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What verb-final and V2 have in common: evidence from the prosody of German restrictive relative clauses in adults and children

Abstract: Theoretical accounts agree that German restrictive relative clauses (RCs) are integrated at the level of syntax as well as at the level of prosody (Brandt 1990; Gärtner 1998, 2002; Endriss and Gärtner 2005; Catasso and Hinterhölzl 2016; Sanfelici et al. 2017) in both the default verb-final and the marked verb-second variant (referred to as iV2). Both variants are assumed to show the same prosodic pattern, i. e., prosodic integration into the main clause, and not unintegrated prosody, which would signal a sequence of two main clauses. To date strong empirical evidence for this close correspondence between prosody and syntax in RCs is missing. Findings regarding prosodic integration of verb-final RCs are not consistent, and research regarding the prosody of iV2 structures is very scarce. Using a delayed sentence-repetition task, our study investigated whether subordination is signaled by prosody in RCs in both the verb-final and the V2 variant in adults ($n = 21$). In addition, we asked whether young language learners ($n = 23$), who at the age of 3 have just started to produce embedded clauses, are already sensitive to this mapping. The adult responses showed significantly more patterns of prosodic integration than of prosodic non-integration in the V-final and the iV2 structures, with no difference between the two conditions. Notably, the child responses mirrored this adult behavior, showing significantly more patterns of prosodic integration than of prosodic non-integration in both V-final and iV2 structures. The findings regarding adults' prosodic realizations provide novel empirical evidence for the claim that iV2 structures, just like verb-final RCs, show prosodic integration. Moreover, our study strongly suggests that subordination is signaled by prosody already by age 3 in both verb-final and V2 variants of RCs.

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1 Introduction

This paper investigates the prosodic realization of German RC structures with verb-final and verb-second order in an experimentally controlled production study. In German restrictive relative clauses (RCs), the verb usually occupies the final position (1a), but under specific conditions, V2 is licensed as well. These are referred to as integrated V2 structures (henceforth iV2, see Brandt 1990; Gärtner 2001a,b), illustrated in (1b):

(1)   a.   *Hier gibt   es   zwei Frauen*, *die   den   Präsident **getroffen***
            here there.is EXPL two   women PRO.NOM the.ACC president met

           haben   RC
           have

      b.   *Hier gibt   es   zwei Frauen*, *die   **haben** den   Präsident*
            here there.is EXPL two   women PRO.NOM have   the.ACC president

           getroffen   iV2
           met
           'Here there are two women that met the President.'

In the theoretical literature it is commonly assumed that the two structures (1a) and (1b) are realized with the same prosodic patterns (Lehmann 1984; Endriss and Gärtner 2005, a. o.): both restrictive verb-final RCs and iV2 structures are claimed to be prosodically integrated into the main clause. That is, they continue the tonal pattern of the main clause and do not exhibit a separate prosodic unit, which would signal an ensuing main clause (see Gärtner 1998; Endriss and Gärtner 2005). Integrated prosodic realization has been claimed to signal the fact that both structures are embedded (Gärtner 1998). This is in line with the standard assumption regarding the syntax-prosody interface according to which specific syntactic phrases correlate with specific prosodic patterns (Truckenbrodt 1995; Selkirk 2005; Wagner 2005, 2010, a. o.). Empirical studies addressing the prosodic realization of verb-final RCs and of iV2 structures have provided mixed results. Studies on the prosodic realization of verb-final German RCs produced in spontaneous speech or in experimentally controlled settings revealed that restrictive verb-final RCs are most often realized with prosodic integration, but that the prosodic patterns may vary depending on the task (Hirschberg et al. 2014; Schubö et al. 2015). IV2 structures have rarely been investigated empirically. The

only study we are aware of was carried out by Birkner (2006, 2008) and, notably, does not support the claim from the theoretical literature. Based on an analysis of adult spontaneous speech corpora Birkner (2006, 2008) concludes that iV2 structures are prosodically separated from the main clause and form a prosodic unit of their own. Therefore, it is unclear whether speakers realize iV2 structures with integrated prosody and consequently, whether iV2 structures exhibit the same prosodic patterns as restrictive verb-final RCs.

The current study contributes to this research by investigating the prosodic properties of restrictive verb-final RCs and of iV2 structures produced by adults in an experimentally controlled setting. Note that by employing the same experimental design for both structures, we are able to collect comparable sets of data, which allows for a closer comparison of the findings. The aim of the paper is twofold. First, we address the relationship between syntax and prosody by investigating whether the syntactic subordinationhood, which holds for both structures, is signaled by a prosodic pattern of integration, as usually assumed in the literature. Second, we study the prosodic realization of verb-final RCs and iV2 structures in young language learners who just begin to produce subordinate clauses. We ask whether the subordinationhood of these two structures, mapped at the prosodic level in adults, is present from the beginning of the production of subordinate clauses, which is around age 3. To our knowledge, this is the first empirical investigation of children's prosodic realization of German RCs.

More specifically, we asked two research questions: (Q1) Is subordination mapped onto prosodic integration in relative clause structures with verb-final and with V2 order in adults? (Q2) Are children at age 3 sensitive to this mapping, and if so, does this hold in both verb-final and V2 relative clause structures? To address these questions, verb-final RCs and iV2 structures, produced in a delayed sentence-repetition task (see Sanfelici et al. 2017, for details of the task), were analyzed prosodically. Prosodic boundaries and accentuation patterns were chosen as measures of prosodic integration, because they have been reported to be the most reliable cues to discriminate between integrated and non-integrated prosody (see Schubö et al. 2015). Following Féry (2011, 2017), RCs were classified as prosodically integrated if (i) there was a rising boundary tone at the end of the main clause before the embedded clause, signaling continuation, and if (ii) there was a downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause, i. e., the nuclear accent of the embedded clause was lower than that of the main clause. If either one or both of these properties were not realized, the RCs were classified as prosodically non-integrated.

We found that both adults and children realized verb-final RCs and iV2 structures significantly more frequently with prosodic integration into the main clause than with non-integration. Children showed more variation overall with respect to

the prosodic patterns they realized. The rate of prosodic integration, however, did not statistically differ between verb-final RCs and iV2 structures for both adults and children. Our study provides first evidence that restrictive RCs are realized with prosodic integration independent of the verb placement, and hence can be taken as support for theoretical accounts arguing for prosodic integration of both verb-final RCs and iV2 structures (see Gärtner 2002). The fact that this prosodic pattern is already evident in three-year-olds suggests that mapping of subordination onto the prosodic level may be mastered quite early – at least for the two types of RC structures examined here.

The paper is organized as follows. In Section 2 we describe the properties of German verb-final RCs and of iV2 structures and provide an overview of the empirical research on the prosodic realization of the two structures. In Section 3 we summarize the state of the art on children's production of verb-final RCs and iV2 structures. Section 4 contains the study and our prosodic analyses. In Section 5 we discuss the results and in Section 6 we conclude the paper with implications for the prosody-syntax interface as well as for the acquisition of subordination.

