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On the Limits of Non-Parallelism in ATB Movement: Experimental Evidence for Strict Syntactic Identity[1]

1 Introduction

Both the theoretical and the empirical syntax literature contain examples where ambiguous (i.e., syncretic) morphological forms can resolve morphosyntactic feature conflicts. To mention two examples:

1. Disjunctive coordination of conjuncts with different person values gives rise to conflicting agreement requirements on the verb. In the following German example, the syncretic present tense ending *-t* is more acceptable than the non-syncretic form of the past tense (*-t* vs. -Ø), see Fanselow & Frisch (2006: 302ff.):

(1) a. Er oder ihr kommt verspätet zu dem Treffen.
he or you(PL) come.3SG/2PL.PRS late to the meeting
'He or you come late to the meeting.'

b. Er oder ihr kamt verspätet zu dem Treffen.
he or you(PL) come.2PL.PST late to the meeting
'He or you came late to the meeting.'

1 Earlier versions of this research were reported at Linguistic Evidence (Tübingen 2012) and at Workshare (Nantes 2012). We thank the audiences at these occasions, in particular Asaf Bachrach, Peter Culicover, Sam Featherston, Kyle Johnson, Luis Vicente, Thomas Weskott and Susanne Winkler. We are also grateful to Gisbert Fanselow for comments on an earlier version of the chapter, to Nicolas Heizmann for help with the materials and running the study, and to Robin Hörnig for help with the statistical analysis and graphics. Finally, the chapter has greatly benefited from the comments of the two reviewers. This research was supported by the DFG SFB 833, Project A7 and B5 (Hartmann, Konietzko), and by grant PA00P1_136379/1 from the Swiss National Science Foundation (Salzmann).

replace with:
by the matrix verb

insert after
"forms":
like *wer*

2. Comparable case conflicts arise with free relatives in German, where the relative pronoun has to match both the case assigned within the relative clause as well as the case assigned ~~to the relative clause as a whole~~. Again, while syncretic forms like *was* 'what' can resolve mismatches, non-syncretic forms are much less acceptable, see Vogel et al. (2006: 363ff.):

(2) a. Ich verteidige$_{\text{ACC}}$, wer __$_{\text{NOM}}$ mich ergreift.
I defend who.NOM me moves
'I defend who moves me.'
b. Ich glaube$_{\text{ACC}}$, was __$_{\text{NOM}}$ mich ergreift.
I believe what.NOM/ACC me moves
'I believe what moves me.'

These two examples clearly show that syncretism, and thus morphological case, plays an important role in (certain domains of) syntax. This is not only an interesting fact in itself, it also constitutes an important clue for the proper syntactic analysis of a given phenomenon.[2]

Across-the-board movement (ATB movement) as in (3), where a filler seems to be related to two gaps simultaneously, can also give rise to conflicting requirements (see Ross 1967).

(3) [Which book] did [John like __] and [Mary dislike __]?

It has often been reported in the literature on ATB movement (e.g., Dyla 1984; Franks 1995: 61ff.; Citko 2005: 487) that case mismatches are tolerated as long as the filler bears a syncretic, i.e. underspecified, form that is compatible with the conflicting requirements of both verbs. This is illustrated by the following example from Polish where the *wh*-word *kogo* is compatible with both accusative and genitive:[3]

2 Note that the two examples of mismatches in (1) and (2) are not fully parallel. The person mismatches lead to decreased acceptability even with the syncretic form, whereas the case mismatches resolved by *was* are judged on a par with fully acceptable sentences where the verbs impose the same case value. This suggests that systematic syncretisms like that in the case of *what*, which can be analyzed as involving underspecification, are treated differently from accidental syncretisms like that between third singular and second plural, which do not lend themselves so easily to an underspecification analysis (but cf. Müller 2006).

3 An exception to this generalization is found in Bondaruk (2003: 230f.). She points out that non-syncretic mismatches between genitive and accusative are possible if the genitive is a genitive of negation.

(4) Kogo$_{\text{ACC/GEN}}$ [Jan nienawidzi __$_{\text{GEN}}$] a [Maria lubi __$_{\text{ACC}}$]?
who.ACC/GEN John hates and Mary likes
'Who does John hate and Mary like?' (Polish)

If instead the *wh*-word is compatible with only one of the verbs, the result is ungrammatical, see Citko (2005: 485):[4]

(5) *Kogo$_{\text{ACC}}$/Komu$_{\text{DAT}}$ [Jan lubi __$_{\text{ACC}}$] a [Maria ufa __$_{\text{DAT}}$]?
who.ACC/who.DAT John likes and Mary trusts
'Who does John like and Mary trust?' (Polish)

In this chapter we will focus on German ATB movement, where – according to the literature – syncretic mismatches are also tolerated:[5]

(6) [Käse] $_{\text{ACC/NOM}}$ [mag ich nicht __$_{\text{ACC}}$] und
cheese.NOM/ACC like I not and
[ist __$_{\text{NOM}}$ auch nicht gut für mich].
is also not good for me
Lit.: 'Cheese I don't like and is also not good for me.'
(Standard German, te Velde 2005: 229f.)

So far, the tendency seems fairly clear. Mismatches in ATB movement are tolerated only if there is a syncretic/underspecified form that is compatible with the conflicting requirements of both verbs.

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4 Surprisingly, the very same example with *kogo* is given as acceptable in Kluck (2009: 150), who cites personal communication with Barbara Citko.

5 Interestingly, in right-node-raising, another sharing construction, even non-syncretic case mismatches have been claimed to be acceptable in German as long as the filler matches the requirements of the adjacent verb, see Citko (2008: 24):

(i) ?Marie vertraute$_{\text{DAT}}$ __ und
Marie trusted and
Johannes kannte$_{\text{ACC}}$ [**den** **Mann**]/* [dem Mann]
Johannes knew the.ACC man the.DAT man
'Marie trusted, and Johannes knew, the man.'

