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Givenness and Stress Rejection

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Abstract: This paper addresses the impact of givenness on phrasal stress assignment in German. It has been observed for English that nuclear stress is rejected on given elements that are part of the focused material if another focused word is available to bear nuclear stress. It is shown that the same effect applies to German. There are various proposals of constraints that militate against prosodic prominence on given elements. The present paper reviews these proposals and argues in favor of a constraint that is restricted to banning *nuclear* stress on given elements, but not phrasal stress in general. The argument is based on the observation for German that phrasal stress commonly occurs on pre-focal given constituents and may as well be present in post-focal position. The paper offers an analysis in the framework of Optimality Theory that captures the aforementioned stress rejection effect as well as the variability observed with regard to post-nuclear phrasal stress positions.

Keywords: phrasal stress; givenness; prominence; prosodic structure; syntax-phonology interface; recursion; MATCH theory; German

1. Introduction

In West Germanic languages, such as German, Dutch, and English, the assignment of phrasal stress depends on various factors, including syntactic structure, focus, and information status. This paper addresses the impact of givenness on phrasal stress assignment in German in the framework of Optimality Theory (OT; Prince and Smolensky 1993/2004). It has been observed for English that nuclear stress is rejected on given elements that are part of the focused material if another focused word is available to bear nuclear stress (e.g., Ladd 1980, 1996). For example, the answer sentence in (1), adopted from Féry and Samek-Lodovici (2006, p. 145), is assigned nuclear stress on *Rome* rather than on *John* because the latter has already been mentioned in discourse.

(1) What did John's mother do?
She went to Rome with John.

The present paper shows that the same holds for German. The stress shift can either apply leftwards or rightwards to another lexical element within the focused material. There are various proposals to account for this effect by means of a constraint that militates against prosodic prominence on given elements (Féry and Samek-Lodovici 2006; Féry 2013; Frey and Truckenbrodt 2015; Büring 2016). The present paper reviews these proposals and argues in favor of a constraint that is restricted to banning *nuclear* stress on given elements, but not phrasal stress in general, as has been proposed in Frey and Truckenbrodt (2015) and Büring (2016, ch.2). The argument is based on the observation for German that phrasal stress (realized by means of pitch accents) commonly occurs on pre-focal given constituents (e.g., Baumann et al. 2007; Féry and Kügler 2008) and has even been attested in post-focal position (Kügler and Féry 2017, see also Wagner and McAuliffe 2019 for English). The constraint militating against nuclear stress on given elements is formalized as *STRESS-GIVEN-ι.

The paper offers an analysis in the framework of OT that captures the aforementioned stress rejection effect as well as the variability observed with regard to post-nuclear phrasal stress positions. The analysis employs *STRESS-GIVEN-ι in combination with RIGHTMOST

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(which requires nuclear stress to be assigned in rightmost position) and MATCH-PHRASE (which requires that each lexical XP is reflected by a corresponding φ-phrase, which in turn must contain a beat of phrasal stress). It is proposed that RIGHTMOST and MATCH-PHRASE are organized as an ordered global tie, which renders structures that are optimal under either of the two possible constraint rankings as grammatical.

The paper is structured as follows: Section 2 introduces the theoretical framework and presents the relevant patterns of stress assignment. It also shows how they are captured by means of constraints and why the constraint militating against prosodic prominence on given elements needs to be restricted to nuclear stress. Section 3 proposes a constraint-based grammar for the assignment of phrasal and nuclear stress in German and shows how the grammar accounts for stress rejection and variability in the framework of OT. Section 4 provides a general discussion, also addressing the role of prosodic recursion in German, and offers some directions for future research in this area.

2. Constraints on Phrasal Stress Assignment

2.1. Prosodic Structure and Intonation

In the line of research adopted here, it is assumed that phrasal stress positions are represented as beats of prominence in a metrical grid (e.g., Liberman and Prince 1977; Halle and Vergnaud 1987), which are connected to specific prosodic constituents (e.g., Hayes 1995). This is illustrated in (2) with a bracketed grid representation, where the grid marks represent degrees of stress and brackets represent prosodic constituents. These constituents belong to different prosodic categories which are organized in a hierarchical structure, known as the Prosodic Hierarchy (e.g., Selkirk 1978, 1984; Nespor and Vogel 1986). Various studies suggested that constituents belonging to the higher categories of the Prosodic Hierarchy (3) are derived from morpho-syntactic structure (e.g., Selkirk 1984, 2005, 2009, 2011; Nespor and Vogel 1986). The Intonation Phrase (ι), often assumed as the highest category, is formed with reference to syntactic clauses.[1] The beat of stress related to this category constitutes the strongest prominence in the prosodic structure and is thus referred to as 'nuclear stress' or 'sentence stress'. This can be captured by the highest column of the bracketed grid representation in (2). The next lower category is the Phonological Phrase (φ), which is formed with reference to lexical maximal projections (XPs).[2] The beat of stress connected to this category is the one referred to as 'phrasal stress'. Beats of phrasal stress are instantiated as pitch accents (see below for details). The lowest of the three categories is the Phonological Word (ω), which is formed with reference to the lexical morphological word. The beat of stress related to this category represents word stress.

(2)
```
(                    *                    )
(       *       )(   *                    )
(       *       )(   *       )(      *     )
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(3) Intonation Phrase (ι)
Phonological Phrase (φ)
Phonological Word (ω)

There are various versions of the Prosodic Hierarchy in the literature differing as to number and types of the assumed categories. Some systems assume more interface categories than those included in (3); Nespor and Vogel (1986), for example, propose the 'clitic group' as a domain between ω and φ, and Selkirk (1986) and others distinguish between 'minor phrase' and 'major phrase' as categories between ω and ι. In this paper, we will adopt the version in (3), following more recent proposals (e.g., Itô and Mester 2012; Selkirk 2009, 2011; Schubö 2018, 2020).

As for the connection between syntax and phonology, the present study adopts MATCH theory (Selkirk 2009, 2011). This theory assumes a direct mapping between syntactic and prosodic constituents, enforcing that specific constituents in syntactic representation must be reflected by specific constituents in phonological representation. For example, it has been proposed that CPs are reflected by corresponding ι-phrases (e.g., Schubö 2018, 2020) and that lexical XPs are reflected by corresponding φ-phrases (e.g., Selkirk 2011). A formalization of the latter will be provided in the following sub-section. The assumption

of MATCH constraints of this sort inevitably leads to the emergence of recursive prosodic structure. This is because the recursive structure in syntactic representation is directly reflected in phonological representation.

