The structure-prosody interface of restrictive and appositive relative clauses in Dutch and German

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Abstract

This paper reports a study on the structure-prosody interface of embedded restrictive and appositive relative clauses in Dutch and German. The first restrict the class to which the antecedent in the main clause refers, whereas the latter denote an additional property of the antecedent. How this difference is reflected in prosody is topic of investigation. For both languages a perception experiment was carried out to test the effect of intonational and temporal cues on the interpretation of restrictive and appositive relative clauses. Results indicate that Dutch and not German listeners can distinguish both clauses on the basis of those cues.

1. Introduction

The restrictive (RRC) and appositive (ARC) relative clauses on which this research focuses are the embedded types as in (1). English and Dutch spelling places a comma before ARCs only. In German a comma is always put before an embedded clause.

(1) The Italian who eats pasta lives in Rome.
     De Italiaan die pasta eet, woont in Rome.
     Der Italiener, der Pasta isst, wohnt in Rom.   (RRC)

     The Italian, who eats pasta, lives in Rome.
     De Italiaan, die pasta eet, woont in Rome.
     Der Italiener, der Pasta isst, wohnt in Rom.   (ARC)

RRCs differ from ARCs in the way they are related to their antecedent (ANT) in the main clause. An RRC has a narrow relation to its ANT and denotes a property that restricts the class to which ANT refers (only the Italian who eats pasta lives in Rome). ARCs have a loose relation with their ANT, they give additional information (the Italian, who eats pasta *by the way*, lives in Rome). Structurally, RRCs are deeper integrated, whereas ARCs are less integrated or placed outside the main clause ([1], [2], [3], [4] and [5]). On the basis of the literature (section 1.2) there are reasons to believe that Dutch and German, although typologically closely related, differ in the way they encode this structural distinction in prosody.

1.1. Structure-prosody interface

The prosody of RRCs and ARCs can be explained as syntactic driven, semantic driven or driven by neither of them. Syntactic structure is often said to correlate with the prosodic realisation of an utterance ([6] and [7]). For example, Truckenbrodt [8] proposes an OT account for a fairly constant alignment of the right edge of an IP with the right edge of a syntactic (embedded) clause in German. However, English data show that coordinated root clauses only form separate intonation phrases, contrary to coordinated embedded clauses. To capture both findings [8] argues that the constraints Align-CP ("The right edge of a CP must coincide with the right edge of an intonation phrase") and Wrap-CP ("Each CP is contained in a single intonation phrase") can be ranked in free order. A dominating Align-CP accounts for the German results, whereas a dominating Wrap-CP accounts for the English.

However, other work merely sees semantics as being responsible for intonational phrasing. For example, Selkirk [9] introduced the Sense Unit Condition, which states: "The immediate constituents of an intonational phrase must together form a sense unit." Selkirk [10] follows [11] in claiming that the intonational difference between sentences containing an RRC or ARC does not follow from a difference in structural position (as suggested by [12] and [13]), but from an annotating syntactic feature [+comma] which only ARCs receive.

In a study by Frazier et al. [14] sentences with extraposed relative clauses (adjoined at VP) were tested. Results show that prosodic phrases breaking a semantic coherent unit (following the Sense Unit Condition) were less acceptable than prosodic phrases breaking a syntactic constituent, which is against Wrap-XP [6]. Thus, results of [14] favour a semantic driven analysis of prosodic phrasing.

Prosodic discontinuities do not occur in constructions like "my brother Bill" or "the answer yes" ([15]). It is argued that these appositive constructions show that prosody is not necessarily driven by syntax or semantics. This view is supported for ARCs by Auran and Loock [16]. They distinguish between three types of ARC according to their discourse function (relevance, subjectivity and continuative). In their corpus study all three types occurred with distinct prosodic realisations (pitch register, duration and intensity). Auran and Loock argue that one syntactic structure can have several prosodic realisations (depending on their pragmatic interpretation).

