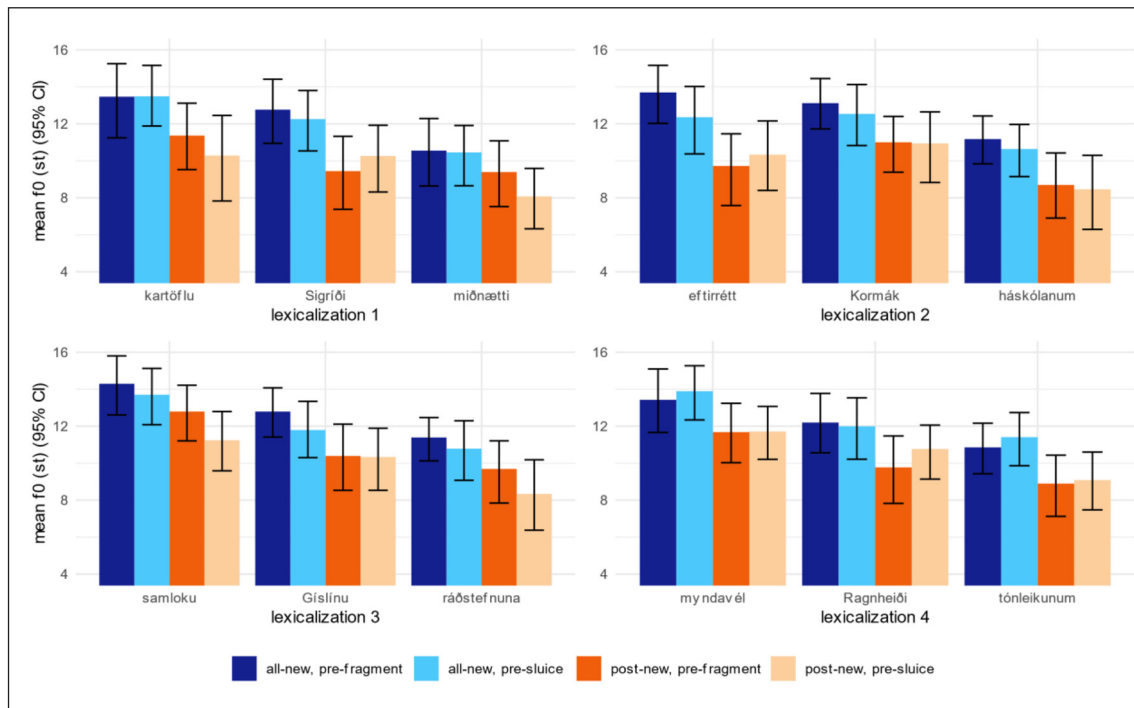**Figure 4** presents the mean F0 for each target word in all conditions across four lexicalizations.

Figure 4: F0 mean (in semitones) for each target word in each lexicalization.

A summary of the best fitting LMEM for the mean F0 data is presented in **Table 2**. In this model, the mean F0 of each individual T-Word is again averaged over. The model summary shows that there was a main effect of INFO-STRUCTURE, but no main effect of ELLIPSIS-TYPE and no interaction effect. This confirms our prediction that our target words in pre-elliptic utterances exhibit a lower overall F0 when given as opposed to broad focused (recall [P2]) and strongly suggests that, more generally, Icelandic employs lower overall F0 level to mark GIVENness.

The absence of a main effect for ELLIPSIS-TYPE or an interaction effect shows that the mean F0 of our T-Words is the same regardless of whether they follow a prominent *wh*-word or a prominent non-*wh* DP. Therefore, [P4] is not borne out for mean F0.

Formula = duration ~ ellipsis-type * info-structure + (1 | speaker)				
Contrasts	Estimate (β)	SE	t	p
all-new – post-new	–2.24	0.21	–10.49	< 0.01
prefrag – presluice	–0.37	0.21	–1.72	0.09
(all-new_prefrag – post-new_prefrag) – (all-new_presluice – post-new_presluice)	0.17	0.30	0.39	0.70

Table 2: Summary of interaction model (meanF0).[13]

3.2.3 F0 register

Figure 5 presents the mean F0 register for each target word in all conditions and lexicalizations.
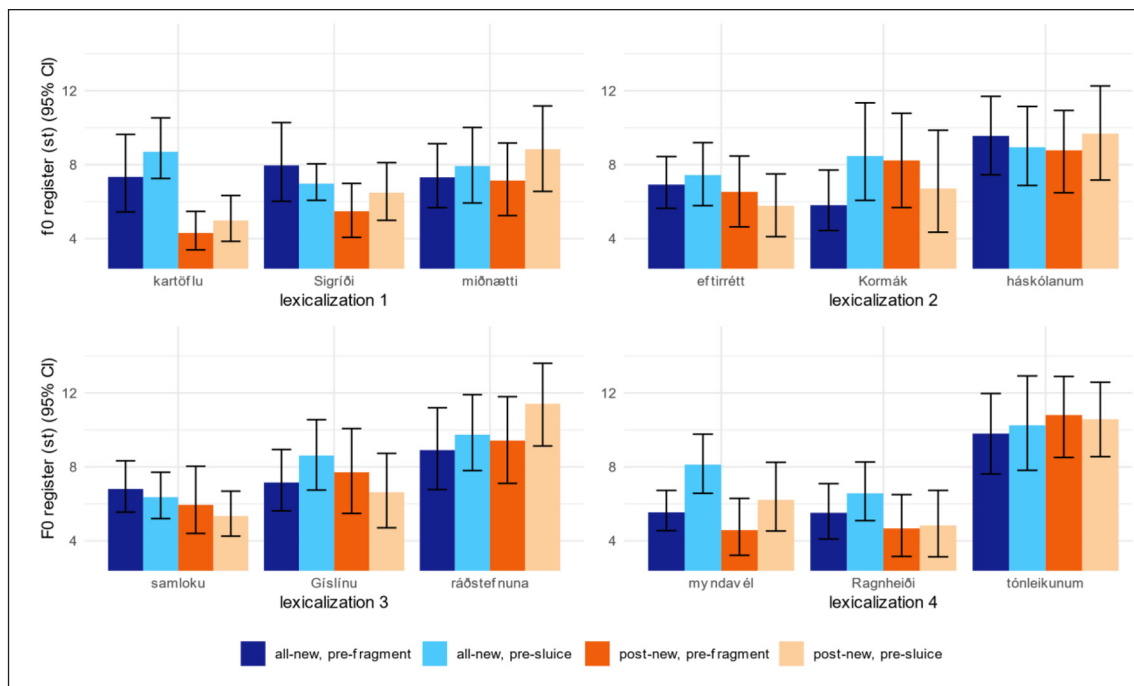
Figure 5: mean F0 register (in semitones) for each target word in each lexicalization.