As stated above, it is assumed here that beats of metrical stress are tied to the prosodic constituents on the respective level of the Prosodic Hierarchy, following the representation of bracketed grids (e.g., Halle and Vergnaud 1987; Hayes 1995). The abstract representation of prosodic structure serves as the basis for the distribution of tonal events, which in turn account for the global intonation contour (Pierrehumbert 1980). Tonal events are thus construed as instantiations of specific properties of the prosodic structure. Beats of phrasal stress (i.e., φ-level prominence) are instantiated as (non-nuclear) pitch accents. Beats of nuclear stress (i.e., ι-level prominence) represent stress on the highest level in the system adopted here and are thus instantiated as pitch accents with relatively stronger perceptual prominence, referred to as 'nuclear pitch accents' (see, e.g., Ladd 1996). Thus, a distinction is made between the abstract representation of stress positions and their instantiation as pitch accents (see, e.g., Gussenhoven 1991). In the following, we will employ the notions 'phrasal stress' and 'nuclear stress' as the relevant representations of prosodic prominence. We will concentrate on the abstract metrical and prosodic structure and refer to the realization of pitch accents only when discussing concrete pitch contours and when reporting on the empirical findings from prior studies that focused on pitch accent realization rather than on the prosodic structure representation. The presence of a (nuclear) pitch accent is taken as indicating the presence of a (nuclear) stress position in prosodic structure.

2.2. Stress Assignment and Syntactic Structure

Gussenhoven (1983, 1992) observed that the lexical elements in a sentence are assigned phrasal stress unless they are verbs adjacent to a stressed argument or not part of the focused constituent of the sentence (see below for examples). Truckenbrodt (1995, 1999) formalized the syntactic aspects of this generalization as the interface constraint STRESS-XP (4), which requires that lexically headed maximal projections in syntactic representation (e.g., NPs and VPs) contain a word that bears phrasal stress in phonological representation. This requirement predicts the correct distribution of phrasal stress in a large variety of structures (see, e.g., Truckenbrodt 2006, 2007 for cases from German and English).

(4) STRESS-XP
Each lexically headed XP must contain a beat of phrasal stress.

As for German, STRESS-XP correctly predicts that the lexical arguments receive phrasal stress independent of the word order of the sentence whereas the verb can remain unstressed. This is illustrated in (5) and (6), where words with phrasal stress are underlined. The clause with (canonical) SOV word order in (5) involves obligatory phrasal stress positions on the subject and the object because they are both lexically headed maximal projections. In order to satisfy STRESS-XP, the VP must also contain a phrasal stress position. This holds in the case at hand because the stressed object (*Jan*) is part of the VP. Phrasal stress on the verb instead of the NP would satisfy the requirement for the VP, but not for the object NP. Phrasal stress on both the object NP and the verb is not enforced by STRESS-XP, but would not cause a violation either. In the sentence in (6), the verb underwent movement to a position outside of the VP, yielding SVO order. Again, the subject and the object, but not the verb, receive phrasal stress, as they are contained in lexically headed phrases (but see Kratzer and Selkirk 2007 for an account of optional stress on the verb in German SVO sentences). The absence of additional stress positions on the verb in (5) and (6) can be assumed to be due to a structure-banning constraint that is ranked below STRESS-XP. In contrast, the intransitive verb in (7) needs to carry phrasal stress because it is the only element that the VP contains. Not stressing the verb in this case would violate STRESS-XP because the VP must contain a stressed element.[3]

(5) What's new?

Dass	die	[Eltern]$_{NP}$	[[Jan]$_{NP}$	loben]$_{VP}$
that	the	parents-NOM	Jan-ACC	praise-PRES

'That the parents are praising Jan.'

(6) What's happening?
Die [Eltern]$_{NP}$ loben$_i$ [[Jan]$_{NP}$ t$_i$]$_{VP}$
the parents-NOM praise-PRES Jan-ACC
'The parents are praising Jan.'

(7) What's happening?
Die [Eltern]$_{NP}$ [schlafen]$_{VP}$
the parents-NOM sleep-PRES
'The parents are sleeping.'

The requirement of STRESS-XP can straightforwardly be modelled into MATCH theory (Selkirk 2009, 2011). As outlined above, MATCH constraints require a direct mapping between specific syntactic and prosodic constituents. The φ-structure is assumed to derive from the lexical XP structure by the interface constraint MATCH-PHRASE, given in (8). MATCH-PHRASE requires that each lexical XP is matched by a corresponding φ, which yields a recursive organization of φ-structure whenever the sentence involves a recursive structure of lexical XPs. For example, the sentence in (5), repeated below as (9a), comprises a VP containing an NP. As a result, MATCH-PHRASE derives the recursive φ-structure given in (9b), where the φ comprising the material of the VP contains the φ comprising the object NP.

(8) MATCH-PHRASE[4]
The left and right edges of a lexical XP in the input syntactic representation must correspond to the left and right edges of a φ in the output phonological representation.

(9) What's new?
a. Dass die [Eltern]$_{NP}$ [[Jan]$_{NP}$ loben]$_{VP}$
b. Dass die (Eltern)$_{\varphi}$ ((Jan)$_{\varphi}$ loben)$_{\varphi}$
that the parents-NOM Jan-ACC praise-PRES
'That the parents are praising Jan.'

Assuming this mechanism of φ-structure derivation, the requirement for phrasal stress assignment captured by STRESS-XP can be modelled as a prosodic wellformedness constraint operating on the (recursive) φ-structure. This constraint is formalized in (10) as STRESS-φ, which militates against φ-phrases that do not contain a word with phrasal stress. The stress distribution indicated by underlining in (9b) satisfies STRESS-φ because each of the given φ-phrases contains a word bearing phrasal stress. The phrasal stress position on the object (*Jan*) is contained by both φ-phrases that are involved in the recursive structure.

(10) STRESS-φ
Each φ must contain a beat of phrasal stress.

As stated above, beats of phrasal stress are often assumed to be connected to φ-phrases for which they function as prosodic heads (e.g., Hayes 1995). The impact of STRESS-φ differs in some respects related to prosodic recursion from regular headedness requirements: First, STRESS-φ is satisfied if several recursively embedded φ-phrases contain a single beat of stress (and thus a single grid mark), not enforcing additional grid marks for each φ-level in a recursive structure (see also Féry 2011 for this assumption). For example. the resulting prosodic structure for a VP containing a verbal head and a lexical NP, as the one in (9a), is given in (11), including phrases and grid marks for the ω- and φ-layer.

(11) ((*)) φ-structure
(*)(*) ω-structure
[[N]$_{NP}$ V]$_{VP}$

Furthermore, STRESS-φ is satisfied if it contains several beats of stress (and thus grid marks) on the same level, not requiring exactly one beat to be contained in one φ-phrase. For example, in a complex NP such as [[*neues*]$_{AP}$ [*Auto*]$_{NP}$]$_{NP}$ ('new car'), MATCH-PHRASE derives a higher φ-phrase containing the entire complex NP and two embedded φ-phrases, one containing the AP and one containing the embedded NP. The prosodic structure representation is shown in (12). In this case, STRESS-φ is not violated because each of the lower φ-phrases contain a beat of stress and the higher φ-phrase contains these lower φ-phrases and thus also their beats of stress. STRESS-φ does not require a unique beat of stress that stronger than the other beats contained in the φ-phrase, but is satisfied

as long as it contains one or more beats of stress which may also be on the same level.

(12)

((	*	)	(	*	))	φ-structure
(	*	)	(	*	)	ω-structure
[[	A	$]_{AP}$	[	N	$]_{NP}]_{NP}$	

In the following, will assume that STRESS-φ constitutes a prosodic markedness constraint that is undominated in German. In other languages, it may be dominated by other constraints and therefore inactive so that φ-phrases without phrasal stress positions emerge.