2 German verb-final RCs and iV2 structures in adults' production

2.1 Relationship between syntax and phonology

Since the 1980s, most linguistic theories have proposed a close relationship between syntax and phonology and a relatively systematic mapping between syntactic and prosodic bracketing. The various accounts differ with respect to the precise mapping function and the degree of isomorphism between the syntactic and prosodic structures (e. g., Selkirk 1984, 1995, 2005; Nespor and Vogel 2007 [1986]; Truckenbrodt 1995; Wagner 2005, 2010). Early works on prosody assumed a strict match between prosody and syntax: they postulated that constituents forming prosodic units also form syntactic constituents in the surface structure (see Chomsky and Halle 1968; Lehiste 1973; Grosjean and Collins 1979; Cooper and Paccia-Cooper 1980; Gee and Grosjean 1983; Halle and Vergnaud 1987). This assumption in its strong version was pursued by most generative studies until the 1980s. More recently, this assumption has been weakened as a consequence of various mismatches that have been reported to exist between syntactic and prosodic phrasing (see Wagner 2005 for an overview). Accordingly, many current accounts of the prosody-syntax interface assume a correspondence between specific syntactic objects (e. g., clauses) and specific phonological categories (e. g., intonational

phrases), but argue for a correlation between syntactic constituency and phonological constituency rather than for identity of objects (Selkirk 1986, 1995, 2005; Truckenbrodt 1995; Wagner 2005, 2010; Büring 2006). Processing accounts hold that the distribution of prosodic boundaries is determined by processing factors and that syntax plays a role only indirectly, as one factor contributing to processing costs (Allbritton et al. 1996; Snedeker and Trueswell 2003). Snedeker and Trueswell (2003), for instance, propose that prosodic boundaries are inserted if necessary, in order to avoid structural ambiguities. This approach assumes that a close relationship between boundaries and syntactic bracketing exists, but that the use of prosody to encode syntax is optional, as it depends on the communicative needs of the speaker.

The different approaches share the assumption that prosody provides information about the syntactic structure and that syntactic phrasing can be signaled by prosody to some extent. This conclusion is further supported by psycholinguistic and neurolinguistic studies, which found that changes in the prosodic contour change the immediate syntactic interpretation of utterances (Kjelgaard and Speer 1999; Steinhauer et al. 1999; Steinhauer 2003). In particular, most studies agree that prosody signals subordinationhood, thereby differentiating subordinate from main clauses (see Selkirk 2005, 2011; Wagner 2005, 2010, among many others). Moreover, it has been reported that various types of subordinate clauses may have different prosodic reflexes, depending on their degree of syntactic and semantic embedding into the host clause. As a case in point, Truckenbrodt and Darcy (2010) and Elvira-García et al. (2017) showed that the intonation of subordinate clauses differed according to their degrees of independence, i.e., more independent subordinate clauses showed less prosodic integration. Similarly, in a sentence-reading experiment, Roll (2004) compared the prosodic realization of Swedish *att* 'that' complement clauses with so-called ordinary subordinate clauses. She found that *att*-clauses, which exhibit main clause phenomena such as topicalization and are thus relatively independent from their matrix clause, showed less prosodic integration than the so-called ordinary subordinate clauses.

2.2 Prosody of relative clauses

RCs are one of the domains in which prosody is assumed to signal syntactic phrasing, and German RCs provide an ideal testing ground for how prosody and syntax are related. In their restrictive reading, German RCs allow two variants, which are both embedded clauses (see Catasso and Hinterhölzl 2016; Sanfelici et al. 2017), but which differ regarding verb placement and their degree of independence from the matrix clause. As stated in the Introduction, in restrictive RCs the finite verb

can be placed either in sentence-final position (as in [1a]) or in second position (as in [1b]) (see Gärtner 2001a,b; Weinert 2004, 2012). We refer to restrictive verb-final relative clauses with the finite verb in sentence-final position as "verb-final RCs" and to relative clause structures with the verb in second position as "iV2 structures" (see Gärtner 1998). The option of verb-final and V2 is available for other embedded clauses in German as well, for instance for complement clauses of specific mental verbs and for *weil* 'because'-clauses (for an overview, see Reis 1997; Wurmbrand 2005, among many others). In general, embedded V2 is assumed to be connected with assertive force, which typically characterizes declarative main clauses (Gärtner 2002). As a result, embedded V2 clauses are argued to be more independent from the matrix clause than their verb-final counterpart, with the specific properties depending on the type of clause. For instance, the V2 variants of *weil*, restrictive RCs and complement clauses are not in the scope of a matrix negation or modal, and V2 *weil* and iV2 clauses are not in the c-command domain of the matrix clause (see Reis 1997 for an overview). Accordingly, iV2 structures are claimed to show more syntactic and semantic independence than restrictive verb-final RCs, because only the former are specified for assertive force (Gärtner 2001a,b).[1] Importantly, both structures are argued to share the same prosodic pattern (Endriss and Gärtner 2005). More specifically, according to the theoretical accounts both, verb-final RCs and iV2 structures are prosodically integrated into the main clause (Lehmann 1984; Brandt 1990).

Recent empirical studies, however, revealed that the prosodic patterns of restrictive verb-final RCs and iV2 structures which the theoretical accounts had postulated based on introspective judgments were not always borne out in empirical data (e. g., Schaffranietz 1999; Birkner 2006, 2008, 2012; Hirschberg et al. 2014; Schubö et al. 2015).[2] Importantly, although the specific criteria used to determine

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1 Moreover, these two types of RCs further differ in a number of respects from each other. Unlike their verb-final RC counterparts, iV2 clauses are licensed under specific syntactic, semantic, and prosodic conditions (Brandt 1990; Gärtner 1998, 2001a,b, 2002; Weinert 2004, 2012). The conditions that have been suggested as necessary for licensing iV2 structures are the following (see Sanfelici et al. 2017 for a more detailed description of the licensing conditions): (a) the main clause predicate is a presentational or existential predicate; (b) the antecedent of the iV2 clause must be a weak [+ specific] noun phrase (Gärtner 2007); (c) iV2 structures must be introduced by d-pronouns, i. e., *der/die/das*, and not by a wh-pronoun such as *wer/was/wo*; (d) iV2 clauses must always be the last constituent of the sentence.

2 The same observation seems to hold for perception studies. Investigating the perception of the prosodic cues associated with relative clauses in German and Dutch, Kaland and van Heuven (2010) did not find much difference in terms of prosody between the two types of RCs. That is, German speakers could not clearly discriminate restrictive from appositive RCs based on accentuation, boundary tones, and pauses.

prosodic integration were not always the same, the production studies all had in common that RCs were classified as "prosodically integrated" if the RC forms an intonational phrase together with the host sentence (Lehmann 1984; Brandt 1990; Frosch 1996; Holler 2005; Truckenbrodt 2005).

2.2.1 Verb-final relative clauses

Schaffranietz (1999) investigated the prosody of RCs in semi-spontaneous speech, elicited via task-oriented dialogues. Recordings from 44 adults resulted in a total of 145 RCs, which were analyzed prosodically. Auditory and acoustic analyses of the RCs were performed based on three factors: position of the accent (on the antecedent of the RC or not), quality of the accent (low, high), and presence of a pause between the antecedent and the RC (yes, no). RCs were classified as prosodically integrated, if the accent was not realized on the antecedent but on the RC, the quality of the accent was high or constant, and if there was no pause between the antecedent and the RC. Using these criteria, Schaffranietz (1999) found that only 62 % of the restrictive RCs were realized with prosodic integration. This data suggests that the prosodic integration of restrictive RCs should be characterized as a tendency rather than as a rule (Schaffranietz 1999: 136).