We have no indication that such mismatches are possible in ATB movement. The empirical verification of this contrast will be subject to future research.

However, morphological identity is not sufficient to restrict ATB movement. Consider the following example (Dyla 1984: 704):

(7) *Dziewczyna, której [Janek dał swoją marynarkę $\_\__{DAT}$]
girl who.DAT John gave REFL jacket
a [mimo tego $\_\__{DAT}$ było zimno ...]
and in.spite it was cold
'The girl who John gave his jacket and in spite of it was cold.' (Polish)

The example is ungrammatical although both gaps are assigned the same morphological case, viz. dative. Franks (1995: 64–77) argues (against Dylas' analysis requiring identity in both abstract and morphological case) that next to morphological identity ATB movement is subject to an additional requirement, viz. that arguments must be identical with respect to thematic prominence. He proposes the following constraint (Franks 1995: 67):

(8) In any ATB construction, the gaps must pertain either to most prominent or to not most prominent arguments, consistently across the conjuncts.

This accounts for the grammaticality of mismatches like (4) and (6), where the gaps are not most prominent in both conjuncts (note that the experiencer in (6) is taken to be higher on the thematic hierarchy than the theme). It also correctly rules out (7) because the first gap is not most prominent whereas the second one is most prominent (as it is the only argument). Furthermore, it can also account for mismatches in abstract case in English where a matrix direct object is combined with an embedded subject (Munn 1993: 43 and Williams 1978: 34):

(9) a. Who did [John support __] and [Mary say __ would win]?
b. I know the man who [John likes __] and [we hope __ will win].

The subject in the second clause does not count as most prominent because of the matrix subject. The importance of thematic relationships is also seen in the following pair involving an experiencer verb (Franks 1995: 76):

(10) a. the boy who [frightened Sue __] and [she hit __] (–agentive)
b. the boy who [__ frightened Sue] and [__ hit her] (+agentive)

Verbs with accusative experiencers usually allow for both a non-agentive reading where the nominative subject functions as a source and is generated as an internal argument (e.g., the mere presence of the boy frightens the girl) and an agentive reading where the subject is volitional (e.g., the boy frightens Mary actively and intentionally by pointing a gun at her) and is generated as an external argument.

Crucially, (10a) only allows for the non-agentive reading whereas (10b) requires the agentive reading. This is in accordance with (8): The gaps are not most prominent in (10a) but most prominent in (10b).

However, the literature contains a number of examples that are not compatible with Franks' generalization (as he notes himself). They all involve combinations of a not-most prominent gap in the first conjunct with a most prominent gap in the second (see Franks 1995: 83, Munn 1993: 65, Goodall 1987: 75):[6]

(11) a. ?a book which [I haven't read__] but [__ was recommended by several professors]
b. ?the man who [John suspected __] but [__ hadn't committed the crime]
c. We went to see a movie which [the critics praised __] but [__ was too violent for my taste].

What is important for the ensuing discussion is the generalization that mismatches in ATB movement are restricted by a morphological identity requirement and some sort of thematic compatibility requirement (even though the exact nature of this requirement is presently ill-understood, we include theta role as a factor in our experiments below to control for this). But mismatches in abstract case, differences in the internal structure of the conjuncts (types of verbs, differences in embedding) and gaps in non-parallel position are in principle tolerated.

Since the previous literature on mismatches in ATB movement is only based on individuals' judgments and since there is some disagreement about the possible mismatches, this chapter intends to explore the limits of

6 Another counterexample to Franks' generalization is found in Dyla (1984: 701), where the combination of an accusative direct object gap with the gap of a nominative subject of an unaccusative experiencer (acc-nom) verb is judged ungrammatical despite the fact that both arguments are not most prominent and the filler bears a syncretic form. Furthermore, Bondaruk (2003: 236) shows that the combination of a dative experiencer argument with the sole genitive theme argument of an unaccusative verb leads to ungrammaticality even though both roles are most prominent. Still another counterexample ~~from English~~ is the following (from Munn 2001: 391, fn. 4), where a matrix subject gap is coordinated with an embedded subject gap:

i. the man who [__ read the paper] and [Bob said __ understood it].

Franks suggests that it could be accommodated if the arguments of the matrix verb in the second conjunct only count optionally. This surely weakens the generalization. Bradley Larson (p.c.) suggested an alternative explanation to us: (i) may involve a parenthetical – *Bob said* – so that the gaps would actually both be most prominent.

replace "coordinated" with "combined"

no comma

non-parallelism in ATB movement in a systematic empirical fashion. We will focus on German in our experiment because it has morphological case, but as opposed to Slavic languages is much less studied in this area. Our chapter is organized as follows: In section 2, we will provide some background information about previous approaches to ATB movement and their predictions with respect to case mismatches. Section 3 introduces two rating studies that investigate to what extent case mismatches are tolerated in German ATB movement and whether it is constrained by a syntactic or a morphological identity requirement. Section 4 reports a self-paced reading experiment based on the rating studies that aims at relating the results of the ratings to processing. Section 5 concludes the chapter.

2 Approaches to ATB movement and their predictions with respect to case mismatches

The major current approaches to ATB movement can be largely divided into two groups: approaches where the filler bears a privileged relationship to the first conjunct, as in asymmetric extraction approaches, and sharing approaches, where the filler has a symmetrical relationship with both conjuncts. The sideward movement approach can be considered a compromise between the two as it involves copying and thus identity as well as asymmetric extraction.

2.1 Asymmetric extraction approaches

Asymmetric extraction accounts all share the assumption that the filler originates in the first conjunct and that the gap in the second conjunct comes about in a different way.