2.3. Nuclear Stress Assignment

It has been observed that, in West Germanic languages, the strongest stress is oriented towards the right of a sentence (e.g., Newman 1946; Chomsky and Halle 1968; Selkirk 1995 for English; Uhmann 1991; Féry 1993, 2013 for German). That is, in simple sentences with two or more phrasal stress positions, the last one is perceived as relatively more prominent (Pierrehumbert 1980; see also Ladd 1996). In the framework adopted here, the strongest prominence is construed as a beat of stress on the level of the ι-phrase, which is the next higher level in the Prosodic Hierarchy. As stated above, this stress position is commonly referred to as 'nuclear stress' (and, accordingly, the pitch accent instantiating nuclear stress is referred to as 'nuclear pitch accent'). Simple sentences, as those discussed here, are usually mapped onto a single ι-phrase, and each ι-phrase contains a single beat of stress that serves as the prosodic head (see, e.g., Truckenbrodt 2005; Schubö 2020 for German). This requirement is formalized in (13) as STRESS-ι, which militates against ι-phrases that do not contain a word with nuclear stress (Nespor and Vogel 1986). As in the case of STRESS-φ, we will assume that STRESS-ι constitutes an undominated wellformedness constraint in German.

(13) STRESS-ι
Each ι must contain a beat of nuclear stress.

The assignment of nuclear stress has been modelled as an alignment mechanism that applies to the right edge of an ι-phrase and the position of its prosodic head (e.g., Truckenbrodt 1995; Féry and Samek-Lodovici 2006) or as a strengthening effect that applies to the rightmost phrasal stress contained in an ι-phrase (e.g., Truckenbrodt 2006, 2007). Following these proposals, we will assume the constraint for nuclear stress assignment in (14). As for the sentence presented in (5/9), RIGHTMOST correctly assigns nuclear stress to the object NP (*Jan*), as it bears the rightmost phrasal stress position in the sentence. The prosodic structure for a sentence of this type is given in (15), including phrases and grid marks for the φ- and ι-layer.

(14) RIGHTMOST
The beat of nuclear stress is assigned to the rightmost phrasal stress in an ι.

(15)

(					*				)	ι-structure
(	*	)	((	*	)			)	φ-structure
[	N	$]_{NP}$	[[	N	$]_{NP}$	V	$]_{VP}$	

2.4. Stress Assignment and Information Structure

2.4.1. Narrow Focus Constructions

Besides syntactic structure, the focus-background partition of sentences and the information status of constituents affect the assignment of stress. It is assumed that constituents belonging to the focused part of a sentence are marked with a feature F in syntactic representation, which is assigned a semantic and a phonological interpretation (Jackendoff 1972). As for the phonological interpretation, various studies provided empirical evidence for the assumption that nuclear stress must be located in the focused part of a sentence (e.g., Cooper et al. 1985; Eady and Cooper 1986 for English; Baumann et al. 2007; Féry and Kügler 2008 for German). This has been captured by means of the constraint STRESS-FOCUS (16), which employs the notion of focus domain (Truckenbrodt 1995; see Féry and Samek-Lodovici 2006 for the specification adopted here). In this line of research, the focus domain serves as the basis for the interpretation of narrow focus constructions and the assignment of the highest prominence (i.e., nuclear stress) of a sentence. In the present paper, we will restrict the discussion to cases of narrow focus where the entire sentence serves as

the focus domain (but see Féry and Samek-Lodovici 2006 for nested focus constructions that entail a more complex distribution of focus domains). For example, the sentence presented in (17) involves a narrow focus on the subject (hence, the F mark annotation) and a contextually given verb in post-focal position. The relevant background for the interpretation of focus is the entire sentence (i.e., [X_F schlafen]). As a result, STRESS-FOCUS enforces nuclear stress on the subject NP (*Eltern*) instead of the verb (*schlafen*), which would bear nuclear stress otherwise (according to the requirements of MATCH-PHRASE and RIGHTMOST), as it is the only element in the VP and it stands in rightmost position.

(16) STRESS-FOCUS
A focused phrase has the highest prosodic prominence in its focus domain.

(17) Who's sleeping?

Die	[Eltern]$_{NP, F}$	[schlafen]$_{VP}$
the	parents-NOM	sleep-PRES

'The parents are sleeping.'

Most accounts on the prosodic structure of narrow focus constructions assume that the given material following the focused constituent does not bear (regular) phrasal stress and is thus unaccented (e.g., Truckenbrodt 1995; Féry and Samek-Lodovici 2006 for English; Baumann et al. 2007; Féry and Kügler 2008; Féry 2013 for German). Under this assumption, the subject in (17) is the only element that bears a beat of phrasal stress, as is suggested by the absence of underlining of the verb. We will refer to this assumption as the 'dephrasing-of-φ-structure view'. In contrast, some studies argue that the prosodic structure is retained on given material in post-focal position (e.g., Féry and Ishihara 2010; Kügler and Féry 2017). Evidence for this assumption comes from the observation that pitch accents undergo a large amount of register compression, but are indeed realized in this position (Kügler and Féry 2017, see below for details; see also Wagner and McAuliffe 2019 for English). Since pitch accents are taken as instantiations of phrasal stress, their presence suggests the presence of φ-phrases. We will refer to this assumption as the 'preservation-of-φ-structure view'.

2.4.2. Stress Rejection Due to Givenness

Given elements can also occur within the focused part of a sentence, in which case they may reject stress (e.g., Ladd 1980, 1983, 1996; Selkirk 1984; Gussenhoven 1992; Schwarzschild 1999). As was mentioned in the introduction, Féry and Samek-Lodovici (2006, p. 145) present such a case from English, which is here reproduced with modified annotations in (18). F-marks are omitted, but the focused part of the answer, as induced by the context question, is marked with FOC instead. The NP at the end of the sentence (*John*) is discourse-given since it is mentioned in the context question. Féry and Samek-Lodovici (2006) point out that nuclear stress is assigned to the object NP (*Rome*), indicated by underlining in (18), although it is not the last lexically headed XP in the focused constituent. The constraints on stress assignment established so far predict that the NP at the end must receive nuclear stress.[5] However, as this NP is a given element, stress falls on the next preceding constituent that is eligible for stress assignment.

(18) What did John's mother do?
She [went to Rome with [John]$_G$]$_{FOC}$

Féry and Samek-Lodovici (2006) account for this effect by employing the constraint DESTRESS-GIVEN (19), which militates against prosodic prominence on constituents that are given in discourse. The use of such a constraint requires the assumption of a givenness feature G. Constituents that are given in discourse undergo G-marking in syntactic representation (hence, the G mark annotation in (18) and the following examples). These constituents are identified as given elements by DESTRESS-GIVEN. As will be discussed below, the specification of this constraint as posited here is problematic for other cases.

(19) DESTRESS-GIVEN
A given phrase is prosodically nonprominent.

Before further addressing the specification of DESTRESS-GIVEN, we will first establish that the stress rejection effect illustrated in (18) also applies in German, and not only to final elements but also to pre-final ones that would otherwise be assigned nuclear stress.