A similar conclusion was reached in the study by Birkner (2008, 2012), who analyzed German relative clause structures in a spontaneous speech corpus. Her prosodic analysis was based on the audio-visual impression of prosodic boundary signals (boundary tones, pre-boundary lengthening, and silent pauses). RCs were classified as prosodically integrated if the primary accent was realized on the RC, if the antecedent and the RC formed a single intonational phrase, and if there was no pause between the antecedent and the RC. RCs were classified as prosodically non-integrated, if the primary accent was realized on the antecedent, if the antecedent and the RC formed two separate intonational phrases, and if a silent break was present between the antecedent and the RC. The analysis of about 1000 RCs, both appositive and restrictive, confirms Schaffranietz's finding that the prosodic realization of RCs in spoken language is more heterogeneous than assumed by the theoretical accounts. As expected, prosodic integration was almost exclusively used with restrictive RCs (95 %) and only rarely with appositive RCs (5 %). Prosodic disintegration, however, was found more often in restrictive RCs (68 %) than in appositive RCs (32 %) (Birkner 2008: 182; Birkner 2012: 35). These findings suggest that integrated prosody is typical for restrictive RCs but that prosodic disintegration is attested in restrictive RCs as well.

Notably, the findings in a more recent study by Hirschberg et al. (2014) differ from Birkner's results (2008, 2012), inviting a different conclusion. The authors analyzed the prosodic realization of appositive and restrictive RCs in two corpora of colloquial and literary German, testing for prosodic phrasing and pause insertion. RCs were classified as prosodically integrated, if there was a rising boundary tone at the end of the main clause and before the RC, if a downstep was present between the nuclear accent of the main clause and the nuclear accent of the embedded clause, i. e., the first nuclear accent was higher than the second, and if there was no pause between the antecedent and the RC. RCs were classified as prosodically disintegrated, if there was a lowering boundary tone at the end of the main clause and before the RC, if no downstep was present between the nuclear accents of the main and the embedded clause, and if there was a pause between the antecedent and the RC. Hirschberg et al. (2014) found that the distinction between restrictive and appositive RCs was generally reflected in prosody. Restrictive RCs were usually realized with an integrated prosodic pattern: of the 33 restrictive RCs that had been analyzed prosodically, only 11 RCs were separated from the main clause by a break. And appositive RCs generally showed a disintegrated contour: 22 of the 35 appositive RCs were separated by a break and a boundary tone from the main clause. Using the same criteria for the classification of RCs as prosodically integrated as Hirschberg et al. (2014), Schubö et al. (2015) elicited restrictive and appositive RCs in read and in semi-spontaneous speech. They found that the participants produced restrictive RCs as prosodically integrated into their host sentence and appositive RCs as prosodically separated from their host clause by boundary tones and silent pauses. Moreover, Schubö et al. (2015) also report that speakers make use of boundary tones and downstep more consistently than of other signals such as silent pauses. Importantly, the predicted prosodic correlates of restrictive RCs such as absence of a pause between the head noun and the RC were only found in one of the production experiments, i. e. experiment 2, eliciting RCs in read speech. On the basis of these results, Schubö et al. (2015) conclude that prosodic patterns and syntactic structures are not two isomorphic objects, although the prosodic patterns of the two types of RCs reflect the different syntactic structures to a certain extent. The authors argue that prosodic realization depends on whether differences in prosody may be relevant to the communicative situation. Disambiguating prosodic cues may be used more likely if the speakers are aware of an ambiguity (see Snedeker and Trueswell 2003, for similar results on English). In summary, previous empirical studies regarding restrictive verb-final RCs mostly agree that adult speakers are aware of the prosodic integration pattern of restrictive verb-final RCs, and that their realization depends on the communicative situation.

2.2.2 iV2 structures

The only empirical study we are aware of comes from Birkner (2006), who investigated the prosodic realization of iV2 structures in adults' spontaneous speech corpora by comparing verb-final RCs as in (2a) with their iV2 counterparts as in (2b). Birkner (2006) analyzed a specific type of RCs found in the corpora referred to as the *Mensch-Konstruktion* 'person-construction'. She found 53 RCs of this type, of which 16 instances showed the verb in second position as in (2b), whereas 37 RCs were verb-final (2a).

(2) a. *Ich bin ein Mensch/jemand/ein Typ, der das gerne **tut**.*
     b. *Ich bin ein Mensch/jemand/ein Typ, der **tut** das gerne.*
         'I am a person/somebody/a type of person that does this with pleasure.'

Birkner's prosodic analysis uses the same criteria as in Birkner (2008) for verb-final RCs (see Section 2.2.1). Prosodic non-integration was found in 11/16 (69 %) of the iV2 structures (8 of which also exhibited a pause between the main clause and the iV2 sentence), whereas 5/16 (31 %) showed prosodic integration into the main clause (Birkner 2006: 231). These results do not support the claim that iV2 structures are always realized as prosodically integrated. Rather, they suggest that verb placement may affect the prosodic realization of RCs, with V2 being less integrated – hence similar to a main clause prosody – than verb-final structures. The results should be taken with caution, however. First, the number of iV2 structures analyzed was small and was limited to one specific structure. Second, Birkner's (2006) prosodic analysis relied on the audio-visual inspection of prosodic boundary signals. As comprehensive prosodic analyses of iV2 structures in adults' production, based on more instances and on different types of iV2 structures, are lacking, it is open whether adult speakers use prosodic integration pattern of iV2 structures. Consequently, it is also open whether the prosodic realization of iV2 structures and restrictive verb-final RCs differs, given the different degree of independence of the two subordinate clauses. Studies on the prosodic realization of RC structures in children are absent altogether.

3 German verb-final RCs and iV2 structures in children's production

Since the nineties a vast body of research has been devoted to children's acquisition of German RCs, with a focus on verb-final RCs, both in production and com-

prehension. Limiting the review to production, many studies found that German-speaking children start producing verb-final RCs at the beginning of their third year of life (Rothweiler 1993; Diessel and Tomasello 2005; Brandt et al. 2008, 2009; Arosio et al. 2012; Adani et al. 2012, a. o.). This early emergence has been reported in spontaneous speech (Rothweiler 1993; Brandt 2004; Brandt et al. 2008) as well as in experimental settings (sentence repetition task: Diessel and Tomasello 2005; picture-based elicited production task: Adani et al. 2012). Few studies have focused on the acquisition of iV2 structures and their findings are less clear than the findings regarding verb-final RCs. Analyzing 786 RCs from the Leo corpus (available on CHILDES), Brandt et al. (2008) found that iV2 structures were produced regularly. Notably, in the early speech samples of Leo's iV2 structures were reported to be very frequent (Diessel and Tomasello 2005). Based on an analysis of the Simone corpus (available on CHILDES), Brandt (2004) likewise states that iV2 structures were more frequent than verb-final RCs up to age 4,0, the point at which the recordings stopped. As we argue in detail elsewhere (Sanfelici et al. 2017), most of the sentences coded by Brandt et al. (2008) as iV2 structures, however, do not meet the licensing conditions for iV2 (see Section 2), which casts doubts on the authors' findings.[3] To put it differently, from this data it seems difficult to judge whether children in fact produced iV2 structures or whether they produced main clauses. Based on an analysis of the spontaneous speech of seven children, Rothweiler (1993), for instance, found that children produced verb-final RCs from early on, whereas iV2 structures were almost absent from children's spontaneous speech. In her corpus of 81 RC structures, only 1 instance of iV2 was attested in one child's production at age 5;[4] all other RCs exhibit the verb-final order. In a picture-supported delayed sentence-repetition task, Sanfelici et al. (2017, 2020) showed that at age 3 most children produced both verb-final RCs and iV2 structures but exhibited a strong preference for verb-final RCs over iV2 structures. That is, children

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3 To illustrate, the antecedent of an iV2 has to be an indefinite noun. In (i), it is definite description. Nevertheless, this V2 clause was coded as iV2.