1.2. Prosody of Dutch and German RRCs and ARCs

It has been claimed that prosodic phrasing differs for RRCs and ARCs. RRCs build one IP with their ANT, whereas ARCs form an IP alone ([2], [17], [18], [19]). However, the literature does not show consensus concerning the specific shape of the pitch contour. Renkema [20] notes that a Dutch ARC is pronounced with a lower pitch compared to the main clause. For German, Brandt [21] associates a rising pitch with RRCs and a continuing pitch with ARCs. It is unclear to which clause positions those contours are associated.

Accentuation of $N_{[ANT]}$ is seen as prototypical for Dutch and German ARCs by [2], [19], [22] and [23] because they form a separate IP. Bosker and Kunneman [23] assume that a deaccented $N_{[ANT]}$ signals an RRC for Dutch. The relative clause (RC) is said to receive an accent in any case ([2] and

[19]). Interestingly, the accentuation of DET[ANT] has been attributed to RRCs for German only ([21] and [24]).

Pause is seen as a major temporal cue being present before ARCs by [2], [21], [25] and [26]. Its effect on the perception of Dutch is found to be significant by Kaland [18]. However, Schaffranietz [24] found no perceptual effect of pause for German. A pause after the RC has been seen as prototypical by [2], [21] and [25] or optional by Birkner [19]. An even stronger claim by Holler [5] states that pause after RC can distinguish between German RRC or ARC. She argues that ARCs form a long embedded sequence, following the classification by Mayer [27]. Note that, if we draw a relation between the structural status of the ARC and the findings on pause duration of Mayer as Holler does, other types of pauses (type II and III in [27]) could also be supported by the claims of [4]. A minor temporal cue often co-occurring with pause is final lengthening [18].

The above mentioned claims for Dutch, except for those of [18] and [23] are rather based on the author's own intuitions or reference books on Dutch grammar. For German, a larger body of empirical work is available. In her corpus study Schaffranietz [24] found a 'bound' and 'separating' intonation contour. The bound contour continues on the RC and shows no pause, whereas the separating contour shows a pre-boundary fall, a post-boundary rise and a pause marking the boundary. Results indicate that 84% of the RCs were pronounced with a bound intonation, no matter whether they were restrictive or appositive. Similarly, in [28] 58,8% of the ARCs were pronounced with a 'restrictive intonation'.

A corpus study by Birkner ([19], p. 137; [29]) distinguishes between seven prosodic configurations of RRCs and ARCs, varying in their degree of integration. Results show that the majority of the ARCs are prosodically integrated and a considerable number of RRCs are prosodically disintegrated.

Thus, the corpus studies of Schaffranietz and Birkner both indicate that the intonation pattern by itself is not able to distinguish RRC from ARC. As Birkner [19] concludes, the results rather support the claim that prosody acts autonomously.

1.3. Literature summary and hypotheses

Table 1. *Literature on prosody of RRCs and ARCs*

Prosody	Claim	Literature
Intonation		
- phrasing	RRC: IP with ANT ARC: IP alone	[2], [17], [18], [19]
- contour	RRC: rising ARC: continuing	[21]
- BT	RRC: continuing ARC: falling	[24]
- RC	ARC: lower pitch	[20]
Accentuation		
- on DET[ANT]	RRC: present	[21], [24]
- on N[ANT]	ARC: present	[2], [19], [22], [23]
	RRC: absent	[23]
- on RC	RRC & ARC: present	[2], [19]
Pause	not distinguishing	[24]
- before RC	distinguishing	[18]
	ARC: present	[2], [21], [25], [26]
- after RC	distinguishing	[5]
	RRC & ARC: optional	[19]
	RRC & ARC: present	[2], [21], [25]
Final lengthening	ARC: present	[18]

To sum up the prosodic characteristics of RRCs and ARCs mentioned in the literature, Table 1 is provided. for both Dutch and German there is consensus about intonational phrasing, accentuation of the N[ANT] of ARCs, pause before the ARC and pause after both the RRC and ARC. For the other features, a variety of assumptions and findings exist.