In (20), the focused part of the answer includes the verb (*loben*) and the object (*Jan*). As discussed above, the default nuclear stress position for this type of sentences is on the object. However, as the object is mentioned in the context question, nuclear stress falls on the preceding verb. Thus, as in the case from English in (18), nuclear stress is rejected by a given element in final position and is instead assigned to the next preceding element in the focused part of the sentence. The pitch contour of a production of this sentence is presented in Figure 1.[6] The contour involves a rising movement in the initial portion and a falling movement in the final portion of the verb (*loben*), and remains low on the following object (*Jan*). This suggests that the verb bears nuclear stress, which is instantiated by a nuclear pitch accent.[7]

(20) What are Jan's parents doing?

Sie	[loben	[Jan]$_{NP, G}$]$_{FOC}$
they	praise-PRES	Jan-ACC

'They are praising Jan.'

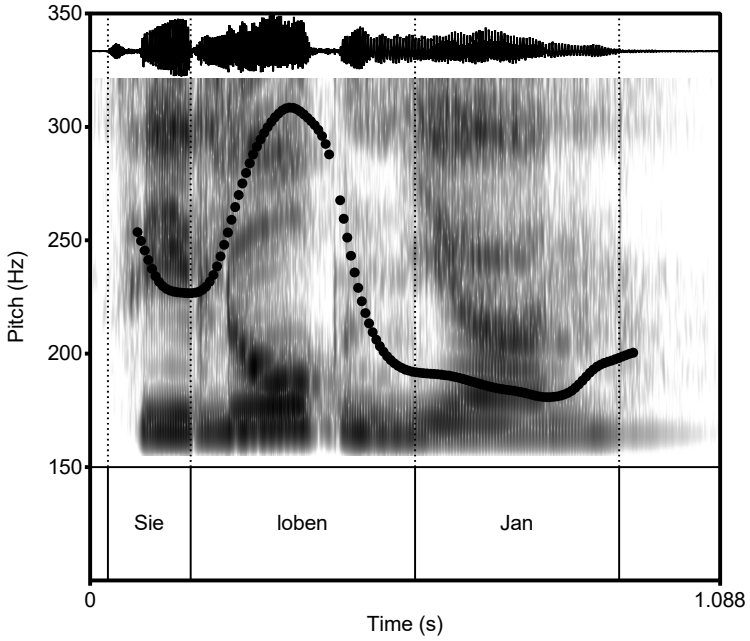

Figure 1. Pitch track, spectrogram, and waveform of a production of the sentence *Sie loben Jan* 'They are praising Jan' (19) where the verb and object (*loben Jan*) are focused and the object (*Jan*) is given.

The example in (21) provides a case that involves the same stress rejection effect as the prior one, but has reversed order of the object and the lexical verb. Here, the focused part of the sentence includes the object (*Jan*) and the following verb (*loben*). As discussed above, the default position for nuclear stress assignment in such a sentence is the pre-final object and not the final verb. However, as the object is given in discourse, it rejects stress, which is instead assigned to the following verb (which is the only element eligible for stress assignment in the case at hand, as it is the only new element in the focused part). This case shows that stress rejection also applies to elements in pre-final position and that stress can be shifted to a following element. Figure 2 shows the pitch contour of a production of the sentence as an answer to the context question in (21). In this case, the contour involves a downstep from the auxiliary (*werden*) to the object (*Jan*). After that, on the verb (*loben*), the contour involves a high-rising movement in the initial part, a falling movement in the middle, and remains low in the last part. As in the prior case, this pattern suggests that the verb bears nuclear stress, instantiated as a nuclear pitch accent.[8]

(21) What will Jan's parents do?

Sie	werden	[[Jan]$_{NP, G}$	loben]$_{FOC}$
they	will-AUX	Jan-ACC	praise-INF

'They will praise Jan.'

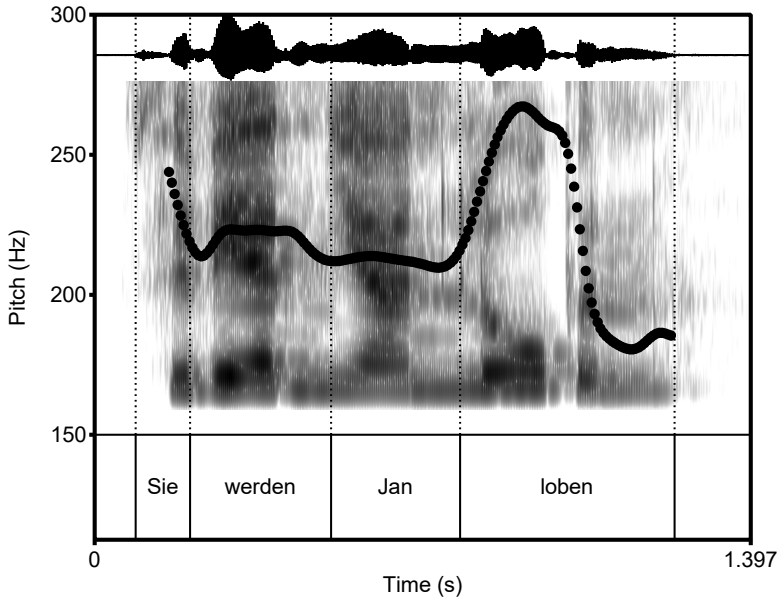

Figure 2. Pitch track, spectrogram, and waveform of a production of the sentence *Sie werden Jan loben* 'They will praise Jan' (20) where the object and verb (*Jan loben*) are focused and the object (*Jan*) is given.

2.4.3. Constraint-Based Analyses of Stress Rejection

Experimental studies found that given elements in pre-focal position often bear phrasal stress (e.g., Cooper et al. 1985 for English; Baumann et al. 2007; Féry and Kügler 2008; Schubö 2020 for German; see also Grice et al. 2009). For example, Baumann et al. (2007) recorded sentences under different focus conditions. They analyzed 432 productions (collected from six speakers) and found that pre-nuclear pitch accents occurred on given constituents in the vast majority of cases across conditions (98% for broad focus, 94% for information focus, and 86% for contrastive focus). Féry and Kügler (2008) conducted a similar study, yet with a larger variety of materials and more speakers. They analyzed a total of 2277 productions from 18 speakers and found that the pitch register was compressed on pre-focal given arguments, but pitch accents were commonly present in this position. These findings are incompatible with the specification of DESTRESS-GIVEN, since the presence of pre-focal pitch accents indicates the presence of phrasal stress on given elements. That is, unlike required by DESTRESS-GIVEN, given phrases can be prosodically prominent. Thus, the constraint should allow for (non-nuclear) phrasal stress on given elements.

As a solution to this problem, Féry (2013, p. 719) proposed to restrict the constraint to militating against "post-nuclear given phases[s]". This is in line with the dephrasing-of-φ-structure view, under which phrasal stress positions are absent in post-focal position, but may be present in pre-focal position. This is however problematic for the cases of stress rejection discussed above in which the assignment of nuclear stress depends on DESTRESS-GIVEN. In these cases, nuclear stress shifts from one element to another due to the givenness status of the word that is in the default position for nuclear stress assignment. If DESTRESS-GIVEN was restricted to the post-nuclear part of the sentence, it would be necessary to assume that the shift of nuclear stress results from a different mechanism, and it remains unclear what mechanism this would be. As will be illustrated in the next section, it is not necessary to employ DESTRESS-GIVEN (or a similar constraint) in order to account for the dephrasing of post-focal φ-structure. Another problem with this restriction is that the identification of post-nuclear material would require some sort of marking in phonological representation, an assumption that is not needed elsewhere in the formation of prosodic structure.