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[13] We omitted the data from Speaker9 when modelling mean F0, as he had an exceptionally high mean F0 (in semitones) for the all-new pre-fragment test items (mean: 3.78, SD: 3.01) and an exceptionally low mean F0 for the all-new pre-sluice (mean: 1.88, SD:3.10), post-new pre-fragment (mean: 2.08, SD: 3.29) and post-new pre-sluice (mean: 1.42, SD:3.07) test items. Put differently, this male speaker produced pre-fragments and pre-sluices at a similarly low level F0 in the post-new condition, and he produced all-new words and post-new words at a similar F0 level for each of the test items in the pre-sluice condition.

A summary of the best fitting LMEM for the F0 register data is presented in **Table 3**. In this model, the F0 register of each individual T-Word is again averaged over. The model summary shows that there was no main effect of INFO-STRUCTURE and of ELLIPSIS-TYPE and no interaction effect. This does not confirm our prediction that our target words in pre-elliptic utterances exhibit a smaller F0 register when given as opposed to broad focused (recall [P3]) and suggests that, more generally, Icelandic does not employ smaller register as means to prosodically mark GIVENness. The absence of an effect between all-new and post-new condition indicates that the post-new condition exhibited an accent on each target word.

The absence of a main effect for ELLIPSIS-TYPE or an interaction effect shows that the register of our T-Words is the same regardless of whether they follow a prominent *wh*-word or a prominent non-*wh* DP. Therefore, [P4] is not borne out for register, we observed no pitch compression.

Formula = F0register ~ ellipsis-type * info-structure + (1 | speaker)				
Contrasts	**Estimate (β)**	**SE**	**t**	**p**
all-new – post-new	0.41	0.30	1.35	0.18
pre-sluice – pre-frag	0.51	0.30	1.72	0.09
(all-new_pre-sluice – all-new_pre-frag) – (post-new_pre-sluice – post-new_pre-frag)	0.44	0.60	0.74	0.45

Table 3: Summary of interaction model (F0register).

One gets the impression from **Figure 5** is that the difference in F0 register between the *all-new* and *post-new* conditions is greater for T-Word1 than for T-Word2 and 3. Consequently, it might be the case that a significant difference obtains between the levels of INFOSTR for F0 register in T-Word1. To determine this, we conducted post-hoc pairwise comparisons of LMEM's estimated marginal means (grouped by T-Word). This indeed revealed a significant effect of modulating INFOSTR on F0 register for T-Word1 but not T-Word2 and 3; see **Table 4**.

Word position	contrast	t	p
T-Word1	all-new – post-new	1.35	0.04
T-Word2	all-new – post-new	0.79	0.10
T-Word3	all-new – post-new	–0.53	0.28

Table 4: Pairwise comparisons of the estimated marginal means for F0 register.

We offer an explanation for this disparity in mean F0 register differences between T-Word1 and T-Word2 and 3 in the discussion section below.