(i)   *Die Biene*, *die   holt ein Mittagessen*
      the bee   that gets a   lunch
      'The bee that is getting lunch' (Leo 2,4)
      (Brandt et al. 2008: 340).

4 The instance is the following:

(i)   *Es   gibt   Menschen die   werfen einfach Dreck ausm me aufm   Fenster*
      EXPL there-is people:ACC PRO:NOM throw simply dirt   out-of-the on-the window
      'There are people who simply throw garbage out of the window' (XI: 5,06)
      (Rothweiler 1993: 42–43).

frequently changed iV2 structures into verb-final RCs but not *vice versa*. Out of the eighteen children, six children even used the verb-final word order only. Summarizing the findings so far, we can conclude that children produce verb-final RCs early, from age 2 onwards, and iV2 structures probably later, around age 4, and less frequently.

As for prosody in acquisition, so far studies have not explicitly addressed the prosodic realization of verb-final RCs and iV2 structures in children. Looking at the word or phrase level, however, acquisition research has long noticed that prosody plays an important role in bootstrapping language acquisition (e. g., Gleitman and Wanner 1982; Mehler et al. 1988; Saffran et al. 1996; Johnson and Jusczyk 2001; Christophe et al. 2001; Pelzer and Höhle 2006, among many others). Intonational cues have been found to contribute to the early parsing of sentences. Both in production and in comprehension children have been reported to make use of the correspondence between intonational phrasing and syntactic constituency during language acquisition to signal syntactic phrases (e. g., Soderstrom and Seidl 2003; Snedeker and Trueswell 2003; Snedeker and Yuan 2008; Müller et al. 2009).

In the current study, we address the open question of whether the prosodic patterns reported in the theoretical literature and found in adults' production for restrictive verb-final RCs and for iV2 structures are present in children's production. Addressing the general issue of how subordination is mapped onto prosody may also shed light on the question of whether children do produce "real" iV2 structures. After all, one of the licensing conditions for iV2 is the prosodic integration within the matrix clause. Given the syntactic properties of iV2 structures (see fn. 1) it may be that children treat them as main clauses. That is, presence of a d-pronoun (property (c), fn. 1) and the verb second placement, i. e. the typical verb position for matrix clauses, could win over the prosodic cue. Alternatively, and in line with the prosodic bootstrapping literature, prosodic integration may be the crucial cue to signal syntactic embedding of iV2 structures, resulting in an analysis of iV2 as embedded.

4 Our study

The present study investigates the prosodic realization of verb-final RCs and iV2 structures produced by adults and by three-year-old children. The data basis consists of utterances produced during a delayed sentence-repetition task reported in detail in Sanfelici et al. (2017). In Sections 4.1, 4.2, and 4.3 we summarize the

information regarding the participants, the method and the results of the syntactic analysis, relevant for the present prosodic analysis. Section 4.4 presents the prosodic analysis, first of the adult and then of the child utterances.

Sanfelici et al. (2017) found that adults and three-year-olds differed in their syntactic realizations. Adults repeated nearly all verb-final RCs and iV2 structures correctly, whereas children's repetitions showed an asymmetry: verb-final RC repetitions were target-like with verb-final verb order, whereas iV2 structures were repeated with the verb order changed into verb-final in about 50 % of the cases. Their study did not address the crucial issue of how adults and how children prosodically realize verb-final RCs and iV2 structures, and whether iV2 structures, which were shown to be difficult for the children, exhibit the prosodic integration pattern claimed to signal subordination. The current study takes up these open issues and asks the following two research questions:

(Q1) Is subordination mapped onto prosodic integration in relative clause structures with verb-final and with V2 order in adults?

(Q2) Are children at the age 3 sensitive to this mapping, and if so, does this hold for both verb-final and V2 relative clause structures?

As for (Q1), two competing predictions can be formulated: according to the theoretical accounts, described in Section 2, adults should use prosodic integration in both verb-final RCs and iV2 structures. According to the existing empirical findings, adults should use prosodic integration in verb-final RCs, but less often so in iV2 structures. Regarding (Q2), it is open whether three-year-old children realize RC structures as prosodically integrated. As for verb-final RCs, children should produce significantly more patterns with prosodic integration than without integration, assuming that they are sensitive to the mapping of subordination onto prosodic integration. As for iV2 structures, children may treat them as main clauses and realize them as prosodically separated from the matrix clause, given that the verb position is the same in both structures. Alternatively, children could treat iV2 structures differently from main clauses and realize them with different prosody, if the properties of iV2 structures are mastered by age 3 (see Sanfelici et al. 2017; fn. 1 in Section 2). In this case, children could realize iV2 structures – just like their verb-final RC counterparts – with prosodic integration.

4.1 Participants

23 typically developing monolingual German-speaking children aged 3 and 21 adults participated in this experiment. All children were recruited in daycare centers in Frankfurt am Main. The parents gave written consent for their children's

participation in the study. A parental questionnaire ensured that none of the children had signs of language impairment, language delay, or hearing problems. Moreover, all children were tested with a standardized language test (SETK 3-5, Grimm 2001) to ensure age-appropriate development. The participant details are summarized in Table 1.

Table 1: Description of participants.

	Participants	Age range	Mean age	SD
Children	23	3;1–3;9 years	43;0 months	3 months
Adults	21	19;2–30;9 years	25;4 years	74 months

4.2 Method and testing procedure

A picture-supported delayed sentence-repetition task (Lust et al. 1996) was developed to investigate whether children, compared to adults, show a preference for V2 or verb-final when asked to repeat verb-final RCs and iV2 structures. The task consisted of three parts: listening to the pre-recorded stimulus, pointing to a matching picture, and repeating the heard sentence. The pointing task was implemented to test children's comprehension of the pre-recorded stimulus and to reach a more than 3 s delay between the stimulus presentation and its repetition. According to McDade et al. (1982), this delay ensures that participants cannot keep the verbal material in their short-term memory. Put differently, they cannot solve

Figure 1: Picture for test item (3).

the task by simply parroting what they hear and have to reconstruct the test sentences based on their grammatical knowledge. Consequently, the number of correct repetitions tells us to what degree participants have mastered the structure tested, and direction of change in the repetitions informs us about participants' preferred grammatical option. Furthermore, the pictures used made the task suitable for young children. The experiment consisted of 24 test items and 24 fillers as well as 6 warm-up items, which familiarized the participants with the experimental procedure. Each item was presented with a picture, as exemplified in Figure 1. The main factor varied in the test items was verb placement in the embedded clause: 12 test items contained a verb-final RC (3a) and 12 test items contained an iV2 structure (3b).

(3)   Example test item
      Hier gibt   es   einen Mann,
      here there.is EXPL a.ACC man

   a. *der   ein großes Krokodil **eingefangen hat***   V-final RC
      PRON.NOM a big   crocodile caught   has
   b. *der   **hat** ein großes Krokodil **eingefangen***   iV2 structure
      PRON.NOM has a   big   crocodile caught
      'Look, there is a man who caught a big crocodile.'