Recent experimental evidence suggests that pitch accents, and thus beats of phrasal stress and φ-phrases, are also retained in post-focal position in German: Kügler and Féry (2017) analyzed 187 productions (collected from eleven speakers) involving a narrowly

focused element and followed by either, one, two, or three given arguments in post-focal position. An analysis of the F0 scaling patterns revealed a downstep or upstep effect among the post-focal arguments in 63 percent of instances. These effects are taken as correlates of phrasing, suggesting that the post-focal arguments form independent φ-phrases. These findings strengthen the preservation-of-φ-structure view, under which given elements can bear prosodic prominence in any position of the sentence. This view is generally incompatible with the specification of DESTRESS-GIVEN in (19) as well as with the assumption that the constraint only affects post-nuclear given phrases.

The predictions of phrasal stress distribution of the dephrasing-of-φ-structure and the preservation-of-φ-structure view are illustrated in (22). This example involves a sentence with three lexical arguments of which the second one, the indirect object (*Jan*), is focused and thus receives nuclear stress (indicated by double-underlining). The subject (*die Eltern*) receives a regular beat of phrasal stress (indicated by single-underlining of the NP). The direct object (*ein Auto*), which immediately precedes the lexical verb at the end, does not receive phrasal stress under the dephrasing-of-φ-structure view. Under the preservation-of-φ-structure view, this object however does comprise a beat of phrasal stress. The discrepancy between the two assumptions is indicated in (22) by dotted underlining of the NP of the direct object. The prosodic structure under the dephrasing-of-φ-structure view is illustrated in (23) and the one under the preservation-of-φ-structure view in (24). Annotations for VPs and their corresponding φ-phrases are omitted. In compliance with STRESS-φ, each φ-phrase contains a beat of stress that serves as its prosodic head.

(22) To whom will the parents give a car?

Die	[Eltern]$_{NP, G}$	werden	[Jan]$_{NP, FOC}$	ein	[Auto]$_{NP, G}$	schenken.
the	parents-NOM	will-AUX	Jan-DAT	a	car-ACC	give-INF

'The parents will give a car to Jan.'

(23)

(			*			)	ι-structure
(	*	)	(	*	)		φ-structure
[	N	]$_{NP}$	[	N	]$_{NP, FOC}$	[N]$_{NP}$	

(24)

(			*			)	ι-structure
(	*	)	(	*	)	**(*)**	φ-structure
[	N	]$_{NP}$	[	N	]$_{NP, FOC}$	[N]$_{NP}$	

Another example is provided in (25). The subject of this sentences contains a possessor NP (*Tom*) and a possessee NP (*Eltern*). As an answer to the preceding context question, the possessor is focused, as it is Tom's and not Jan's parents who will give Jan a car, and it is thus assigned nuclear stress (again indicated by double-underlining). The remaining lexical XPs of the sentence are given and do not receive phrasal stress under the dephrasing-of-φ-structure view, but do under the preservation-of-φ-structure (again indicated by dotted underlining). The prosodic structures are shown in (26) and (27), respectively. Under the dephrasing-of-φ-structure view, neither of the post-focal NPs is matched by a φ-phrase (26) whereas, under the preservation-of-φ-structure all of the post-focal NPs are matched by a corresponding φ-phrase. Given that this sentence has several constituents containing lexical XPs in post-focal position, it appears likely that φ-phrases (and thus phrasal stress positions) emerge for rhythmical reasons, yielding the prosodic structure in (27).

(25) Jan's parents will give a car to Jan?

[Toms]$_{NP, FOC}$	[Eltern]$_{NP, GIV}$	werden	[Jan]$_{NP, GIV}$	ein	[Auto]$_{NP,GIV}$
Tom's	parents	will	Jan	a	car

schenken.
give

No, Tom's parents will give a car to Jan.

(26)

(	*										)	ι
(	*	)										φ
[	N	]$_{NP, FOC}$	[	N	]$_{NP}$	[	N	]$_{NP}$	[	N	]$_{NP}$	

(27)

(	*										)	ι
(	*	)	(	*	)	(	*	)	(	*	)	φ
[	N	]$_{NP, FOC}$	[	N	]$_{NP}$	[	N	]$_{NP}$	[	N	]$_{NP}$	

Independent of the view one adopts with regard to post-focal φ-structure, the mentioned specifications of DESTRESS-GIVEN cannot account for the rejection of nuclear stress by given elements that are part of the focused constituent and at the same time be compatible with the presence of φ-phrases (and thus stress positions) that contain given elements. Ladd (1980, p. 56) remarks that the rejection of nuclear stress on a given element is achieved by "relative weakening of its hierarchical rhythmic position", and that this weakening leads to different prosodic patterns depending on the order of the involved elements. In case nuclear stress shifts to an earlier element in the sentence, the weakened element is in post-nuclear position, which is prosodically weak and thus leads to destressing. If nuclear stress however shifts to a later element, the weakened element is in pre-nuclear position and receives "secondary stress" (Ladd 1980, p. 57). In both cases, Ladd (1980, p. 57) remarks, the resulting rhythmic structure involves a pattern in which the given element is perceived as relatively weaker. This observation suggests that the mechanism responsible for stress rejection only affects the highest prominence in the sentence, which is ι-level prominence in terms of the Prosodic Hierarchy given in Section 2.1. Frey and Truckenbrodt (2015) capture this pattern in a version of DESTRESS-GIVEN that restricts the stress rejection to sentence stress, which corresponds to nuclear stress (or ι-level prominence) in the terminology adopted here. The formulation employed in Frey and Truckenbrodt (2015) is given in (28). This formulation overcomes the problem of DESTRESS-GIVEN as posited in Féry and Samek-Lodovici (2006) by allowing for (non-nuclear) phrasal stress on given elements.

(28) *STRESS-GIVEN
Do not assign sentence stress to a constituent marked as G (i.e., contextually given).

In a comprehensive account of the distribution of stress in English, Büring (2016, ch.2) captures the observation that given elements do not bear the strongest prominence by means of the condition in (29). The first part of this condition corresponds to the constraint in (28). The F-REALIZATION CONDITION referred to in the second part of (29) is an adaptation of STRESS-FOCUS. Büring (2016, p. 164) later models the condition in (29) as the constraint FOCUS REALIZATION, which requires that "[t]he highest stress within a F-domain *D* falls on a focus of *D*" (in line with, e.g., Truckenbrodt 1995 and Féry and Samek-Lodovici 2006). Furthermore, Büring (2016, p. 173) points out that the G-REALIZATION CONDITION (29) can be construed as a combination of two constraints: a constraint militating against nuclear stress on given elements (29) and a higher-ranking FOCUS REALIZATION constraint.

(29) G-REALIZATION CONDITION
A G-marked constituent does not contain the nuclear accent, unless forced by the F-Realization Condition.