In the parasitic gap approach to ATB movement (Munn 1993; Franks 1995; Bošković & Franks 2000), coordinating conjunctions are functional heads that project a BP (= Boolean phrase); the BP is adjoined to the first conjunct. In ATB movement there is asymmetric extraction from the first conjunct while empty operator movement in the second conjunct leads to a parasitic gap. The two chains are then combined via chain formation:

(12) Which book$_1$ did [$_{TP}$ [$_{TP}$ John like __$_1$] [$_{BP}$ Op$_2$ [$_{B'}$ and [$_{TP}$ Mary dislike __$_2$]]]]?

As far as we can tell, the issue of case mismatches has not been addressed in these accounts; but it seems to us that since the two operators receive case from two different case probes, nothing in principle seems to rule out conflicting cases on the two operators. To rule out such mismatches the chain composition mechanism would have to be extended by an explicit constraint.

Zhang (2010) proposes an account based on asymmetric extraction and variable binding: The filler extracts asymmetrically from the first conjunct and binds a *pro*-DP in the second conjunct (an instance of variable binding):

(13) Which book$_1$ did [$_{\&P}$ [$_{TP}$ John like __$_1$] and [$_{TP}$ Mary dislike *pro*-DP$_1$]]?

Nothing in this approach seems to require identity in case as there is no direct movement relationship; furthermore, variable binding allows for case mismatches, as in *I told every student$_i$ that he$_i$ should go*.

Another variant of this type of approach are analyses based on asymmetric extraction from the first conjunct plus deletion in the second (see George 1980, Wilder 1994, te Velde 2005, An 2006, Salzmann 2012a, 2012b). The constituents of the second conjunct are deleted under identity with the extracted constituents in the first conjunct (i.e., they undergo some form of ellipsis); in Salzmann (2012a: 408), this is executed as follows (strikethrough = regular PF-deletion, angled brackets = deletion under identity):

(14) [$_{CP}$[Which book]$_1$ did$_3$ [$_{\&P}$ [$_{TP}$ John ~~did~~$_3$ [$_{vP}$ ~~[which book]~~$_1$ like ~~[which book]~~$_1$]] & [$_{TP}$ Mary <did> [$_{vP}$ <[which book]$_2$> dislike ~~[which book]~~$_2$]]]]?

The extracted *wh*-phrase binds into the second conjunct at LF:

(15) [$_{CP}$ [Which $_x$] [$_{\&P}$ [$_{TP}$ John did [$_{VP}$ like [x book]]] & [$_{TP}$ Mary did [$_{VP}$ dislike [x book]]]]]?

Since there is no direct movement relationship between the extractee and the gap in the second conjunct, nothing in principle rules out mismatches in case – to the extent that they are acceptable in ellipsis (which is to be expected given that ellipsis is famous for tolerating morphological mismatches and mismatches between pronouns and R-expressions, see Fiengo & May 1994).

2.2 The sideward movement approach (Nunes 2004)

In this approach the filler is merged in the second conjunct. It is then copied to an independent phrase marker (i) from which the first conjunct is built.

After both conjuncts are complete, they are merged under &. Then there is asymmetric extraction from the first conjunct (ii). At PF, the extracted operator forms a chain both with the copy in the first conjunct and the one in the second. Chain reduction leads to the deletion of the lower copies in both conjuncts and thus derives the illusion of simultaneous movement from both conjuncts:

(16) a. [Mary dislike [which book$_1$]]
b. [like [which book$_1$]] (i)

(17) Which book$_1$ did [$_{\&P}$ [John like ~~which book~~$_1$] and [Mary dislike ~~which book~~$_1$]]? (ii)

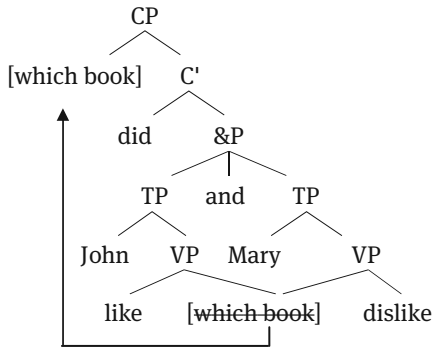
Whether case mismatches are possible depends on the precise implementation of sideward movement. If, as in the original version that is cast in the checking theory of early minimalism, DPs have pre-specified case values that need to be checked, the two DPs will necessarily bear the same case value since copying is involved. As a consequence, no mismatches, not even in abstract case, are expected; the issue is briefly mentioned in Nunes (2004: 176, fn. 12) where he seems to suggest an account in terms of underspecification, but how that interacts with chain formation remains unclear. If, on the other hand, case checking involves assignment of case values under Agree, the two DPs can differ in case features when they are affected by two different case probes; for this to be possible, sideward movement must take place before Agree. Consequently, case mismatches seem possible (but such derivations may crash since conflicting case values might prevent chain formation and chain reduction – the copies may no longer count as non-distinct).

no comma

2.3 Multi-dimensional/sharing-approaches

Such approaches have been proposed in various guises, see Williams (1978), Goodall (1987), Moltmann (1992), Citko (2005); they are the default in HPSG, cf. Pollard & Sag (1994), Levine et al. (2001). For simplicity's sake, we will only discuss Citko (2005), but as far as we can tell, our conclusions carry over to other approaches. In her proposal, constituents can undergo Parallel Merge, so that they are dominated by two mothers. For reasons of linearization, such shared constituents have to undergo movement. In ATB movement, this leads to one chain with one deleted copy.

(18)



Since the ATB-moved DP is present only once in the structure, we do not expect case mismatches. However, Citko (2005: 487) claims that mismatches in case, i.e., the assignment of conflicting case values to a single DP, are tolerated as long as there is a syncretic (i.e., underspecified) morphological form as in (4) above that is compatible with both requirements. This implies a late-insertion approach to morphology and a morphological identity requirement (but see Hein & Murphy 2016 for critical assessment).[7, 8]

2.4 Interim summary

Simplifying somewhat, current approaches to ATB movement either predict mismatches to be readily available or to be very restricted. Since according to the literature only syncretic mismatches are allowed, the facts tend to support sharing approaches. But since these claims have not been verified empirically, one should not rush to conclusions. In the following two sections, we will report three experiments that put these claims under close scrutiny and explore the consequences of the results for theories of ATB movement.

no comma

7 Note that different implementations of multidominance may allow for certain mismatches, see Moltmann (1992: 107ff.) for the domain of reconstruction.