3.2.4 Time-normalized average F0-line charts

The **Figures 6** and **7** below present time-normalized mean F0 line-plots for each lexicalization. Each plot averages over speakers and test item repetitions. From these plots one obtains an impression of the contour properties—e.g. possible downstep, flattening, prosodic chunking, or upstep behaviour—for our test items in the *all-new* and *post-new* conditions.
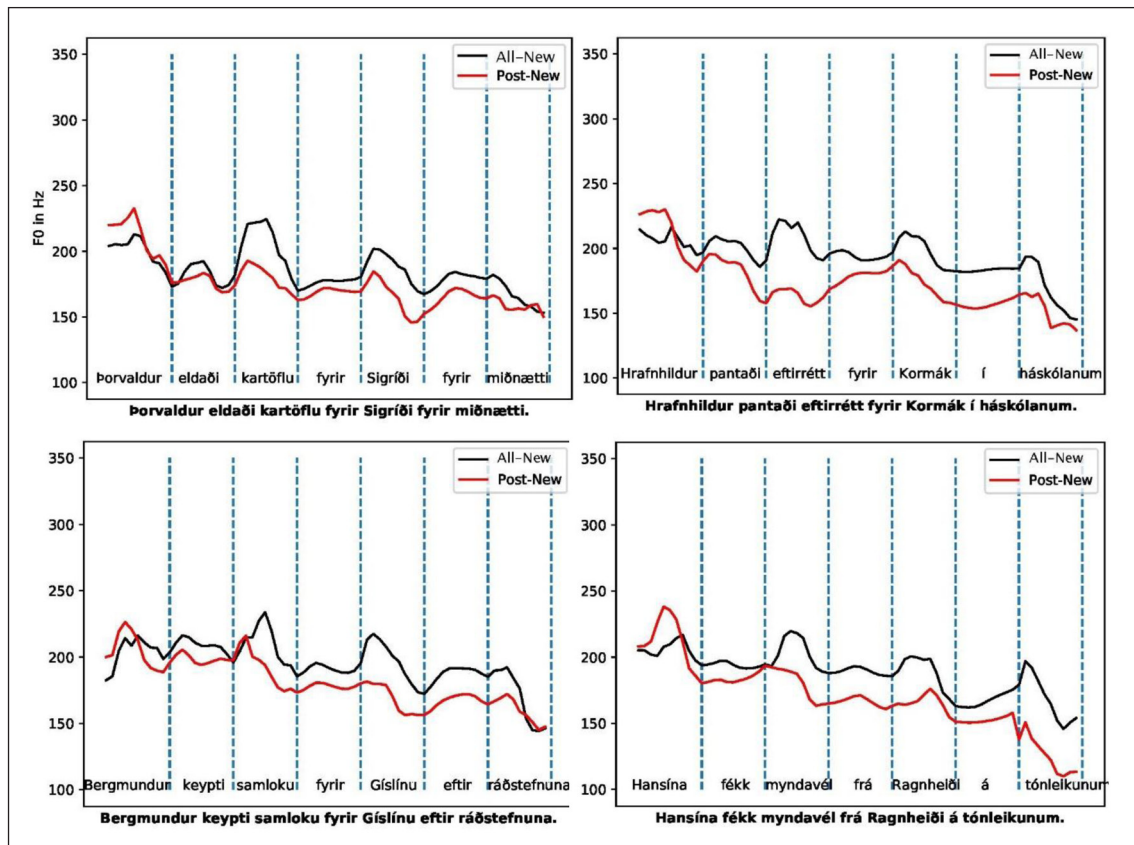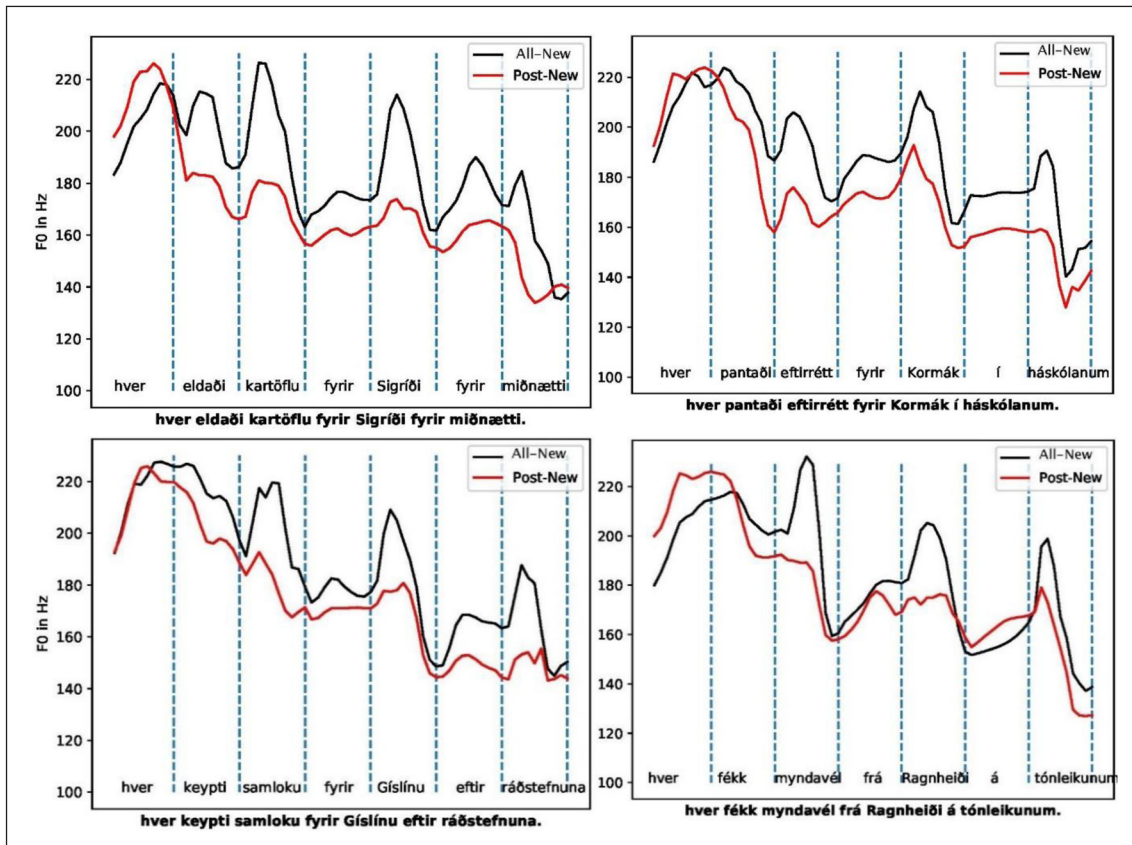

Figure 6: Time-normalized F0-line charts for the entire tokens [Focused Subject (the left-most word)+pre-elliptic domain] in pre-fragment condition, in neutral/ all new (black line) and post-focal/post-new (red line) context.