The hypotheses in (2) can now be formulated (B1 = boundary before RC, B2 = boundary after RC):

(2) I - phrasing: when ANT and RC build one IP an RRC is favoured
II - accentuation: when ANT is accentuated an ARC is favoured
III - BTs: when B1 is tonally marked, an ARC is favoured
IV - pause: when B1 is temporally marked, an ARC is favoured.
V - B2: both RRC and ARC are preferred when B2 is temporally and tonally marked.
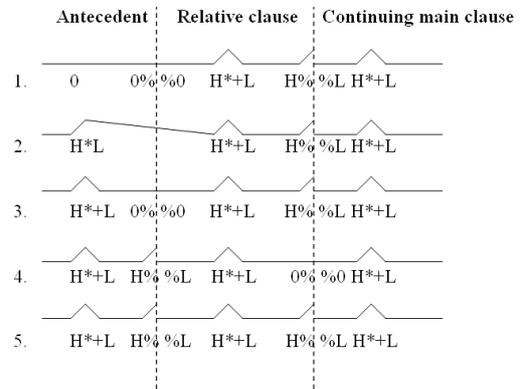
2. Method

Figure 1: *Pitch contours used in the experiments.*

Intonational and temporal cues were manipulated on sentences containing an RRC or ARC. As for intonation five contours were used (Figure 1, henceforth C1 to C5) varying in three different aspects: (un)marking of N[ANT], (un)marking B1 and (un)marking B2. C1 neither marks ANT, nor B1, so ANT and the RC could form one IP having only an accent in the RC. This contour is prototypical for the German RRC ([19]). C2 marks ANT, albeit with L reaching the baseline before the next accented syllable and thus crossing B1. Here ANT forms an IP with the RC as well. Cohesion could be expected. C3 only assigns nuclear accents to three IPs. No tones cross boundaries, only B2 is accented as in the previous contours. Both cohesion (B1 not marked) and breaking (separate IPs) could be expected. C4 marks B1, but not B2. This contour contrasts minimally with C3 and C5 to test the importance of the individual sentence boundaries. C5 exhibits tonal marking of three IPs and both B1 and B2. This contour is a prototypical production of the German ARC ([19]) and preferred perceptually for Dutch ARCs ([18]).

As for the temporal characteristics, pause and final-lengthening marking B1 or B2 were co-varied.

2.1. Stimuli

One native speaker of Dutch and one native speaker of German read aloud sentences of the type in (1) with an obligatory restrictive or appositive reading. This reading was

obtained by using (negative) quantifiers in ANT (RRCs) or sentence adverbs like 'by the way' in the RC (ARCs). The sentences were presented with punctuation marks and recorded as a wave file on a computer (mono, 16 bit, 32 kHz).

The recordings were edited on a computer using Praat [30]. B1 and B2 were either temporally marked (pause and final lengthening present) or unmarked (pause and final lengthening absent). Pause durations of 200 ms were taken ([18], [24]). A factor of 1.4 was taken for final lengthening of the vowel in the last syllable preceding the boundary ([18]).

After temporal manipulation the five pitch contours shown in Figure 1 were added to each sentence. To account for microprosodic differences this was done differently for Dutch and German. For the Dutch stimuli a text-to-speech program (Fluency by [31]) generated C5 for each stimulus sentence. The pitch point positions and the Hertz values of the Fluency-contour were then copied on the recordings using Praat [30]. The other pitch contours were deduced from C5 by deleting pitch points. The stylization of the German pitch contours is based on the model of Adriaens [32]. The other contours were derived from C5 again by deleting pitch points, except for C4. This contour was derived from C5 by lowering the second BT with 5 semitones, so that there was no declination reset (the pitch height stays at declination level 3, see [32], chapter 4.3).

2.2. Procedure

Per experiment 20 native speakers without hearing problems participated voluntarily. They were all students in the age of 19-25 (Dutch) and 19-29 (German). The male/female ratio was 9/11 for Dutch and 10/10 for German.