8 In HPSG, the nonlocal feature principle (Pollard & Sag 1994: 164) allows for the percolation of slash specifications from more than one daughter; they merge by set union. This predicts strict identity between fillers and gaps as slash specifications can be unified only if they are identical. As a consequence, case mismatches are unexpected. Mismatches with syncretic forms have been addressed in Levine et al. (2001) by revising the case type hierarchy: a syncretic form is both *nom* and *acc* so that it can satisfy the unification of the requirements of both gaps, i.e., of being both nominative and accusative.

3 Rating studies

3.1 Introduction

Please replace "it has one major drawback" with "this requires some care"

s shown in the first section, the literature suggests that case mismatches e allowed in ATB movement if the shared antecedent bears a syncretic/ nderspecified case form. We will therefore investigate the following hypothesis our experiments:

(19) **Hypothesis:** ATB movement allows for case mismatches with syncretic forms only.

Before we introduce the experiments, we need to address a methodological difficulty that obtains when trying to construct an experiment that investigates the role of syncretic mismatches in German ATB movement: When we look at inflectional paradigms in the nominal domain in German, we find the most systematic syncretism between nominative and accusative case with singular feminine and neuter nouns and all nouns in the plural. It thus seems natural to capitalize on this syncretism. However, it has one major drawback: If we combine two transitive verbs in an ATB construction with the gaps in different case positions, the gaps will usually also differ in thematic role, i.e., agent vs. theme. Since compatibility of thematic role was shown to be important for the acceptability of mismatches, see section 1, transitive verbs are not the ideal test case for German. It differs from Slavic languages, where we find syncretism of cases that can be assigned to internal arguments that bear the same thematic role, i.e., theme (as in (4)). To control for the influence of theta roles, our experiments make heavy use of experiencer verbs because their arguments (Exp, Th) can occur with nominative or accusative.[9]

9 There are two other syncretisms that one could, in principle, have tested, viz. genitive-dative singular feminine and accusative-dative with bare plurals. We did not rely on the dative-genitive syncretism because genitive is only assigned by very few verbs in contemporary German (essentially just two or three) and is usually perceived as stylistically marked; this makes it unsuitable for experimental testing.

We also refrained from using accusative-dative syncretisms of bare plurals because when used with transitive verbs, these will usually involve a mismatch in theta-role (theme-recipient). Gisbert Fanselow suggested that we test accusative-dative mismatches with dative- and accusative-experiencer verbs. Even though dative-experiencer verbs are rare, we consider investigating the effects of this syncretism in future research.

Experiencers can be nominative (as in psych-verbs I) or accusative (as in psych-verbs II). If we combine the two types of experiencer verbs, we can construct examples with a syncretic case mismatch without a mismatch in theta role (this is the basis for the first rating study):

(20) a.	psych-V I:	**Nom/Exp**	Acc/Th	e.g.,	like, hate
b.	psych-V II:	**Acc/Exp**	Nom/Th	e.g.,	interest, surprise, worry, irritate[10]

Similarly, the theme can associate with both accusative (with transitive verbs and with psych-verbs I) and nominative (with psych-verbs II). Again, no mismatch in theta role obtains when we combine the two verb types (this is the basis for the second rating study)

full stop

(21) a.	transitive verb:	Nom/Ag	**Acc/Th**
b.	psych-V II:	Acc/Exp	**Nom/Th**

We have carried out two rating experiments that are based on the same design. They differ in the case and thematic role of the extractee: While it is a nominative experiencer subject in the first study, it is an accusative theme object in the second. We decided to test both because there is reason to believe that whichever choice we make (nominative/accusative) may lead to lower acceptability for independent reasons: First, subject gaps in the first conjunct are less acceptable with mismatches, (cf. Munn 1993: 43f.). Second, accusative/object gaps may lead to markedness since we employ topicalization in our experiments (a choice we will justify below). While subject topicalization is neutral, object topicalization is information-structurally marked and may therefore affect

no comma

10 We follow Belletti & Rizzi (1988) in treating such verbs as unaccusatives with acc>nom base order. The ordering facts discussed in den Besten (1985) provide independent support for this in languages like German. Note that we thus differ from Landau (2010), where non-stative verbs of this class are treated as transitive with the experiencer being base-generated as the (oblique) object and the nominative, which is treated as a causer, as the external argument. Our items include both statives and non-statives; in the latter case, our items are designed as to make an agentive interpretation unlikely.

please rephrase: "our items are designed such that an agentive interpretation is unlikely."

acceptability, see Fanselow et al. (2008). By testing both options, we intend to make sure that these effects are neutralized. The following table gives an overview of both rating studies:

Table 1: Overview rating experiments

	Material			Conditions		
	extractee	*gap1*	*gap2*	Case form	Theta role	
Experiment 1	**$SU_{Nom/Acc}$**	t_{Nom}	**t_{Acc}**	syn(cretic)	+θ match	A
					−θ match	B
	SU_{Nom}			diff(erent)	+θ match	C
					−θ match	D
	SU_{Nom}		t_{Nom}	same	+θ match	E
					−θ match	F
Experiment 1	**$DO_{Nom/Acc}$**	t_{Acc}	**t_{Nom}**	syn(cretic)	+θ match	A
					−θ match	B
	DO_{Acc}			diff(erent)	+θ match	C
					−θ match	D
	DO_{Acc}		t_{Acc}	same	+θ match	E
					−θ match	F

In both experiments, we have three levels pertaining to form. In two levels, there is a case mismatch between the two gaps.[11] In one, and this is the one we are particularly interested in, the filler is syncretic (in bold-face); in the other, it is unambiguously specified for case. In the third level, the filler is clearly specified for case and matches the requirements of both conjuncts. All three levels are tested with matching and non-matching theta roles.