The impressionistic observations that we gather from the inspections of the F0-line charts are in line with the hypothesis testing results we obtained for F0. In particular, when we compare the contour trends in all-new condition (in black) to post-focal condition (in red), we see that both conditions exhibit a downstep of pitch accents, and that the high points of each step of downstep is a bit lower in the post-focal condition. Similarly, the lowest point of each step in the downstep is also lower. This explains why we found no significant difference in the F0 register. As such, in the post-focal condition, pitch accents are fully realized but on a lower level overall, when

compared to the all-new condition. We observe no pitch compression, but an overall low-level pitch in post-focal area.

To summarize the results, pitch accents on the lexical item in the given area are realized, yet they are also diminished, exhibiting lower mean overall F0, and shorter duration, when compared to their non-given counterparts.


Figure 7: Time-normalized F0-line charts for the entire tokens [*Wh*-word *hver* + pre-elliptic domain] in pre-sluice condition, in neutral/ all new (black line) and post-focal/post-new (red line) context.

3.2.5 Focused item: mean F0 and Max F0 comparisons

Inspection of time-normalized F0 line charts show us that focused item in pre-ellipsis clauses, and their all-new context counterpart also show a visually inspectable difference, such that the potential remnants (i.e., narrowly focused items) in the pre-ellipsis condition seem to be produced with an overall higher F0. Although our hypothesis does not make any predictions about the focus-prosodic properties in pre-elliptic clauses, to report an additional observation about the acoustic properties of narrow focus in Icelandic, we ran post-hoc statistical analyses, in which we aimed to inspect the prosodic properties of only the focused word in pre-elliptic clauses and its counterparts in all-new context.

In the pre-fragment condition the potentially focused items are the sentence initial subjects (i.e., *Þorvaldur, Hrafnhildur, Bergmundur,* and *Hansína)*, which are all tri-syllabic (in which the initially accented syllables are closed syllables). In the pre-sluice condition, the potential target of narrow focus is always the mono-syllabic wh-word, *hver*. Since the pitch accent is realized initially on the leftmost stressed syllable in our data, then in the pre-sluice condition the only existing syllable (i.e., that of the wh-word *hver*) carries the pitch accent on this word. However, in the pre-fragment case after the initially realized pitch accent, there are two more syllables within the word that leaves room for a post-accentual fall, which we expect to be steeper in post-new condition. Independent of the ellipsis properties, the two ellipsis-related conditions then are also distinct in terms of the number of syllables in their remnants. We envisage that the syllable number has an effect on mean F0 calculations, such that the post-accent area in the tri-syllabic words will involve a stretch of unaccented syllables exhibiting post-accent fall. We do not expect to see this fall in mono-syllabic words. Therefore, in our analysis we kept the ellipsis condition as a variable, however keeping in mind that it is not the ellipsis but the syllable number that is the relevant type of property that distinguishes pre-fragment and pre-sluice conditions for our post-hoc analysis. In the following we report our findings.

Figure 8 presents the mean F0 and Maximum F0 for only the focused word in all conditions averaged over all lexicalizations.
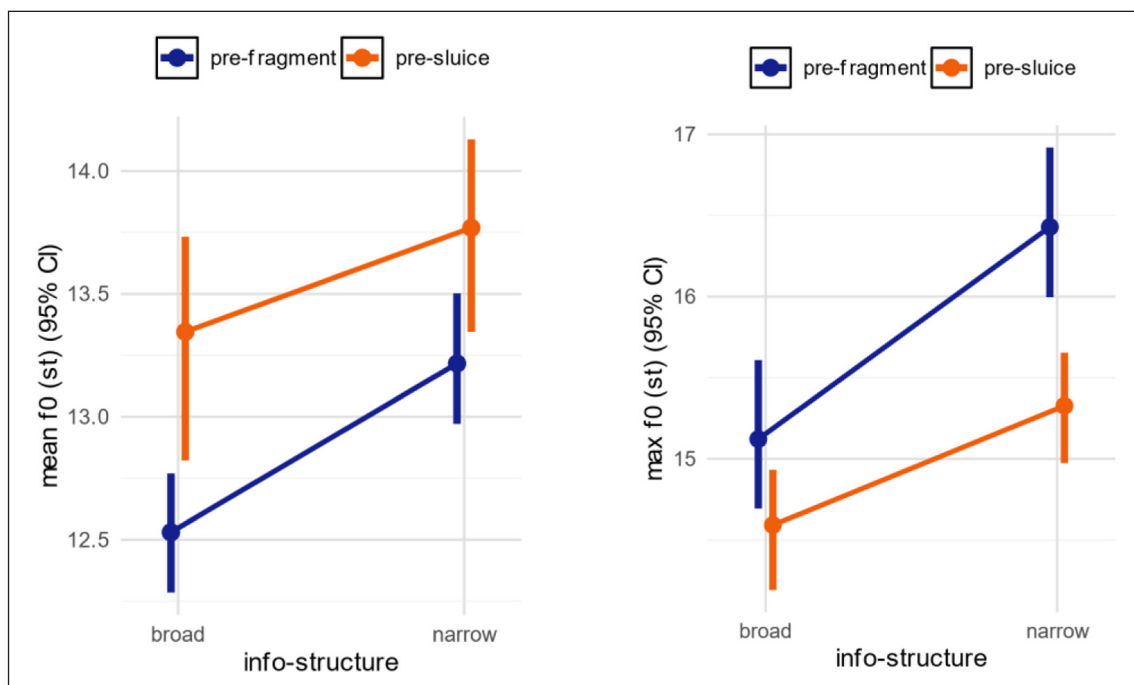
Figure 8: mean F0 (left) and maximum F0 (right) for only the (potentially) focused word in each lexicalization.