In the account proposed in Büring (2016, ch. 7), the constraint on stress rejection is eventually modeled as stated in (30). The indirect formulation is meant to comply with cases where an entire ι-phrase contains given material so that nuclear stress must fall on a given element. This is illustrated in (31) with an example from Büring (2016, p. 174, stress marks adapted). The first clause of the answer is a repetition of the second clause of the question and thus comprises only given material. The repeated clause however does involve a nuclear stress (*Kim*), as it is realized as a separate ι-phrase. The same holds for the German example in (32), which is an adaptation of (31). As in the English example, nuclear stress falls on the object (*Tom*), which in this case is followed by the verb. The pattern in (31/32) is compatible with (30), but not with (28/29). Regarding the English example in (31), Büring (2016, p. 174) remarks that the beat of nuclear stress on the focused clause might have stronger prominence than the one on the given clause. Intuitively, this also seems to hold for the German adaptation in (32). Nuclear stress on *Ärger* ('trouble') appears stronger than nuclear stress on *Tom*.[9] This can be represented by means of a recursive ι-structure involving a higher ι-phrase for the entire sentence and an additional beat of nuclear stress on the focused clause (see Schubö 2020 for recursive ι-structure in German).

(30) GIVENNESS REALIZATION
If the strongest stress in a prosodic constituent π is on a given element, π itself is given.

(31) What happens if Sam talks to Kim?
If Sam talks to Kim, we're in big trouble.

(32) Was passiert, wenn Jan mit Tom spricht?

Wenn	Jan	mit	Tom	spricht,	haben	wir	großen
if	Jan-NOM	with	Tom-DAT	talks	have-PRES	we	big
Ärger.							
trouble-ACC							

'If Jan talks to Tom, we're in big trouble'

The constraints in (28/29) and (30) both predict the correct stress distributions. They however differ in the following respects: GIVENNESS REALIZATION (30) is a relational constraint that applies to each category in the Prosodic Hierarchy (π), not only to instances of nuclear stress (i.e., on the ι-level). Thus, it potentially also militates against instances of regular phrasal stress. Given the data discussed above, this is not necessary, since a constraint enforcing stress rejection due to givenness only needs to affect nuclear stress. Therefore, the more restricted stress rejection constraint in (28/29) is adopted here, which also conforms more with statements of constraints used in the framework of OT. The problem that this constraint is incompatible with the pattern in (31/32) is solved by the assumption of an undominated constraint STRESS-ι. As stated earlier, this constraint enforces a nuclear stress position in any ι-phrase, regardless of the givenness status of the contained material. Thus, STRESS-ι enforces the emergence of nuclear stress in cases as (31/32) in violation of the constraint that militates against nuclear stress positions on given elements.

The stress rejection constraint employed in Frey and Truckenbrodt (2015) and included in Büring's (2016) G-REALIZATION CONDITION (25) is referred to as *STRESS-GIVEN-ι in the following. This constraint is formalized as in (33). For the evaluation of output structures, the formalization is to be interpreted in the following way: Assign one violation mark for each beat of stress on the level of the ι-phrase that is located on a discourse-given morpho-syntactic constituent.

(33) *STRESS-GIVEN-ι
A given constituent does not bear nuclear stress.

3. Analysis

In order to account for the observations on stress assignment presented above, this paper offers a constraint-based analysis in the framework of OT. The nuclear stress rejection effect on given elements and the variability with regard to post-focal dephrasing are captured by the grammar presented in (34).[10] This grammar comprises the undominated constraints STRESS-FOCUS and STRESS-ι that are ranked above *STRESS-GIVEN-ι, which in turn outranks RIGHTMOST and MATCH-PHRASE. The low-ranking constraints are organized as an ordered global tie, here represented as {RIGHTMOST, MATCH-PHRASE}. Ordered global ties are a means to account for structural variability in OT. The assumption is that a set of constraints do not have a fixed ranking in the grammar, but are equally important, so that each candidate in the output that is optimal under at least one of the rankings provided by the set of constraints is rendered as grammatical in the language. Here, the ordered global tie is employed in order to capture the variability observed with regard to the presence of post-nuclear stress positions. The ranking statements in the grammar in (34) are motivated in the following.

(34) STRESS-FOCUS, STRESS-ι >> *STRESS-GIVEN-ι >> {RIGHTMOST, MATCH-PHRASE}

It has already been established in the prior section that STRESS-ι must outrank *STRESS-GIVEN-ι, as given elements do bear nuclear stress in cases where the entire ι-phrase is given. The example from German presented in (32) is here repeated as (35). As stated earlier, the first clause of the answer (*Wenn Jan mit Tom spricht*) is given, but nevertheless contains a nuclear stress position. This nuclear stress position is however less prominent than the one on the focused clause. As illustrated in Figure 3, this pattern is predicted by the grammar in (34). It is assumed here that the main and the subordinate clause are each mapped onto a separate ι-phrase (see, e.g., Truckenbrodt 2005; Schubö 2020 on the relationship between

clause structure and ι-structure in German). Candidates (a) and (b) have an additional ι-phrase containing the entire sentence, which yields a recursive ι-structure. Candidate (a) is selected because it is the only one that satisfies both STRESS-ι and STRESS-FOCUS, having a beat of nuclear stress in each ι-phrase and the strongest prominence on the focused clause. Candidate (b) has the same ι-structure, but the strongest prominence is not on the focused clause, violating STRESS-FOCUS. Candidates (c) and (d) do not have a higher ι-phrase layer. Candidate (c) violates STRESS-FOCUS because the focused clause does not have stronger prominence than the given clause. Candidate (d) satisfies STRESS-FOCUS and *STRESS-GIVEN-ι, but violates STRESS-ι because the ι-phrase containing the given clause does not have a beat of stress. Note that the grammar would also predict the strongest stress on the focused clause if it was in initial position (i.e., *Wir haben großen Ärger, wenn Jan mit Tom spricht*), as the impact of STRESS-FOCUS and STRESS-ι are the same, and lower ranked constraints are not decisive for this case.

(35) Was passiert, wenn Jan mit Tom spricht?

Wenn	Jan	mit	Tom	spricht,	haben	wir	großen
if	Jan-NOM	with	Tom-DAT	talks	have-PRES	we	big
Ärger.							
trouble-ACC							

'If Jan talks to Tom, we're in big trouble'

	(Was passiert, wenn Jan mit Tom spricht?)	STRESS-FOCUS	STRESS -ι	*STRESS-GIVEN-ι
	[[Wenn Jan mit Tom spricht]$_{CP,G}$ [... Ärger]$_{FOC}$]$_{CP}$			
	if Jan with Tom talks ... trouble			
(a)	(*)$_ι$			
☞	(*)$_ι$ (*)$_ι$			*
	[[Wenn Jan mit Tom spricht]$_{CP,G}$ [... Ärger]$_{FOC}$]$_{CP}$			
(b)	(*)$_ι$			
	(*)$_ι$ (*)$_ι$	*!		**
	[[Wenn Jan mit Tom spricht]$_{CP,G}$ [... Ärger]$_{FOC}$]$_{CP}$			
(c)	(*)$_ι$ (*)$_ι$	*!		*
	[[Wenn Jan mit Tom spricht]$_{CP,G}$ [... Ärger]$_{FOC}$]$_{CP}$			
(d)	( )$_ι$ (*)$_ι$		*!	