11 Note that the mismatch always obtains in the second conjunct while there never is a mismatch in the first conjunct. We refrained from testing the reverse configuration because it has been shown that configurations where the filler is not compatible with the requirements of the adjacent/closest conjunct are strongly unacceptable; see, e.g., Vogel et al. (2006: 379) for an experiment with coordinated verbs assigning conflicting cases to one single DP; see also Kluck (2009) for similar observations for Right Node Raising.

3.2 Experiment 1: Rating study 1

3.2.1 Factors and conditions

We investigated the following two factors:

(22) Factor 1: Case form: syncretic – different – same
Factor 2: Theta role: match – mismatch

The factor case form defines the form of the initial DP (the extractee) and its relation to the two gaps. It has three levels: (a) the initial DP bears a syncretic case form and is linked to gaps that have conflicting case-requirements (syncretic); (b) it bears a non-syncretic case-form and is linked to gaps that have conflicting case-requirements (different); (c) it bears a non-syncretic form that is compatible with the case requirements of both gaps (same). The factor theta role is included to control for the influence of the theta role. Crossing the two factors results in the six conditions illustrated in Table 1 above.

3.2.2 Materials

We created 24 lexical variants and distributed the test sentences across six lists in a Latin Square design. Additionally, the experiment contained 80 filler sentences. Importantly, we used topicalization instead of *wh*-movement as extraction type so that we could include comprehension questions after each item to ensure that participants read and process the sentences correctly. We used TP coordination with 'and'.[12] The extractee was a nominative experiencer that matched the first gap. To vary mismatch in case and theta roles we used three different types of verbs altogether: (i) psych-verbs I with a nominative experiencer and an accusative theme (first gap in all conditions, second gap in condition E); (ii) psych-verbs II with accusative experiencer and nominative theme (second gap in condition A, C, F); and (iii) regular transitive verbs with nominative agent and accusative theme (second gap in condition B, D). The material is schematically represented in the following table (gaps are highlighted with gray, underline indicates mismatch).

12 Note that C'-coordination as in (6) may actually involve coordination of two full CPs with the subject in the second CP undergoing topic drop. TP-coordination in our experiments rules out this alternative analysis.

Table 2: Materials experiment 1

	NP	has	Arg1	Arg2	VERB	&	Arg1	Arg2	VERB
syn-match	NP nom/acc		— **nom** **exp**	NP acc theme	psych-V I		— **acc** **exp**	NP nom theme	psych-V II
syn-mismatch	NP nom/acc		— **nom** **exp**	NP acc theme	psych-V I		NP nom agent	— **acc** **theme**	trans. V
diff-match	NP nom		— **nom** **exp**	NP acc theme	psych-V I		— **acc** **exp**	NP nom theme	psych-V II
diff-mismatch	NP nom		— **nom** **exp**	NP acc theme	psych-V I		NP nom agent	— **acc** **theme**	trans. V
same-match	NP nom		— **nom** **exp**	NP acc theme	psych-V I		— **nom** **exp**	NP acc theme	psych-V I
same-mismatch	NP nom		— **nom** **exp**	NP acc theme	psych-V I		NP acc exp	— **nom** **theme**	psych-V II

A sample item illustrating all conditions is given in (23):

(23)

A. syn-match:

Diese Athletin hat __ den W. respektiert und __ der R. beunruhigt.

This athlete$_{Nom/Acc}$ has the$_{Acc}$ W. respected and __ the$_{Nom}$ R. worried

Lit.: 'This female athlete respected Werner and Robert worried.'

B. syn-mismatch:

Diese Athletin hat __ den W. respektiert und der R. __ bestochen.

This athlete$_{Nom/Acc}$ has the$_{Acc}$ W. respected and the$_{Nom}$ R. bribed

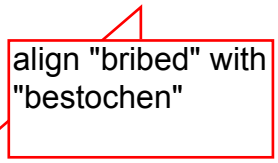
Lit.: 'This female athlete respected Hans and Robert bribed.'

C. diff-match:

Dieser Athlet hat __ den W. respektiert und __ der R. beunruhigt.

This athlete$_{Nom}$ has the$_{Acc}$ W. respected and the$_{Nom}$ R. worried

Lit.: 'This male athlete respected Werner and Robert worried.'



align "bribed" with "bestochen"

D. diff-mismatch:

Dieser Athlet	hat __ den	W. respektiert	und der	R. __ bestochen.
This athlete$_{Nom}$	has	the$_{Acc}$ W. respected	and the$_{Nom}$	R. bribed

Lit.: 'This male athlete respected Werner and Robert bribed.'

Please delete "Lit.:"

E. same-match:

Dieser Athlet	hat __ den	W. respektiert	und __ den	R. herbeigesehnt.
This athlete$_{Nom}$	has	the$_{Acc}$ W. respected	and	the$_{Acc}$ R. longed-for

Lit.: 'This male athlete respected Werner and longed for Robert.'

align "worried" with "beunruhigt"

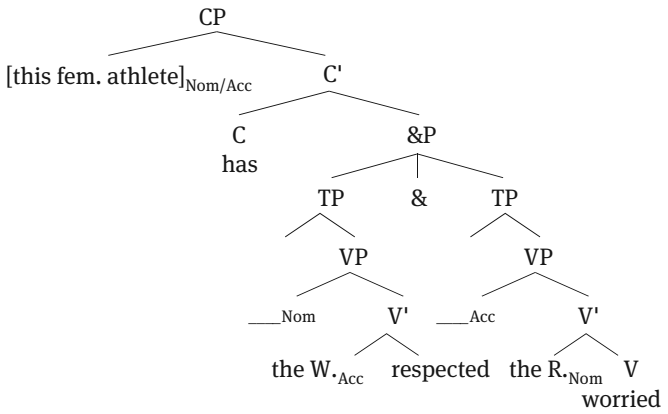
F. same-mismatch:

Dieser Athlet	hat __ den	W. respektiert	und den	R. __ beunruhigt.
This athlete$_{Nom}$	has	the$_{Acc}$ W. respected	and the$_{Acc}$	R. worried

Lit.: 'This male athlete respected Werner and worried Robert.'