A summary of the best fitting LMEM for the mean F0 data is presented in **Table 5** below. The model summary shows that there was a main effect of INFO-STRUCTURE and ELLIPSIS-TYPE, but no interaction effect between the two factors. This shows that the focused item in pre-elliptic utterances exhibits a significantly different mean F0 than their counterparts in all-new condition. The plot on the left panel in **Figure 8** shows that narrowly focused words are produced with higher F0 than their counterparts in broad focus condition. The plot on the left panel in **Figure 8** also shows that the monosyllabic wh-item is produced with a higher overall F0 (both in broad focus and in narrow focus condition) than the multi-syllabic words. Absence of the interaction effect between information structure and ellipsis type shows that these are two completely independent variables.

Formula = F0mean ~ ellipsis-type * info-structure + (1 | lex)				
Contrasts	Estimate (β)	SE	t	p
all-new – post-new	0.55	0.17	3.17	<0.01
pre-sluice – pre-frag	0.68	0.17	3.91	<0.01
(broad focus_pre-sluice – broad focus_pre-frag) – (narrow foc_pre-sluice – narrow foc_pre-frag)	0.26	0.34	0.75	0.45

Table 5: Summary of interaction model for only the focused word (F0mean).

A summary of the best fitting LMEM for the maximum F0 data is presented in **Table 6** below. The model summary (similar to the mean F0 results for the focused item) shows that there was a main effect of INFO-STRUCTURE and ELLIPSIS-TYPE, but no interaction effect between the two factors. This shows similar results to mean F0 findings.

Formula = F0max ~ ellipsis-type * info-structure + (1 | lex)				
Contrasts	Estimate (β)	SE	t	p
all-new – post-new	1.02	0.20	4.88	<0.01
pre-sluice – pre-frag	0.81	0.20	3.90	<0.01
(broad focus_pre-sluice – broad focus_pre-frag) – (narrow foc_pre-sluice – narrow foc_pre-frag)	0.57	0.41	1.36	0.17

Table 6: Summary of interaction model for only the focused word (F0max).

The plot on the right panel in **Figure 8** shows that narrowly focused words are produced with higher F0 than their counterparts in broad focus condition. The maximum F0 plot **Figure 8** also shows that the monosyllabic wh-item is produced with a lower maximum F0 (both in broad

focus and in narrow focus condition) than the multi-syllabic words in pre-fragment condition. We link this to the syllable number of the items in pre-sluice vs. pre-fragment condition. That is, the overall high levelled mean F0 in pre-sluice condition is linked to the fact the inspected wh-item (*hver*) is monosyllabic carrying the high accent, H*, (focal or not) on this word therefore exhibits no stretches F0 fall that one usually observed in post-H* area. On the other hand, since in pre-fragment condition the inspected words all involved three syllables the first one of which is accented, the fall that is observed after the initial H* caused the observed difference in the means in both elliptic conditions, such that pre-sluice data ends up having a higher F0 mean. This contrast clearly changes its direction when we compare maximum F0 values. Here we see that the maximum F0 of the H* in pre-fragment condition is much higher than the maximum F0 on *hver* of the pre-sluice condition. However, in both ellipsis conditions, there is a significant F0 boosting effect (both in terms of maximum F0 and in terms of mean F0) of narrow focus.

The significantly higher mean and maximum F0 values in narrow focus condition (when compared to broad focus condition) may be an additional prosodic cue that the speakers employ to distinguish non-all-new context from all-new context.

4 Discussion

### 4.1 Prosodic properties of post-focal GIVENness in Icelandic

Results show that, although Icelandic does not exhibit canonical deaccentuation (partially confirming previous literature), it exhibits GIVENness-related prosodic attenuation (with shorter duration and lower overall F0 level) on post-focally GIVEN items both in post-sluice condition and in post-fragment condition, when they are compared to their counterparts in broad focus contexts. In the *post-new* condition (in the area that we predict properties related to deaccentuation), we found no significant difference between pre-sluice condition and pre-fragment condition. Therefore, our prediction 4 is not confirmed, such that the prosodic profile of the areas that follow the *wh*-item in the pre-sluice condition and the focused word in the pre-fragment condition did not differ. The F0 register measurements showed that pitch accents are realized. Therefore, our Prediction 3 is <u>not</u> confirmed, supporting the previous observations about the lack of deaccentuation of linguistically given items in Icelandic. Although, GIVENness does not seem to be linked to the lack of accents in Icelandic, we found that the target words exhibited diminished acoustic values when they are linguistically given. As such, when compared to their broad-focus counterparts, linguistically given target words in the post-focal position exhibited shorter duration and lower overall F0. Therefore, our Prediction 1 and Prediction 2 are confirmed. The inspection of the time-normalized F0 line charts clearly shows the presence of post-focal pitch-accents, which are produced with a lower level F0 than the pitch accents in the all-new condition.

In most cases in **Figures 6** and **7**, for the all-new context, we observe that the downstep seems to start with T-Word1 (i.e. the post-verbal Object in the SVO order). Compared to the Subject's F0 properties for this context, we also observe that there is a slight upstep after the Subject's peak, and on the Object's peak (in which either the Object's peak is as high as the Subject's peak, or they have equal height) (see **Figure 9** below for the schematized representation of the all-new contour). In the pre-elliptic context, intonational peak on the Subject is followed by a downstepped peak on the Object, which then progresses into the following two lexical items that follow the Object creating a continual downstep pattern throughout the entire intonational phrase. Given that an upstep on the Object is only observed in all-new context (on the black lined contours in **Figures 6** and **7**) we relate this to the default prosodic phrasing in which the Subject is prosodically parsed as an independent prosodic domain and the Verb and the items that follow it are parsed as another prosodic domain as in: (S)(VO X X) (see **Figure 9** below). Given that verbs do not receive a pitch accent in all-new contexts (c.f., Gussenhoven 1992 among many others) in Germanic, the higher pitch peak on the Object can be explained in terms of the start of a new prosodic domain. This bi-phrased prosodic structure, and the intonational contour of the all-new condition is schematized in **Figure 9** below, in which the two large dots represent the first pitch accents of each phonological phrase. Small dots represent the downstepped pitch accents and valleys in between H tones.