	[[Wenn Jan mit Tom spricht]$_{CP,G}$ [... Ärger]$_{FOC}$]$_{CP}$			

Figure 3. Prosodic structures predicted by STRESS-FOCUS, STRESS-ι >> *STRESS-GIVEN-ι for an SVO sentence with a discourse-new verb and a discourse-given object under focus.

Furthermore, prior studies have argued that STRESS-FOCUS must outrank the constraint responsible for stress rejection (e.g., Féry and Samek-Lodovici 2006; Büring 2016), here *STRESS-GIVEN-ι. This assumption is based on the observation from English that a word that is the only element under focus does receive nuclear stress, even if it is given (see, e.g., Schwarzschild 1999, p. 150). An example from German is given in (36), where the focused constituent contains an anaphoric pronoun (*ihn*), which does receive nuclear stress. As functional elements are not mapped onto φ-phrases by default, the presence of nuclear stress must be attributed to focus rather than to default stress assignment.

(36) Who are Jan's parents praising?

Sie	loben	[ihn]$_{FOC, G}$
they	praise-PRES	him-ACC

'They are praising him.'

The predictions by *STRESS-GIVEN-ι >> {RIGHTMOST, MATCH-PHRASE} for sentences with a given element are illustrated in Figures 3 and 4. The high-ranking constraints STRESS-FOCUS and STRESS-ι will be treated as inviolable, and we will only take prosodic structures into account that comply with these constraints. Figure 4 presents an analysis for the case introduced in (20), which is here repeated as (37). This case involves an SVO sentence with a verb that is new and an object that is given, both being under focus. High-ranking *STRESS-GIVEN-ι eliminates candidate (c) because nuclear stress is on the object (*Jan*). Candidates (a) and (b) both have nuclear stress on the verb and thus satisfy *STRESS-GIVEN-ι. These candidates differ only as to the presence of post-nuclear φ-structure. Candidate (a) lacks a φ-phrase on the post-nuclear NP, which satisfies RIGHTMOST, but violates MATCH-PHRASE. Candidate (b) bears a φ-phrase on the post-nuclear NP, which leads to the reverse violation pattern. As a result, each of the two candidates is selected under one of the two rankings. Note that the absence of post-nuclear φ-structure in candidate (a) is accounted for by RIGHTMOST outranking MATCH-PHRASE, so that no stress rejection constraint is required in this regard (following Truckenbrodt 1995).

(37) What are Jan's parents doing?
Sie [loben [Jan]$_{NP,G}$]$_{FOC}$
they praise-PRES Jan-ACC
'They are praising Jan.'

	(What are Jan's parents doing?)	*STRESS-GIVEN-ι	RIGHTMOST	MATCH-PHRASE
	Sie [loben [Jan]$_{NP,G}$]$_{FOC}$			
	they praise Jan			
(a)	(*)$_{ι}$			
☞	(*)$_{φ}$			*
	Sie [loben [Jan]$_{NP,G}$]$_{FOC}$			
(b)	(*)$_{ι}$			
☞	(*)$_{φ}$ (*)$_{φ}$		*	
	Sie [loben [Jan]$_{NP,G}$]$_{FOC}$			
(c)	(*)$_{ι}$			
	(*)$_{φ}$	*!		
	Sie [loben [Jan]$_{NP,G}$]$_{FOC}$			

Figure 4. Prosodic structures predicted by *STRESS-GIVEN-ι >> RIGHTMOST, MATCH-PHRASE for an SVO sentence with a discourse-new verb and a discourse-given object under focus.

Figure 5 presents the case introduced in (21), which is here repeated as (38). In this case, a focused NP in sentence-medial position is preceded and followed by a given NP that is not under focus. *STRESS-GIVEN-ι does not incur a violation by any of the presented structures. Structures with nuclear stress on either of the given NPs also violate STRESS-FOCUS and are thus eliminated at an earlier stage. Candidates (c) and (d) violates RIGHTMOST because they involve a post-nuclear φ-phrase. Candidates (a) and (b) both lack a post-nuclear φ-phrase and thus comply with RIGHTMOST, but violate MATCH-PHRASE for this reason. Candidate (b) and (c) lack a pre-nuclear φ-phrase, which causes a violation of MATCH-PHRASE, resulting in two violations of this constraint for candidate (b). Candidate (c) thus violates both RIGHTMOST and MATCH-PHRASE. As a result, candidates (b) and (c) are eliminated whereas candidates (a) and (c) are each optimal under one of the possible rankings of the ordered global tie. Again, the absence of post-nuclear φ-structure in candidate (a) is achieved without the involvement of a stress rejection constraint.

(38) To whom will the parents give a car?
Die [Eltern]$_{NP,G}$ werden [Jan]$_{NP,\ FOC}$ ein [Auto]$_{NP,G}$ schenken.
the parents-NOM will-AUX Jan-DAT a car-ACC give-INF
'The parents will give a car to Jan.'

	[N]$_{NP,G}$ … [N]$_{NP,FOC}$ … [N]$_{NP,G}$ V$_G$	*Stress-Given-ι	Rightmost	Match-Phrase
(a)	(*)$_ι$			
☞	(*)$_φ$ (*)$_φ$			*
	[N]$_{NP,G}$ … [N]$_{NP,FOC}$ … [N]$_{NP,G}$ V$_G$			
(b)	(*)$_ι$			
	(*)$_φ$			**!
	[N]$_{NP,G}$ … [N]$_{NP,FOC}$ … [N]$_{NP,G}$ V$_G$			
(c)	(*)$_ι$			
	(*)$_φ$ (*)$_φ$		*!	*!
	[N]$_{NP,G}$ … [N]$_{NP,FOC}$ … [N]$_{NP,G}$ V$_G$			
(d)	(*)$_ι$			
☞	(*)$_φ$ (*)$_φ$ (*)$_φ$		*	
	[N]$_{NP,G}$ … [N]$_{NP,FOC}$ … [N]$_{NP,G}$ V$_G$			

Figure 5. Prosodic structures predicted by *Stress-Given-ι >> Rightmost, Match-Phrase for a sentence with a focused NP preceded and followed by unfocused given NPs.

4. Discussion

The present paper proposed an analysis of stress assignment in the framework of Match theory, employing Match-Phrase to derive the φ-structure in phonological representation from the lexical XP structure in syntactic representation. As a starting point, it was proposed to adopt the basic requirement of the interface constraint Stress-XP for a prosodic wellformedness constraint, called Stress-φ. This constraint requires that each φ-phrase must contain a beat of phrasal stress. It is satisfied if one or more beats of phrasal stress are contained in a φ-phrase which may also be contained by embedded φ-phrases.