The TP coordination structure we assume is illustrated in the following simplified tree structure for the sample item in condition A (syn-match):

(24) Tree structure for sample item in condition A (syn-match)



Thus, we coordinate constituents of the same syntactic category (and of the same semantic type). The internal structure of the two conjuncts differs somewhat, but this is usually unproblematic for coordination (e.g., *He laughed and went to the bathroom*).[13] Since we assume an unaccusative analysis for accusative-experiencer verbs (i.e., type II), the syn-match condition (and also the different-match condition) involves extraction from two structurally (almost fully) parallel gaps

13 According to Frazier et al. (2000), conjuncts with identical structure are processed more quickly, but this does not affect the acceptability of coordinations involving conjuncts that differ in internal structure.

(note that the nominative experiencer originates in Spec,vP while the accusative experiencer originates in Spec, VP; we abstract away from this difference in the tree diagrams). The extraction is certainly parallel in the sense that in each case the structurally highest argument is extracted. Assuming, as is standard, that structural prominence corresponds to thematic prominence, these extractions also satisfy Franks' constraint in (8): the extractee is the most prominent argument in both conjuncts. In the examples with theta-mismatch, the gaps are located in structurally non-parallel positions (external vs. internal argument or highest vs. non-highest gap/theta role).

3.2.3 Method and procedure

We used the method of thermometer judgments (see Featherston 2008) with the help of the WebExp2 software (Keller et al. 1998; Keller et al. 2009); the experiment was carried out under supervision in the Tübingen computer lab. 36 participants from the Tübingen area (all non-linguists, mostly students) rated each sentence and answered a control question after each sentence. All participants answered more than 70% of the control questions correctly. The average accuracy of the 36 participants was 91% (on average 21.4 out of 24 questions).

3.2.4 Results experiment 1

Figure 1 displays the normalized mean ratings of the F1 analysis. While the conditions E/F (form: same) that involve case-matching received comparably high ratings, all the other conditions received much lower ratings.

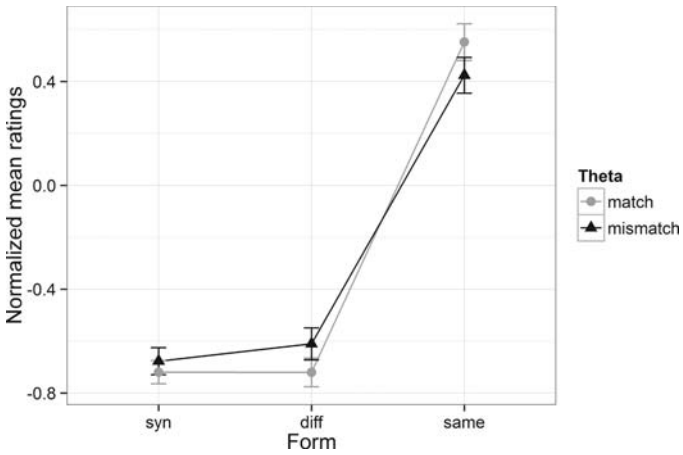


Figure 1: Normalized mean ratings (z-scores) per condition in experiment 1 (error bars indicate standard errors)

The normalized ratings were analyzed with repeated measures ANOVAs. The statistical analysis revealed a significant main effect for the factor case form: $F_1(2,70) = 145$, $p < 0.001$; $F_2(2,46) = 269$, $p < 0.001$. There is no significant main effect for the factor theta role (F_1, $F_2 < 1$) and no interaction of the two factors $F_1(2,70) = 2.8$, $p = 0.07$; $F_2(2,46) = 2.1$, $p = 0.13$. We specified two orthogonal contrasts known as reverse Helmert contrasts or difference contrasts, which compare each level of a factor with the mean of the previous levels of the factor; hence we compared, in a first step, morphologically different case forms (diff) with syncretic forms (syn), and, in a second step, we tested averaged different and syncretic forms against case identical forms (same). This reveals a highly significant contrast between identical forms (same) vs. the two other levels (syn,diff): $F_1(1,35) = 209$, $p < 0.001$, $F_2(1,23) = 450$, $p < 0.001$. This shows that there is a very clear difference between the conditions with the same form vs. the syncretic/different case forms.[14]

replace comma with semicolon

3.2.5 Discussion

Our results show that case mismatches in ATB-topicalization in German are not tolerated. Crucially, syncretisms do not lead to an improvement. The ratings in the conditions A/B were just as low as those in C/D. Consequently, the hypothesis in (19) cannot be confirmed. Additionally, mismatches in theta role do not have a significant influence. The effect that we observe reverses in the conditions SAME vs. SYN/DIFF. Our results therefore do not provide evidence for a constraint like (8) that requires identity in thematic prominence. Altogether, our results go counter our expectations and the claims in the literature. We now turn to experiment 2 that investigates the same hypotheses with slightly different materials.