$[(SUBJECT)\text{-}_\varphi ((V\text{-}OBJECT)_\varphi (T\text{-}WORD\ 2)_\varphi (T\text{-}WORD\ 3)_\varphi)_\varphi]_{All\text{-}New\text{-}\iota}$
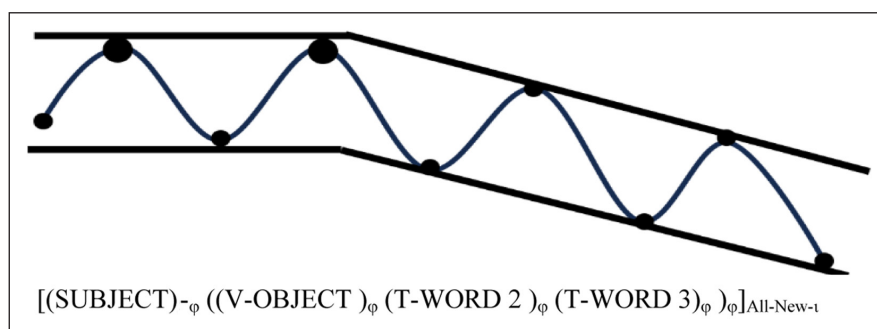
Figure 9: Observed intonational contour and prosodic phrasing of all-new condition. High pitch accent on the Subject and Object.

When we compare our findings to Kügler & Féry's (2017) observations on post-focal accents in German, we see a difference in intonation between German and Icelandic. While the German post-focal accents are produced with a compressed pitch register, we found no such compression in Icelandic, but an overall lowering in the F0 level. Compare the schematic representations of German post-focal accents (in **Figure 1**) and Icelandic (based on the findings of our current study) in **Figure 10** below:
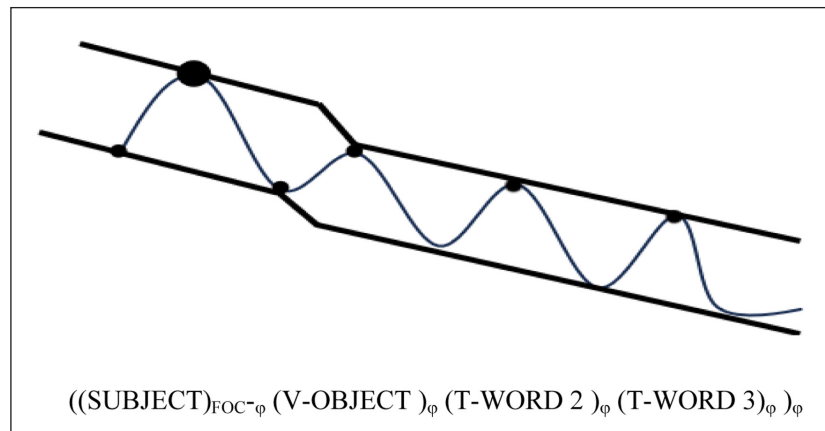
Figure 10: Low-level pitch accents in the post-focal / post-nuclear region in Icelandic and single phonological phrase formation. Small dots represent post-focal accents on the given area, the large dot represents the nuclear/focal pitch accent.

Due to the presence of pitch accents on the linguistically given post-focal items, our results confirm the findings of Nolan & Jónsdóttir (2001) and Dehé (2009). Our findings differ from Nolan & Jónsdóttir's (2001) observation, in which post-focal accent was found to be as high as the focal accent that precedes the post-focal item. Our findings, confirming Dehé's (2009) observation regarding downstep, show that accents on the words that are post-focal and linguistically given exhibit a downstep relation with the nuclear accent and other accents in the post-focal area.

Another prosodic difference between the all-new and post-new condition is prosodic constituency. We observe that in all-new condition the sentence initial Subject is separated from the rest of the utterance (see the representation in **Figure 9**), whereas, in the post-new case we observe that the linguistically given area is at some level parsed together with the sentence initially focused Subject (see **Figure 10**). In the all-new case in **Figure 8**, the Subject and Object are parsed into separate phonological phrases, and the phonological phrase that contains the Object includes recursive phonological phrases, such that each embedded phonological phrase represents a step of downstep within the second maximal phonological phrase. In the post-new case in **Figure 9**, we observe that Subject and the Object (together with all the other lexical items in the utterance) are parsed into a single maximal phonological phrase, and each embedded phonological phrase flanks a lexical item (this is the string of the verb and the Object in the case of the second embedded phonological phrase). The observed downstep observed across the entire utterance can be explained via a downstep across the embedded phonological phrases, with the Intonational Phrase as the domain of downstep, confirming earlier observations since Árnason (1998).

The prosodic grouping of the given items together with the focused item may be interpreted as a symptom of prosodically weaker and dependent nature of information structurally given constituents, which is also in line with the weakened durational and mean-F0 cues we observed.