Two separate lists of items were created so that each participant heard only one variant (either V2 or V-final) of the given stimulus. Importantly, all test items met the requirements discussed in the literature for licensing iV2 structures (Sanfelici et al. 2017, see also fn. 1). Recall that iV2 structures are claimed to only receive a restrictive interpretation, and therefore the verb-final RCs counterparts in our experiment were all restrictive as well. In line with the proposals in the theoretical literature (see Section 2), the iV2 and the verb-final RC stimuli were pre-recorded with integrated prosody as follows: there was a high boundary tone at the end of the main clause and before the RC, and a downstep was present between the nuclear accent of the main clause and the nuclear accent of the embedded clause, with the downstep characterizing the F0 lowering of a high tone compared to a preceding high tone in the same utterance.

Participants were tested individually by an experimenter in a quiet room, and the experiment was video-taped and audio-recorded for further analysis. The test session started with a familiarization phase during which the experimenter introduced the participant to the "Findebuch" 'finding book', a book with pictures of animals and people, and ask the participant to name the animals and people; this way the lexical items used in the task were introduced. After this introductory session, the experimenter explained the task as follows:

(4)   *Hör gut zu, ich sag dir was, du suchst das richtige Bild und zeigst es mir. Und*
      dann sagst DU den Satz genauso noch mal.
      'Listen, I will tell you something, and then you look for the right picture
      and show it to me. Then YOU will repeat the sentence once more exactly as
      it was.'

In the picture book, pictures and empty pages alternated. After the presentation of the prerecorded stimulus, the experimenter turned the empty page and showed the corresponding picture to the participant. The participant pointed to the matching scene and then repeated the sentence. Three warm-up items were presented first. If the participant did not understand the instructions or the order of the tasks, the experimenter repeated the three warm-up items. Then the testing session started. If the participant was hesitant or did not follow the requested procedure, the experimenter repeated the respective item once. No response-contingent feedback was given. Children were tested in two sessions, comprising the experiment and the standardized language test, which lasted between 25 and 40 minutes each. Adults were tested in one session.

4.3 Summary of the syntactic data analysis

For the syntactic analysis, all repetitions that contained the main clause, the head noun, the d-pronoun, and the embedded sentence were considered (see Sanfelici et al. 2017). The adult data comprises a total of 504 utterances, 252 in each condition, and the child data comprises a total of 205 utterances (V-final condition: 111; iV2 condition: 94). These repetitions were analyzed syntactically according to how often the verb placement of the test item was repeated correctly (Correct), i. e. V-final as V-final, and V2 as V2, and how often it was changed (V-Change), i. e. V2 as V-final and V-final as V2. Figure 2 summarizes the results.
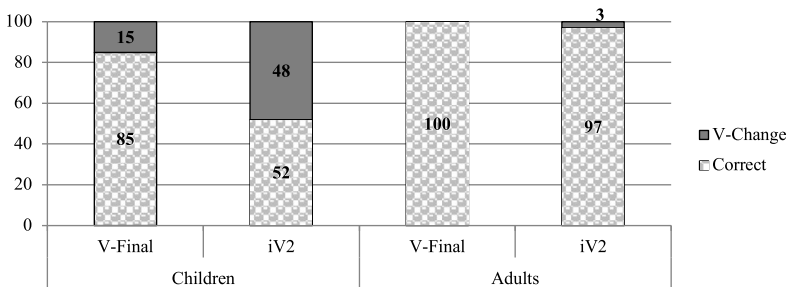
Figure 2: Percentage of correct verb placement and verb change per condition for children and adults (taken from Sanfelici et al. 2017).

Adults repeated both verb-final RCs and iV2 structures correctly; the very few changes were produced in the iV2 condition. Children correctly repeated verb-final RCs significantly more often than iV2 items ($p < .001$). Moreover, they changed the verb placement significantly more often from V2 to verb-final but not *vice versa*. These results indicated that iV2 structures, but not verb-final RCs, are difficult for young children. It is argued that children's preference of verb-final over V2 structures may result from an economy strategy which favors the unmarked word order, namely verb-final (see Sanfelici et al. 2017 for a detailed discussion of this point).

4.4 Prosodic study

For the present study, we analyzed the repetitions displayed in Figure 2 with respect to their prosodic realization. The target sentences were extracted from the audio-recordings and analyzed with the acoustics analysis software Praat (Boersma and Weenink 2012). If the quality of the audio did not allow performing a Praat analysis (e.g., because child and experimenter overlapped in their speech, or background noise), utterances were excluded from further analysis. For the prosodic analysis, 99 child utterances were randomly selected from the corpus of 205 utterances, and 62 adult utterances were randomly selected from the corpus of 504 utterances. Table 2 summarizes the number of items considered for the prosodic analysis classified by verb placement exhibited in children' and adults' repetitions.

Table 2: Number of the items considered for the prosodic analysis by verb placement in adults' and children's repetitions.

	V-final Placement	V2 Placement	Total repetitions
Adults	33	29	62
Children	52	47	99

The items reported in Table 2 were produced by 17 three-year-old children (age range 3,1–3,6, mean = 42 months) and 8 adults (age range 19,2–27,4, mean = 23,4 years).[5]

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5 We checked whether the exclusion of 6 children for which the quality of the audio was too poor for the prosodic analysis changed the results in Sanfelici et al. (2017) (see Figure 2). The

4.4.1 Data coding

Two properties were investigated in the prosodic analysis: (i) the quality of the boundary tone at the end of the main clause and before the RC (rising contour, flat contour, or falling contour) and (ii) the presence of a downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause. Following Féry (2011), we classified an utterance as prosodically integrated iff (i) a high boundary tone was present and (ii) a downstep existed between the nuclear accent of the main clause and the nuclear accent of the embedded clause. When one or both properties were not met, we considered the utterance prosodically non-integrated. Note that the present study follows the autosegmental-metrical framework (Pierrehumbert 1980), which uses different tones ordered in a sequence and two levels of prosodic phrasing (see Féry 2017). Figures 3 and 4 below illustrate the pitch tracks produced with Praat; they show the F0 contour. Tones are annotated as follows: H* and L* are pitch accents assigned to accented syllables. Hφ and Lφ are boundary tones of prosodic phrases and Lι is a boundary tone of an intonational phrase, the largest prosodic constituent in this experiment.

4.4.2 Adults' prosodic realization of V-final RCs and iV2 structures

First we address (Q1), namely whether adults map the subordinate status of relative clauses with verb-final and with V2 onto prosodic integration. The adults' repetitions (n = 62) all involved (i) a steep and high tonal rise at the end of the main clause that we analyzed as a continuation rise, signaling that the utterance has not come to an end. Their repetitions differed as to whether (ii) a downstep was present between the nuclear accent in the main clause and the nuclear accent in the embedded clause. Overall, two different prosodic patterns could be observed in the adult repetitions. Pattern I is characterized by a high boundary tone and a downstep between the nuclear accent in the main clause and that of the embedded clause. This is exactly the prosodic integration pattern defined by Féry (2011). Prosodic pattern I was present in 58/62 productions, occurring in both V-final (30 utterances) and iV2 structures (28 utterances).