3.3 Experiment 2: Rating study 2

3.3.1 Factors and conditions

The second experiment had the same design as the first; we again investigated the factors case form and theta role. The major difference with respect to the first

14 For the statistical analysis all ratings were included, independently of whether the control question had been answered correctly. Excluding the ratings for those sentences after which the control question received an incorrect answer does not change the results. The main effects and contrasts remain the same: factor CASE FORM: $F_1(2,68) = 116$, $p < 0.001$; $F_2(2,46) = 240$, $p < 0.001$; factor THETA-ROLE: F_1, $F_2 < 1$; interaction: $F_1(2,68) = 2.7$, $p = 0.08$; $F_2(2,46) = 1.8$, $p = 0.18$; Contrast in FORM level 3 (same) vs level 1,2 (syn,diff): $F_1(1,34) = 168$, $p < 0.001$; $F_2(1,23) = 434$, $p < 0.001$. One participant is missing in the F_1 analysis because of a missing value in one condition.

experiment was that the extracted topicalized phrase was the accusative theme argument of the first conjunct.

3.3.2 Materials

As in the first experiment, 24 experimental items were distributed across 6 lists in a Latin Square design; the test sentences were intermixed with 70 filler sentences. As in the first experiment, we used ATB-topicalization and the conjuncts were TPs conjoined with *und* 'and'. Changing the extractee from nominative experiencer to accusative theme had two consequences. First, the theta roles are different from experiment 1 in the matching/mismatching conditions. In A–D, the match is between two theme-arguments (and not between two exp-arguments as in experiment 1) whereas the mismatch is theme-agent (vs. exp-theme in experiment 1). In E/F the mismatch is theme-experiencer in both experiments. Additionally, we had to use different combinations of verb types in the respective conditions. In A–D the condition with matching theta role combines a transitive verb with a psych verb II (vs. psych-V-I and psych-V-II in experiment 1) and the mismatch condition combines two transitive verbs (vs. psych-V-I and a trans. V in experiment 1). In E–F the match condition E combines two transitive verbs (vs. two psych-V-I verbs in experiment 1) while we combined a transitive verb with a psych verb II in the mismatch condition F (vs. psych-V I and psych-V II in experiment 1). The material is schematically represented in the following table (gaps are highlighted with gray, underline indicates mismatch).

Table 3: Materials experiment 2

	NP	**has**	**Arg1**	**Arg2**	**V**	**&**	**Arg1**	**Arg2**	**V**
syn-match	NP nom/acc		NP nom agent	__ **acc** **theme**	trans. V		NP acc exp	__ **<u>nom</u>** theme	psych-V II
syn-mismatch	NP nom/acc		NP nom agent	__ **acc** **theme**	trans. V		__ **<u>nom</u>** **<u>agent</u>**	NP acc theme	trans. V
diff-match	NP acc		NP nom agent	__ **acc** **theme**	trans. V		NP acc exp	__ **<u>nom</u>** **theme**	psych-V II
diff-mismatch	NP acc		NP nom agent	__ **acc** **theme**	trans. V		__ **<u>nom</u>** **<u>agent</u>**	NP acc theme	trans. V
same-match	NP acc		NP nom agent	__ **acc** **theme**	trans. V		NP nom agent	__ **acc** **theme**	trans. V

Table 3 (continued)

	NP	has	Arg1	Arg2	V	&	Arg1	Arg2	V
same-mismatch	NP acc		NP nom agent	__ acc theme	trans. V		__ acc exp	NP nom theme	psych-V II

A sample item illustrating all conditions is given in (25):

(25)

A. syn-match:
Diese Komödiantin hat der H. __ besucht und den P. __ amüsiert.
This comedian$_{Nom/Acc}$ has the$_{Nom}$ H. visited and the$_{Acc}$ P. amused
Lit.: 'This female comedian, Hans visited and (she) amused Peter.'

B. syn-mismatch:
Diese Komödiantin hat der H. __ besucht und __ den P. vorgestellt.
This comedian$_{Nom/Acc}$ has the$_{Nom}$ H. visited and the$_{Acc}$ P. introduced
Lit.: 'This female comedian, Hans visited and (she) introduced Peter.'

replace with introduced

C. diff-match:
Diesen Komödianten hat der H. __ besucht und den P. __ amüsiert.
This comedian$_{Acc}$ has the$_{Nom}$ H. visited and the$_{Acc}$ P. amused
Lit.: 'This male comedian, Hans visited and (she) amused Peter.'

Please replace (she) with (he)

D. diff-mismatch:
Diesen Komödianten hat der H. __ besucht und __den P. vorgestellt.
This comedian$_{Acc}$ has the$_{Nom}$ H. visited and the$_{Acc}$ P. introduced
Lit.: 'This male comedian, Hans visited and (she) introduced Peter.'

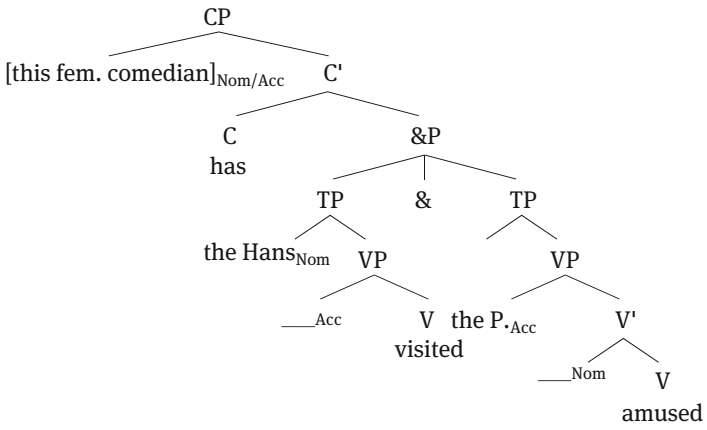
Please delete "Lit.:"

E. same-match:
Diesen Komödianten hat der H. __ besucht und der P. __ vorgestellt.
This comedian$_{Acc}$ has the$_{Nom}$ H. visited and the$_{Nom}$ P. introduced
Lit.: 'This male comedian, Hans visited and Peter introduced.'

F. same-mismatch:
Diesen Komödianten hat der H. __ besucht und __ der P. amüsiert.
This comedian$_{Acc}$ has the$_{Nom}$ H. visited and the$_{Nom}$ P. amused
Lit.: 'This male comedian, Hans visited and Peter amused.'