4.2 Motivating post-focal accents in Icelandic: syntax, and phonology

It is clear in the F0 line charts that the post-focal accents in the post-new condition on T-W1, T-W2 and T-W3 (represented with red lines) are not "phrase accents" (i.e., the tonal event on the transitional area from final, nuclear pitch accent to the right edge intonational phrase boundary tone) (see a discussion on the post-focal pitch accents vs. phrase accents in Kügler & Féry 2017: 283). Given that focus related pitch accent is often identified as nuclear accent (which is often defined as the right-most pitch accent within an intonational phrase in languages with right-headed intonational phrases), the post-focal accents that we observe in Icelandic (similar German (e.g., Kügler & Féry's 2017), or Swedish (e.g., Myrberg & Riad 2015)), challenge our current understanding of "nuclear accents / intonational phrase headedness". How can one motivate the presence of post-nuclear accents in intonationally right-headed languages? In this section we will discuss two possible avenues in motivating the presence of post-nuclear/post-focal accents in Icelandic. These are (i) reminiscent accents due to prosodic phrasing linked to syntactic phrasing, and (ii) rhythmic beat-based accent insertion as a phonological requirement. We leave the discussion open however noting both hypotheses are plausible sources of keeping post-focal accents in Icelandic (and any language that has similar behaviour for that matter).

(i) ***Post-focal accents due to syntax-based prosodic constituency:*** In line with the discussions in Wagner & McAuliffee (2019), and Kügler & Féry (2017), the post-focal accentuation may be linked to the conclusion that "prosodic phrasing created by syntax is not affected by information structure" (Kügler & Féry 2017: 283). Such that, at the level of syntax-based prosodic constituency, all target words (and other weaker words e.g., the function words that surround lexical items) may be parsed into individual prosodic constituents (even in the post-focal area). It seems that information structural import of an item does not fully override its prosodic properties retained form syntax-based chunking. We may interpret the phonetic reduction of the cues (i.e., the overall F0 level and duration) on the post-focal area as the result of the non-final focus and hence nuclear accent. Therefore, a prosodic weakening in the area that follows focal/nuclear accent is still present.

(ii) ***Post-focal accents due to a rhythm-based phonological requirement:*** The possible import of eurythmic organisational factors in phonology may also be considered as an alternative, if not an additional factor to post-focal constituency idea. In particular, post-focal accentuation may be present solely as a result of a strong phonological requirement (in this case, a rhythm based accent boosting requirement) to maintain rhythmic grouping, even when the items are given, in such a way that the word-level prominence of post-focally given items is boosted to be present at the phrase level. Since the post-focal troughs are low due to the post-focal attenuation, then the pitch peaks are also relatively low. Similar rhythm-based accentuation of linguistically given material in the pre-

nuclear / focal area has been previously documented (e.g., Horne 1990). Specifically for Icelandic, previous research highlights the role of rhythmic grouping in various prosodic levels. Árnason (2011: 309) maintains that the fact that Icelandic major word classes are inherently left-strong along with other "more or less regular principles combine to define what we may call the normal scansion of a sentence".

Perhaps, in Icelandic, then, strong beats at foot structure are not *deleted* at a higher level in the prosodic hierarchy if associated with a non-focus item, but they are just weakened, preserving the lexically based "normal scansion of a sentence" (i.e. lexically determined positions of strong beats), while at the same time reflecting focus or information structure (similar to tone languages in such a way that those may be faithful to the shape of lexical tones at phrasal/sentence level, but that information status of items may still be globally marked by f0 such that the contour is flattened or realized at a lower f0 level; or expanded pitch range for focus).

4.3 RD and its place in the ellipsis literature in the light of the findings

In terms of the question whether Icelandic challenges WRD, our results indirectly favour this hypothesis. This is because, although the domain of potential clausal ellipsis in Icelandic does <u>not</u> exhibit "low-flat intonation", it exhibits prosodic attenuation (manifested with shorter duration and overall lowering of the F0 level).

The fact that deaccentuation (or attenuation) is particularly visible in the post-focal area, also known as post-focal dephrasing or deaccentuation, is naturally linked with a prominent account of the syntactic derivation of ellipsis, i.e. the *move-and-delete* theory of ellipsis (Jayaseelan 1990; Merchant 2001; 2004; Gengel 2008; Toosarvandani 2008; Boone 2014; Weir 2015; see Lipták & Güneş 2022 for an overview). According to this theory, items in an elliptic clause move higher in the hierarchical structure of their clause (often to the left periphery in the CP domain). When ellipsis applies (to VP or TP), the items (including the foci) that are outside of the domains of ellipsis are left pronounced and become the remnants of ellipsis. In such accounts, the area that is elided is always structurally lower than the focused remnant (and to the right of it after linearization), e.g., in TP ellipsis the remnant is assumed to be somewhere higher in the CP domain. Therefore, this area is the post-focal area in the pre-elliptic paraphrases, e.g., in TP ellipsis the focused item, being in CP will be linearized before the contents of the TP, which is given. Move-and-delete approaches therefore predict that the domain of ellipsis is the syntactic constituent that would be linearized in the post-focal area if pronounced. This is schematized in (15):

(15)   [REMNANT$_F$] [$_{TP/VP}$ ~~domain of ellipsis~~]

Since post-focal deaccentuation is more prominent in intonation languages, with a view restricted to this particular typological class of languages, one may conclude that both SRD and WRD can successfully predict a correspondence between the domain of ellipsis and the domain of post-focal deaccentuation.