Figure 3 illustrates prosodic Pattern I. The speaker realizes a pitch accent in the relative clause, in this case on the noun *Vogel* 'bird'. In the present case, the

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percentages changed only slightly (V-final condition: 87 % correct, iV2 condition: 54 % correct), and the statistical results remained unchanged. The same observation holds for the adult group.
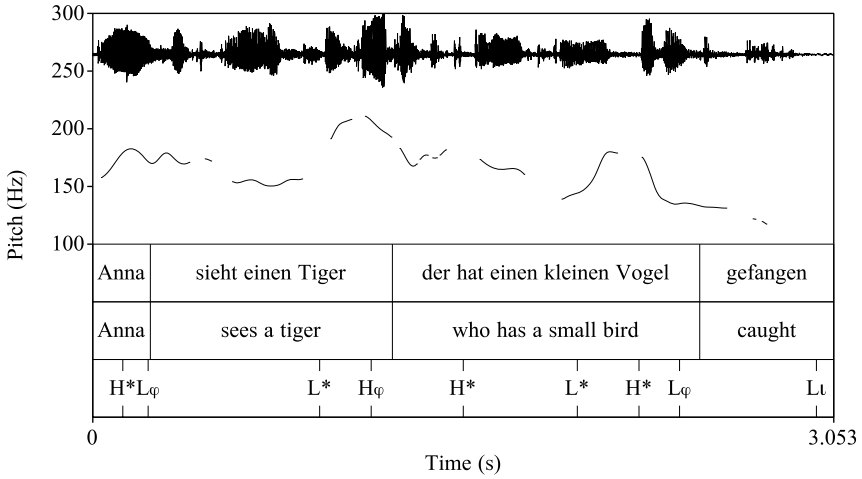
Figure 3: Example of Pattern I (high boundary tone, downstep) in an adult's realization.

accent on *Vogel* is downstepped relatively to the high boundary tone on the final noun in the main clause (*Tiger* 'tiger'). Prosodic Pattern II is characterized by a high boundary tone, just like Pattern I, but without a downstep between the nuclear accent in the main clause and that of the embedded clause. Pattern II, which we classified as non-integration, was found in 4/62 productions. Like Pattern I, this prosodic realization occurred in both V-final RCs (3 utterances) and iV2 structures (1 utterance).
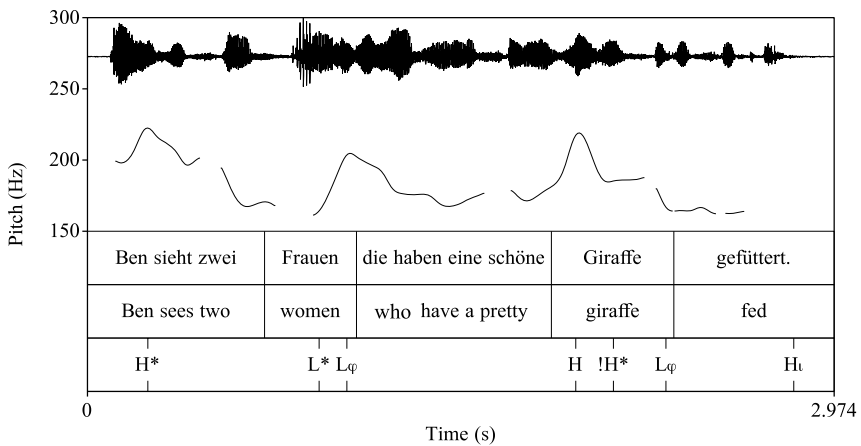
Figure 4: Example of Pattern II (high boundary tone, no downstep) in an adult's realization.

Figure 4 illustrates the prosodic Pattern II. Unlike in Pattern I, the pitch accent on the embedded noun, *Giraffe* 'giraffe', is as high as the boundary tone on the final noun of the main clause (*Frauen* 'women'); i. e. there is no downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause.[6] The data is summarized and compared to the child data in Figure 7.

4.4.3 Children's prosodic realization of V-final RCs and iV2 structures

Let us now turn to (Q2), the question of whether children at age 3 are sensitive to the mapping of subordination onto prosodic integration, and if so, whether this holds for both verb-final and V2 RC structures. A total of 99 child utterances were analyzed in the same way as the adult data. Regarding property (i), like the adult utterances, the vast majority of child utterances (89/99) exhibited a rising boundary tone at the end of the main clause. Notably, this boundary tone was present in both V-final (46/50) and iV2 RCs (43/49). 10/99 utterances showed two further prosodic patterns not attested in the adults: 6 exhibited no high boundary tone, but were produced with a flat contour across the main clause and the embedded clause (V-final: 3, iV2: 3), and 4 utterances exhibited a falling boundary tone on the main clause (V-final: 1, iV2: 3). Children hence differed from the adults in showing more varied prosodic contours in both iV2 structures and V-final RCs. Importantly, these patterns were almost equally distributed between V-final and V2 productions.

For the remainder of the discussion, we focus on the 89 child utterances that showed a rising boundary tone at the end of the main clause. Of these 89 utterances exhibiting a high boundary tone, 72 utterances showed a downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause, i. e. they exhibited prosodic Pattern I. The remaining 17 utterances with a high boundary tone did not show a downstep, i. e., they exhibited the prosodic Pattern II. Figure 5 illustrates Pattern I and Figure 6 illustrates Pattern II produced by children.

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6 The accent on *Giraffe* is an instance of an "early peak", with a high tone on the first syllable and a second downstepped high tone on the second syllable, that is, the syllable carrying the primary lexical stress, as the transcription in Figure 4 shows. Notice that this does not affect the classification of Figure 4 as an example of Pattern II, since there is no downstep.
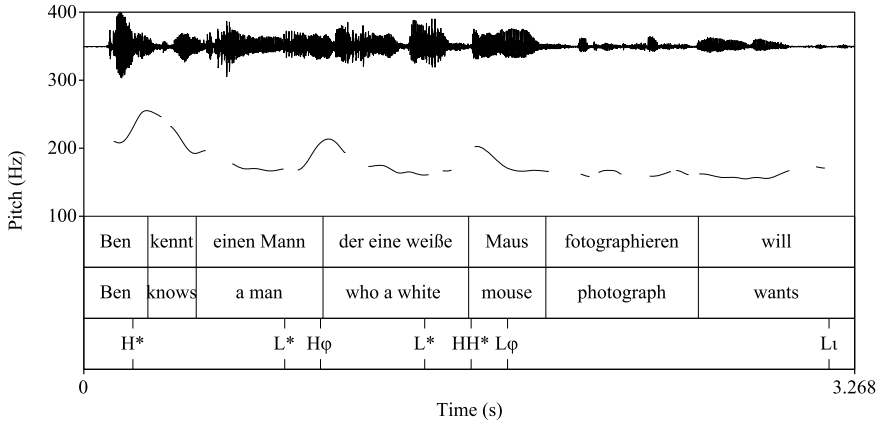
Figure 5: Pattern I in children's prosodic realization: high boundary tone plus downstep.
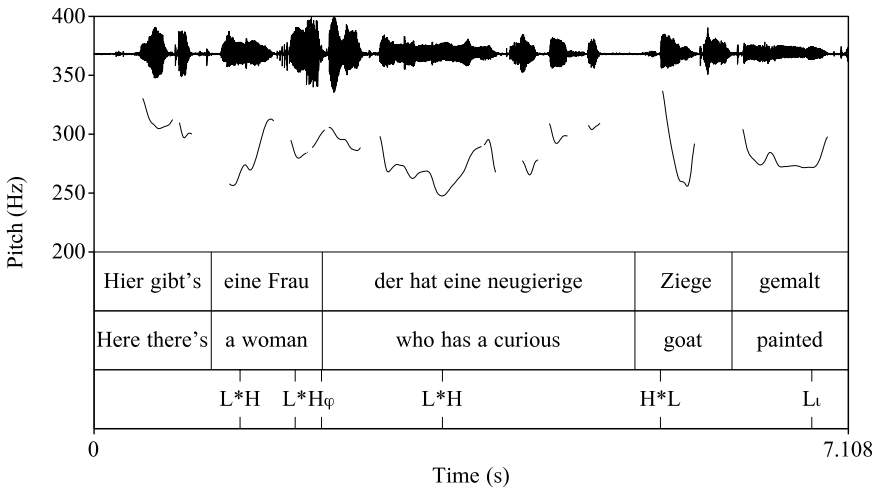

Figure 6: Pattern II in children's prosodic realization: high boundary tone, absence of downstep.