Furthermore, Stress-ι was assumed as an undominated wellformedness constraint that enforces ι-phrases to bear a beat of nuclear stress. The requirements of these Stress constraints could be construed as resulting from a single constraint, call it Stress-π, that enforces a beat of stress on each constituent belonging to the interface categories of the Prosodic Hierarchy (i.e., ι, φ, and ω). Similar constraints have been proposed in prior research (e.g., Hyman 2009, who uses the constraints Obligatoriness and Culminativity). Several further prosodic wellformedness constraints have been used in prior studies that have not been included in the present analysis (e.g., constraints enforcing binary branching in prosodic structure). This is because they do not have an impact on the selection of the structures and are thus either low-ranking and therefore inactive or it is not possible to make a ranking statement for them based on the data discussed here.

At the center of the present discussion was the phenomenon of stress rejection by given elements, which has been discussed for English in various studies. The present study showed that the same effect also applies in German, where final as well as pre-final elements can be affected. This observation provides additional motivation for a constraint that prevents given elements from bearing higher-level prosodic prominence. The constraint employed by Féry and Samek-Lodovici (2006) to account for stress rejection, Destress-Given, required that given phrases be prosodically non-prominent. The present discussion

revealed that this rather vague specification is incompatible with the observation that phrasal stress can occur on given elements in pre- and post-nuclear position. As a solution, the present paper argues in favor of a constraint militating only against *nuclear* stress, here called *STRESS-GIVEN-ι, but not against phrasal stress in general. This condition was observed by Ladd (1980, pp. 56–57) and has later been adopted by Frey and Truckenbrodt (2015) and Büring (2016). It was argued that the restriction to nuclear stress is more elegant than the alternative proposal to restrict the constraint to post-nuclear given constituents. This is because, in the case of stress rejection by a given element under focus, the assignment of nuclear stress depends on the requirement of the constraint that accounts for stress rejection. Furthermore, the identification of post-nuclear material would require some sort of marking in phonological representation, an assumption that is not needed elsewhere in the formation of prosodic structure. The alternative formulation of the stress rejection constraint proposed in Büring (2016, ch.7) also accounts for the correct stress distributions, but the more restricted version of the constraint, militating only against nuclear stress, was adopted because it suffices to account for the data discussed here.

The account proposed in this paper involved an ordered global tie of the constraints RIGHTMOST and MATCH-PHRASE in order to capture the variability observed by Kügler and Féry (2017) with regard to the presence of post-nuclear φ-structure, who observed post-nuclear phrasal stress positions in 63 percent of instances. The two rankings entailed by the tie allow for structures with and without post-nuclear stress positions, which reconciles the preservation-of-φ-structure and the dephrasing-of-φ-structure view. The dephrasing of φ-structure is achieved by RIGHTMOST (in combination with STRESS-FOCUS), if ranked above MATCH-PHRASE (following Truckenbrodt 1995), so that it is not necessary to employ a constraint against phrasal stress on given elements in this position. As for pre-nuclear material, the grammar proposed here only allows for structures that do comprise φ-phrases, and thus phrasal stress positions, on given constituents in pre-nuclear position (provided they are relevant to MATCH-PHRASE). This is in line with the findings by Baumann et al. (2007), who observed that pre-nuclear phrasal stress positions were present in the vast majority of cases across different focus conditions (98% for broad focus, 94% for information focus, and 86% for contrastive focus), as well as with the findings by Féry and Kügler (2008), who observed that phrasal stress positions were regularly present on pre-focal given constituents. Further factors might affect the presence of pre-nuclear stress positions. For example, there is some evidence that faster speech leads to the realization of fewer stress positions in German, at least for some speakers (Trouvain and Grice 1999). Generally, it remains open if instances that have been analyzed as lacking a phrasal stress in pre-nuclear position do involve traces of φ-phrases, such as specific F0 scaling patterns or slight changes in segmental duration. Attesting such traces would further strengthen the grammar proposed here.

The analyses presented in this paper do not require recursive φ-structure, but can be restricted to minimal φ-phrases, that is, φ-phrases that do not contain other φ-phrases (see Itô and Mester 2012 for this notion). It remains unclear at this point if the assumption of higher φ-phrases, and thus recursive φ-structure, is necessary to account for stress assignment in German. Thus, including higher φ-phrases, such as one matching the verb phrase in the examples discussed above, would lead to more violations of MATCH-PHRASE accordingly. This would however not affect the selection of the output candidates because all candidates would cause an additional violation. The assumption of non-minimal φ-phrases is compatible with the proposed account (yet not required). It is left for future research to explore if they are relevant to phrasal stress assignment in German as well. The grammar proposed here would also be compatible with the assumption of STRESS-XP (instead of MATCH-PHRASE) as the constraint that derives phrasal stress positions from syntactic structure. The literature however provides independent motivation for MATCH theory (e.g., Selkirk 2011) and prior studies have shown that recursive prosodic structure reflecting recursive syntactic structure is relevant to German with regard to prosodic phrasing (e.g., Féry and Schubö 2011; Kentner and Féry 2013). A model that fully integrates

these findings with the account on stress assignment offered here should be developed in future research.

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Notes

1 It has been argued that not all clauses are mapped onto ι-phrases (e.g., Selkirk 2005; see also Hamlaoui and Szendroi 2015 regarding the mapping between syntactic constituents and ι-phrases).

2 It is debated in the literature whether functional elements are mapped onto prosodic constituents as well (see, e.g., Truckenbrodt 1999; Elfner 2012; Tyler 2019).

3 The assignment of nuclear stress in intransitive sentences has also been claimed to depend on the class of the verb: Unergative verbs bear nuclear stress whereas unaccusative verbs do not (see, e.g., Uhmann 1991 for German). This difference can be captured by STRESS-XP under the assumption that the subject is part of the verb phrase in sentences with unaccusative verbs, but not in sentences with unergative verbs (see, e.g., Truckenbrodt and Darcy 2010; Irwin 2011). Furthermore, the stress pattern can be affected by the predictability of the verb (see Verhoeven and Kügler 2015).

4 This formalization is based on the proposal in Selkirk (2011). See also Elfner (2012).

5 For example, as an answer to the question *What did Carla do?*, nuclear stress in the sentence *She went to Rome with John* would fall on *John* rather than on *Rome*, as *John* constitutes the rightmost NP in the sentence.

6 The pitch tracks and spectrograms presented in this section are based on productions from a female native speaker of Southern German, who read the respective question-answer pairs. The recordings, pitch tracks, spectrograms, and waveforms were made with Praat (Boersma and Weenink 2020). The pitch contours were smoothed at a bandwith of 10 Hertz.

7 The type of pitch accent realized in the case at hand could be analyzed as H*L (following Féry 1993) or L+H* (following Grice et al. 2005).

8 As in the case presented in Figure 1, the nuclear pitch accent, here located on the verb, could be analyzed as H*L (following Féry 1993) or L+H* (following Grice et al. 2005). The local peaks on the pre-verbal elements might also be correlates of pitch accents.

9 By intuition, the same pattern emerges in case the given subordinate clause is in final poistion. That is, in the sentence *Wir haben großen Ärger, wenn Jan mit Tom spricht*, the strongest nuclear stress is on *Ärger*. It might also be that the given clause undergoes pitch register compression in this case. These patterns should be tested in future research.

10 I am grateful to Gerrit Kentner for his comments on an earlier version of this paper, including the suggestion to model the variability with regard to post-nuclear φ-structure by means of *STRESS-GIVEN-ι >> {RIGHTMOST, MATCH-PHRASE}.

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