The subjects' task was to judge how well the intonation (explained as general term for all prosodic characteristics taken together) fits to the contents of the stimulus sentence. The judgements were given on a 0-10 scale (0: worst chosen intonation, 10: best chosen intonation). Participants had three seconds to make a judgement on an answer form. To prevent habituation effects the 80 stimulus sentences were randomized and presented twice. Two orders were used: the first was presented to the initial 10 participants, the second (in opposing order) was presented to the final 10 participants. For concentration matters the two initial and final stimuli were dummies. Four test stimuli were presented before the actual experiment started, so that the participants could get used to the sound and tempo of the experiment. Judgements of the test stimuli are ignored in the data.
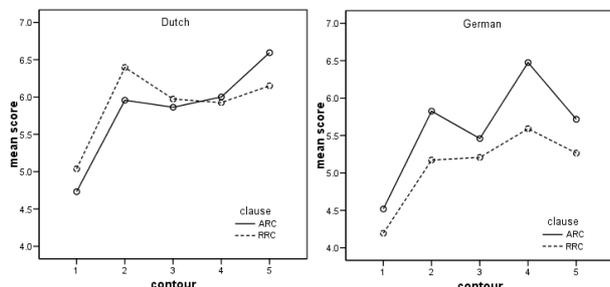
3. Results

Figure 2: *Mean acceptability scores per contour for RRCs and ARCs (all data).*

Mean acceptability scores were calculated per contour per language (Figure 2). The Dutch scores being overall higher compared to the German ones show that RRCs are preferred with C2 and ARCs with C5 (lines cross between C3 and C4). For German no such preference exists: ARCs are overall higher rated. An RM-ANOVA of the Dutch scores (within-subject factors: clause-type, contour, B1 and B2) shows that the effect of the contour is significant [$F_{(4, 76)} = 13.8$, $p < 0.0001$]. The temporal effects show significance at B1 [$F_{(1, 19)} = 6.7$, $p < 0.018$], but not at B2 [$F_{(1, 19)} = 0.9$, $p < 0.356$]. There is significant interaction between the contours and B1 [$F_{(4, 76)} = 3.4$, $p < 0.014$] as well as B2 [$F_{(4, 76)} = 2.8$, $p < 0.031$]. The same RM-ANOVA on the German data shows that contour has a highly significant effect [$F_{(4, 76)} = 13.2$, $p < 0.0001$]. Although not significant, a difference between the effect of B1 [$F_{(1, 19)} = 0.8$, $p < 0.380$] and B2 [$F_{(1, 19)} = 3.2$, $p < 0.089$] was found. The interaction between contour and B1 or B2 was not significant, but showed differences as well [contour*B1: $F_{(4, 76)} = 2$, $p < 0.107$ and contour*B2: $F_{(4, 76)} = 2.3$, $p < 0.069$].

Results found in this study suggest that Dutch and German have different structure-prosody interfaces of embedded RRCs and ARCs. Dutch listeners' scores largely confirm the hypotheses: lines cross between C3 and C4 indicating that there is a preference for contour depending on the type of clause (Figure 2). Thus, when ANT and RC build one IP (C1, C2, C3) an RRC is favoured (I). No evidence can be found for a strong effect of accentuation favouring an ARC reading (II). This contradicts [22] and [23]. Higher ARC scores for C4 and C5 confirm (III). When the results are broken down by temporal marking (Table 2) ARCs are favoured for C3, C4 and C5 (only B1 marked) or slightly for all contours (B1 and B2 marked) confirming (IV). Evidence for a temporally and tonally marked B2 is not found. This rejects (V) and contradicts [25].