4.4.4 Statistical analysis

In order to answer our two research questions, we investigated the distribution of Pattern I and Pattern II in both adults' and children's productions in the two conditions. Figure 7 plots the proportion of responses, showing the proportions of
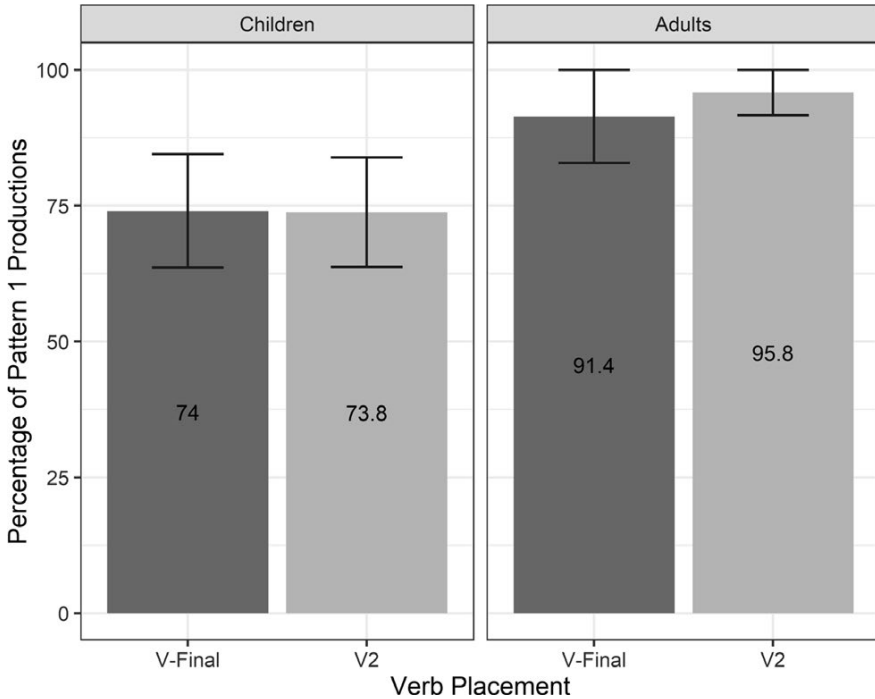
Figure 7: Percentage of responses of Pattern I productions for adults and children according to verb placement in the RC (V-Final and V2). (The error bars represent +/− 1 standard error of the between-subject variance.)

Pattern I utterances as calculated on a by-subject basis. The remaining percentages to reach 100 % comprise the proportions of Pattern II utterances.[7]

The data were analyzed using a generalized linear mixed-effects (LME) model in R (R Core Team 2016) with the package lme4 (Bates et al. 2015). The model contained two random components: participants and items. As the dependent variable, Pattern I was used, which was set as 1 for Pattern I utterances and 0 for Pattern II utterances. Two factors were allowed to interact: Age (Adults vs. Children) and Verb Placement in the productions (V-final vs. V2).[8] The model esti-

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7 All eight adults produced Pattern I; only one adult also produced Pattern II. Out of the seventeen children, fifteen produced Pattern I, eleven of which also produced Pattern II. Two children only produced Pattern II.
8 The formula is the following: pattern1 ~ 1 + agegroup ∗ vposResp + (1 | ID) + (1 | itemno). As random components only intercepts for participants and items are included. No random slopes

Table 3: Output of the statistical model. (For each effect the effect size in log odds (from the model) is given along with the standard error, z- and p-values and the significance level (* < .05, ** < .01, *** < .001)).

Effect	Effect size [log odds]	Standard error	*z*-value	*p*-value	Significance level
Intercept	2.7354	0.7191	3.804	0.000142	***
Age (Adults vs. Children)	1.9848	1.1650	1.704	0.088445	
Verb Placement (V-final vs. V2)	−0.3835	0.7997	−0.480	0.631545	
Age:Verb Placement	−1.6957	1.6797	−1.010	0.312718	

mates the probability to produce Pattern I given the age and the verb placement in the RC.

The estimates are given in log odds (see Table 3), because the model uses a binomial link function. Regarding the proportion of Pattern I utterances, the model shows that both adults and children performed significantly above chance in choosing Pattern I over Pattern II (p = .000142). Moreover, the fixed effects, Age and Verb Placement, are not significant, even though there is a tendency for an age effect (p = .088). This effect is positive (going from children to adults), indicating that adults gave relatively more Pattern I responses overall than children did. The effect of Verb Placement is not significant (p = .632), i. e., the frequency of Pattern I responses did not significantly differ depending on the verb placement in the RC (V-final vs. V2). In addition, the interaction between Age and Verb Placement is not significantly different from chance. That is, there is no significant difference between children and adults in the production of Pattern I responses depending on the verb placement of the RC.

5 Discussion

This study investigated the prosodic patterns of verb-final RCs and iV2 structures produced by adults and three-year-old children in an experimentally controlled setting. Two research questions were addressed: (Q1) Is subordination mapped onto prosodic integration in relative clause structures with verb-final and with V2

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were included because of two reasons: (a) there is limited data in general, and (b) some items occur only once and some participants only give a few responses, making it difficult for the model to estimate variance across participants for the fixed effects.

order in adults? (Q2) Are children at the age 3 sensitive to this mapping, and if so, does this hold in both verb-final and V2 relative clause structures? The data sample consisted of the responses collected in a delayed sentence-repetition experiment targeting V2 and verb-final RC structures. A total of 62 repetitions produced by 8 adult speakers and a total of 99 repetitions produced by 17 child speakers were analyzed prosodically. Following Féry (2011), prosodic integration was defined as presence of (i) a rising boundary tone at the end of the main clause and before the RC, which signals continuation, and presence of (ii) a downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause, i. e., the nuclear accent of the embedded clause is lower than that of the main clause. Accordingly, we distinguished two prosodic patterns: Pattern I of prosodic integration, i. e., properties (i) and (ii) are fulfilled, and Pattern II of prosodic non-integration, i. e., one or both of the properties (i) and (ii) are missing. All utterances were analyzed regarding the quality of the boundary tone at the end of the main clause and before the RC and regarding the presence of a downstep between the nuclear accent of the main clause and the nuclear accent of the embedded clause. All analyses were carried out on the pitch tracks produced with Praat.