Given the wider range of data, in which domains other than TP or VP may be subject to ellipsis (non-constituent ellipsis e.g., see Bruening 2015), and the fact that not all remnants can be moved to the left periphery in the pre-elliptic clauses (e.g., Ott & Struckmeier 2016) scholars also posited alternative ways of predicting ellipsis domains. One of the more prominent alternative approaches is the *in-situ approach to ellipsis*, i.e., *scattered deletion approaches. In-situ ellipsis* approaches pursue the idea that remnants remain in their base-position (or non-ellipsis related moved position) and do not go through any ellipsis-related movement. If focused items remain in situ, and if these items are the only remnants in the elliptic clause, then any item that would be linearized on either side of the focus marked items in the pre-elliptic clause would be deleted in its elliptic version. This type of approach makes certain predictions that conflict with the predictions of the move-and-delete approaches. Such that ellipsis does not necessarily target a single syntactic constituent and domains that are hierarchically higher than the remnant in the syntactic structure may be deleted. This is schematized in (16) in which the ellipsis domain (ellipsis dom.) is scattered around the focused remnants:

(16)   [[ellipsis dom.]…[[REMNANT_F]…[[ellipsis dom.]…[[REMNANT_F]…[ellipsis dom.]]]]]

When both stronger and weaker versions of RD are considered, WRD would be better suited even in languages such as German and English, simply because the areas that would precede the foci in pre-elliptic clauses are not necessarily deaccented in these languages. For this reason, WRD accounts would be better suited to the premises of *scattered deletion* accounts, if they opt for a phonological reduction strategy.

The literature that links deaccentuation and GIVENness is built on the speaker's behaviour. Based on production experiments, depending on whether there are prosodic properties of deaccentuation on the items that are (linguistically) given, the scholars decide whether a language systematically utilises deaccentuation to mark GIVENness. Such conclusions often disregard the availability of optionality in using deaccentuation. It may well be the case that, for instance, in Icelandic, GIVENness related deaccentuation (with low-flat intonation) is available to the speakers, yet they often produce linguistically given items with a degree of accentuation. Optional availability of post-focal (de)accentuation has been reported for a number of genetically related languages such as German (Kügler & Féry 2017) and Swedish (Myrberg & Riad 2015) The optional availability of deaccentuation effects the way we can restrict the RD hypothesis. As such, one may state that the availability of deaccentuation of a GIVEN domain is the key

condition on the prosodic licensing of ellipsis, such that if a domain is *deaccentable*, then it may be elidable. For the case of Icelandic elliptic clauses, then, one may speculate that although in the majority of the pre-elliptic clauses speakers do not deaccent GIVENness, all elliptic clauses are systematically deaccented, exhibiting low-level flat intonation at some point in derivation (simply because it is available in their grammar). This way of reformulating RD is, however, not free of issues. First of all, since one cannot measure the prosodic properties of the ellipsis domain, the argument that this area is always produced with deaccentuation (unlike their pre-elliptic counterparts) is unfalsifiable. Additionally, this idea is based on the assumption that complete deaccentuation is available in the prosodic grammar of Icelandic as a (seldomly used) marker of GIVENness, yet this has not been tested or attested before.

A perception study that compares the acceptability of low-flat intonation and lowered accentuation (as reported in this study) as markers of GIVENness is necessary as a next step. One way of carrying out such a study would involve an offline perception and decision task, in which participants are asked to decide what question (a broad focus triggering question vs. narrow focus triggering question) is suitable for the audially presented answer tokens. Stimuli would involve the recordings elicited for two conditions in the current experiment as well as recordings in which the post-new accents on the post-new condition are destroyed, and the post-new area is completely flattened (the latter can be artificially generated as a resynthesized speech stimuli or produced naturally by a trained native speaker). As a next step, participants would be asked to decide on the naturalness of those tokens for the given context which can be done via forced choice tasks (in which accented and deaccented post-new recordings may be contrasted directly) as well as Likert Scale assessment task which would also allow to observe gradience in judgments.

5 Conclusion

In this paper, we investigated the acoustic correlates of post-focal GIVENness in pre-elliptic clauses in Icelandic to confirm or disfavour the cross-linguistic validity of Radical Deaccentuation hypothesis of ellipsis. The previous literature on RD hypothesis suffered from a lack of empirical scrutiny regarding the precise nature of the prosodic aspects of pre-elliptic clauses that are suggested to directly correlate with ellipsis formation and the delimitation of the domain of ellipsis. Based on our findings on Icelandic, we conclude that the strong form of phonological reduction hypothesis cannot be maintained. We have found that Icelandic exhibits signs of GIVENness related prosodic attenuation in pre-elliptic clauses, such that pitch accents are realized, yet they are also lowered bearing lower mean F0 and shorter duration. We have also found a difference in prosodic constituency between all-new and pre-elliptic clauses, such that the given part in the pre-elliptic condition is structurally integrated to the prosodic domain of the focused item. The weak reduction hypothesis is therefore better suited to the Icelandic data. WRD hypothesis is further supported by the unavailability of pre-focal deaccentuation in other

intonation languages. Grammatical status of GIVENness related prosodic attenuation in Icelandic should be tested in perception experiments. Our results support the view that GIVENness-related deaccentuation is not a defining property of intonation languages (Kügler & Calhoun 2020). Our post-hoc analysis of the narrowly focused words in pre-elliptic clauses and their all-new counterparts revealed that there is a significant effect of information structure such that narrowly focused words exhibit significantly higher F0 mean and higher maximum F0. We interpret this as a strategy to mark the narrow focus, and indirectly to delimit the E-GIVENness domain in pre-elliptic clauses. We have suggested a perception study as the next step, to assess whether our acoustic findings of GIVENness are stored as correlates of GIVENness in the prosodic grammar of Icelandic.

Abbreviations

DEF = definite, ACC = accusative, NOM = nominative.

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Competing interests

The authors have no competing interests to declare.

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