Table 2. *ARC preference ($m_{ARC} - m_{RRC}$) per contour split for temporal boundary marking (– = unmarked, + = marked)*

Temporal marking	Language	C1	C2	C3	C4	C5
–B1 –B2	Dutch	-0.48	-0.93	-0.28	0.27	0.60
	German	0.76	0.64	0.34	0.81	0.36
–B1 +B2	Dutch	-0.97	-0.44	-0.94	-0.45	0.14
	German	0.05	0.54	-0.13	0.74	0.74
+B1 –B2	Dutch	-0.34	-0.50	0.43	0.34	0.20
	German	0.31	0.65	0.46	0.99	0.66
+B1 +B2	Dutch	0.50	0.03	0.35	0.07	0.84
	German	0.21	0.74	0.29	0.87	0.14

German listeners, however, show a contour preference (C4) which is independent from clause type. Therefore it is hard to find any evidence confirming the hypotheses I to IV in favour of one of the clause types. Nevertheless, the C4 bias indicates a rather fine-grained preference for intonational unmarking and temporal marking (Table 2) confirming (V) at least partly.
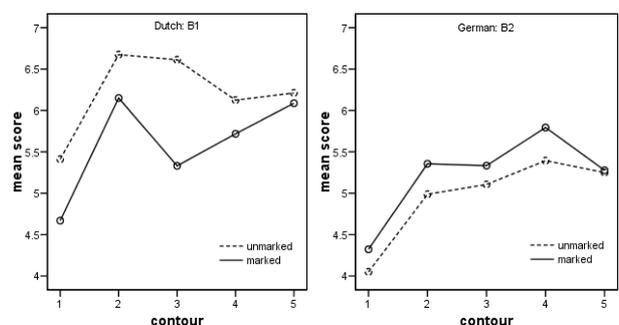

Figure 3: *Mean acceptability scores per contour for temporal (un)marking (RRCs only).*

If results are split for temporal marking and boundary Dutch RRCs show a preference for an unmarked B1, whereas German RRCs are preferred with B2 marked (Figure 3). This picture holds for all contours and can neither be found for the other RRC configurations (Dutch: B2, German: B1) nor for ARCs. The effect of temporal marking in Figure 3 is significant for Dutch [$F(1, 19) = 7.8$, $p < 0.012$] but not for German [$F(1,19) = 2.5$, $p < 0.133$].

4. Conclusions

The results are asymmetric in three ways: Dutch listeners depend more on prosody than German listeners, the perception of RRCs seems to be more determined by prosody than the perception of ARCs and temporal cues are stronger than intonational cues. The latter finding is in line with strong pause effects on perception for Dutch by [18].

As shown by the RRC results Dutch and German differ in the way they mark structural cohesion prosodically. Dutch listeners perceive cohesion when B1 is unmarked, German listeners perceive it when B2 is marked. This is not surprising since an unmarked B1 prevents RRCs from being heard as a separate IP and a marked B2 signals that the preceding has to be interpreted as one IP. The importance of B2 for German confirms the suggestion of Holler [5] following Mayer [27] (section 1.2).

The hypotheses for Dutch are confirmed to some extent. For German it is not only the case that no hypothesis can be fully confirmed, results even suggest that prosody is fixed regardless of clause type. This raises the question how German listeners can distinguish RRCs from ARCs. If prosody has a minor role, pragmatic (discourse) cues could be decisive as suggested by Auran and Loock [16]. Such an answer could possibly also account for the results of Schaffranietz [24], [28] and Birkner [19], [29] (section 1.2). Interestingly, prosody dependency in distinguishing embedded clause types could then be seen as a language dependent factor.

This research has failed to show a uniform relation between structure and prosody for both Dutch and German. Despite the consensus on prosodic cues signalling either cohesion or breaking the question remains whether the prosodic differences between both languages are reflected in their punctuation habits or whether punctuation differences are only conventional and unrelated to prosody. The literature showed a variety of syntactic analyses. In the light of those analyses a tendency could be found for RRCs to be deeper structurally integrated than an ARCs. The results of the experiments only partly reflect this tendency. Future research should explore to what extent other (non-)prosodic cues are able to discriminate RRCs from ARCs.

5. Acknowledgements

6. References

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