    With regard to Question 1, our results indicate that adults realized the restrictive RCs both with verb-final and with V2 order as prosodically integrated into the main clause. 91 % of the verb-final utterances exhibited the presence of a high boundary tone plus a downstep (Pattern I). Similarly, 96 % of the V2 repetitions exhibited the presence of a high boundary tone plus a downstep (Pattern I). The statistical analysis confirmed that the production of Pattern I, i. e., of utterances with prosodic integration, was significantly higher than the production of Pattern II, i. e., utterances with no prosodic integration. Our findings support the theoretical claims, based on introspective judgments, for verb-final RCs (see Lehmann 1984; Brandt 1990) and, notably, also for iV2 structures (see Gärtner 1998; Endriss and Gärtner 2005). What is more, we may conclude that the iV2 structures produced by adults are in fact subordinate clauses and not main clauses as proposed in Gärtner (1998, 2002). Our results are in line with the empirical studies on verb-final RCs by Hirschberg et al. (2014) and Schubö et al. (2015), using different designs. However, our study did not replicate the previous findings of Schaffranietz (1999) and Birkner (2008, 2012) that restrictive verb-final RCs are often realized with prosodic non-integration. Furthermore, our data regarding the prosodic integration exhibited in iV2 structures differs from the results in Birkner (2006), according to which the "*Mensch*-construction" iV2 structures showed almost no prosodic integration. Future research is needed to explore in how far the difference between our findings and the findings by Schaffranietz (1999) and Birkner (2006, 2008, 2012) results from the different settings. In contrast to semi-spontaneous (Schaffranietz

1999) and spontaneous (Birkner 2006, 2008, 2012) speech data, the current study analyzed elicited productions in an experimental context. This may have resulted in more conscious speech productions by the participants in the current experiment, and thus, in a more consistent production of prosodic integration. In fact, the experimental situation could have favored an RC prosody that disambiguates between restrictive and appositive RCs, whereas this need was not present in the natural speech data analyzed by Birkner (2006, 2008), and possibly in Schaffranietz (1999).

Turning to Question (2), our results indicate that three-year-old children produce both restrictive verb-final RCs and iV2 structures as prosodically integrated into the main clause. More specifically, 74 % of the verb-final utterances and 74 % of iV2 utterances were realized with a high boundary tone plus a downstep (Pattern I). The statistical analysis showed that children produced significantly more Pattern I utterances than utterances with no prosodic integration (Pattern II). Similar to the adult group, we did not find any significant difference in the prosodic integration depending on the verb placement. Our results demonstrate that children use the prosodic pattern argued for in the theoretical literature and attested in the adult group in both verb-final RCs and iV2 structures. As for the adults, we may conclude that the iV2 structures produced by three-year-old children are in fact subordinate clauses and not main clauses (Gärtner 1998, 2002). In line with the effects found for prosodic bootstrapping, we suggest that prosody might help the child to learn that – despite their apparent similarity with main clauses – iV2 structures are subordinate clauses. Notably, the proportion of Pattern I responses did not differ significantly between adults and three-year-olds, suggesting that the prosodic realization of verb-final RCs and iV2 structures may be produced in a target-like way from early on. Interestingly, unlike the adult utterances some of the child utterances exhibited no high boundary tone (10 out of 99 responses), in verb-final as well as V2 structures. Further research is needed to shed light on these unusual prosodic patterns.[9]

In summary, our study provides novel empirical evidence for the theoretically motivated claim from Gärtner (1998, 2002) that both, verb-final RCs and iV2 structures are prosodically integrated into the main clause and that this holds for adults and for children as young as age 3. More generally, our study supports the assumption that subordination is signaled by prosodic integration. Our results are compatible with many accounts, including the Match approach

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9 It could be that these ten utterances reflect a lack of understanding of the subordinated nature of the relative clause. This would explain why this flat pattern was not found in the adults' responses.

proposed by Selkirk (2011), which assumes a straightforward matching relationship between specific syntactic phrases and corresponding prosodic domains. At the same time, our findings are compatible with the processing accounts of the prosody-syntax interface as proposed by Snedeker and Trueswell (2003) and by Schubö et al. (2015). Recall that in our task two competing referents were depicted in each picture, which only differed with respect to the property encoded in the RC structure. For instance, in Figure 1 there are two men, one caught a big crocodile and one caught a kangaroo. This set up ensured a restrictive interpretation of the verb-final RCs and of the iV2 structures. It may well be the case that the participants were aware that they needed to disambiguate the subordinate clause in order to make a restrictive statement and thus, select the right referent. Similarly, participants may have been aware of the need to produce a restrictive RC in order to be pragmatically adequate. Recall that there were always two referents of the same kind, for instance two men in Figure 1. Accordingly, if the main clause *Hier ist ein Mann* ('here is a man') is not followed by a restrictive RC, this would give rise to pragmatic inconsistencies (i. e., Horn's implicature that there only is one man). Put differently, the consistent use of prosodic integration to signal restrictive subordinate clauses may reflect participants' awareness of the need to disambiguate between restrictive and appositive statements.

It remains open whether different degrees of independence correlate with different prosodic patterns as shown for Swedish in Roll (2004). Adults and children produced verb-final RCs as well as iV2 structures, which are claimed to be specified for assertive force and hence to be more independent from the matrix clause than their verb-final counterpart, significantly more often with prosodic integration than with prosodic non-integration. Our statistical analysis revealed that the frequency of prosodic integration (Pattern I) did not differ between verb-final and iV2. We acknowledge that statistical non-significance is necessarily inconclusive. Interestingly, though, note that our results resemble the findings in Kentner and Franz (2019), who investigated adults' prosodic realization of German *that* complement clauses and their embedded V2 counterparts in two production experiments and found no compelling evidence for rhythmic and prosodic differences between the two complement types.

More research is needed to investigate the phenomenon of German embedded V2 and its prosodic realization. Futures studies involving a larger number of participants and data points is required to ensure the robustness of our findings. We have argued that our experimental design due to the 3 s delay (McDade et al. 1982) did not favor parroting the structures as prosodically integrated. Nevertheless, it remains to be shown whether our results are robust across methods. As a case in point, if at age 3 children have fully mastered the prosody of verb-final and

V2 RC structures, they should produce these structures with the same prosody in spontaneous speech as well.

6 Conclusion

The current study contributes to the empirical research on the prosodic realization of German RCs in adults and is the first to investigate experimentally the prosodic realization of German verb-final RCs and iV2 structures produced by adults and by children, using the same design. Relying on intuitive judgments, both RC structures have been argued on theoretical grounds to be prosodically integrated into the main clause and hence to share the same prosodic pattern. Empirical evidence, however, has been lacking to support these claims. Addressing this gap, the present study investigated the prosodic properties of restrictive verb-final RCs and iV2 structures produced by adults in an experimentally controlled setting. In addition, we explored the prosodic realization of verb-final RCs and iV2 structures in three-year-old children to test whether their syntactic subordinationhood, claimed to be reflected at the prosodic level in adults, is present from early on. Our results showed that both adults and children produced both iV2 and verb-final RCs significantly more frequently with a prosodic integration pattern than without prosodic integration. This data strongly supports the theoretical claims for adults' prosodic realization of verb-final RCs and iV2 structures (Brandt 1990; Gärtner 1998, 2002; Endriss and Gärtner 2005). Moreover, our findings confirm previous empirical results on verb-final RCs in adults (Hirschberg et al. 2014; Schubö et al. 2015). In addition, our results indicate that already by age 3 children are sensitive to the prosodic pattern of these two structures. We conclude that the status of subordination of verb-final RCs and of iV2 structures is reflected at the prosodic level from early on – at least in the experimental set up used here. And given that prosodic integration is present from early on, we suggest that the correspondence between this prosodic pattern and subordination is a property rooted in the grammar.

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