Again, we assume that these sentence types involve TP coordination as the simplified illustration in (26) shows for the condition A: syn-match:

(26) Tree structure for sample item in condition A (syn-match)



Note again that the gaps are structurally parallel in the conditions A/C/E (both are sisters of V). They are also identical not only in the exact theta role, but also in terms of thematic prominence, they are both not most prominent, thus in accordance with the constraint in (8).

3.3.3 Method and procedure experiment 2

The procedure was the same as in experiment 1. We used thermometer judgments (Featherston 2008) with the help of the WebExp2 software (Keller et al. 1998; Keller et al. 2009). 42 participants rated each sentence and answered a control question after each sentence. We excluded five participants that had an error rate above 30% for the question following the judgment. To have an equal number of participants on all six lists, the last participant on the remaining list was excluded. The average accuracy of the remaining 36 participants was 92% (22 out of 24 questions).

3.3.4 Results experiment 2

As Figure 2 shows, there is a sharp contrast between E/F on the one hand and the clearly less acceptable A–D (syn and diff) on the other hand. While the match/mismatch conditions in the syn and diff conditions differ only slightly from each other, the match condition received much better ratings than the mismatch condition when case forms were the same. The normalized ratings were analyzed with repeated measures ANOVAs. The statistical analysis revealed a significant

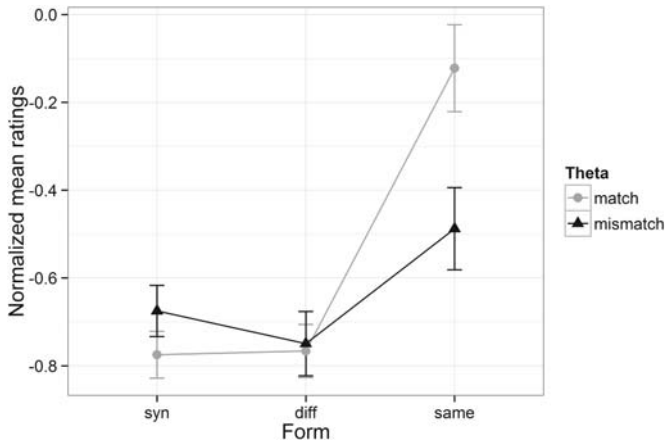


Figure 2: Normalized mean ratings (z-scores) per condition in experiment 2 (error bars indicate standard errors)

main effect for the factor case form: $F_1(2,70) = 10.1$, $p < 0.001$; $F_2(2,46) = 43.4$, $p < 0.001$. Although there was no significant main effect for the factor theta role [$F_1(1,35) = 3.1$, $p = 0.09$; $F_2(1,23) = 1.6$, $p = 0.22$], there was a significant interaction, $F_1(2,70) = 11.9$, $p < 0.001$; $F_2(2,46) = 7.8$, $p < 0.002$. The interaction is clearly a result of the difference between the two conditions (E,F), which is significant: $t_1(35) = 3.9$, $p < 0.001$, $t_2(23) = 3.97$, $p < 0.001$. The difference between C, D (diff), however, is not significant, while that between A/B is only marginal ($p = 0.065$). Again we specified the reverse Helmert contrasts or difference contrasts. We find a highly significant effect of the factor form when identical (same) forms are compared against both different and syncretic case forms [$F_1(1,35) = 11.9$, $p > 0.003$; $F_2(1,23) = 86.1$, $p < 0.001$].[15] We also find a highly significant interaction between form and theta role when identical (same) forms are compared against both different and syncretic case forms [$F_1(1,35) = 22.05$, $p < 0.001$; $F_2(1,23) = 15.2$, $p < 0.002$]. Theta-role mismatches are rated slightly more acceptable with different

Please replace "C,D" with "C/D"

replace comma with semicolon

15 Again, we included all ratings in the statistical analysis, independently of whether the control question had been answered correctly. Excluding the ratings for those sentences after which the control question received an incorrect answer does not change the results. The main effects and contrasts remain the same: factor CASE FORM: $F_1(2,70) = 10.05$, $p < 0.001$; $F_2(2,46) = 41.8$, $p < 0.001$; factor THETA ROLE: $F_1(1,35) = 3.2$, $p = 0.08$, $F_2(1,23) = 1.8$, $p = 0.19$; interaction: $F_1(2,70) = 11.6$, $p = 0.249$; $F_2(2,46) = 5.4$, $p < 0.01$; contrast factor case form, syn/diff vs. same, $F_1(1,35) = 12.2$, $p < 0.002$, $F_2(1,23) = 87.1$, $p < 0.001$. All items and all subjects had at least one rating per condition.

replace comma with semicolon

and syncretic forms (factor case form: syn,diff), while matching theta-roles are rated more acceptable when the case form suits both gaps (same).[16]

3.3.5 Discussion

The results of the second experiment confirm those of the first. Both rating studies show that case mismatches degrade judgments in German ATB topicalization: the conditions A–D receive much lower ratings than the case-matching conditions E and F. Crucially, syncretic case forms receive equally low ratings as NPs unambiguously specified for case. The hypothesis in (19) can thus not be supported. The constraints on mismatches in German ATB topicalization are obviously stricter than we expected based on the previous literature: mismatches in case are generally not tolerated, ATB movement in German is subject to a strict syntactic identity requirement meaning that the gaps have to match not only in morphological but also in abstract case.[17]

comma after "identical"

These results have important implications for theories of ATB movement: our data support analyses that require the gaps to be identical i.e. to bear the same abstract case. This means that our results are most compatible with the sideward-movement approach assuming prespecified case values or sharing approaches that disallow the assignment of conflicting (abstract) case features to the shared DP.

Globally, case has a stronger effect on the acceptability judgments in our experiments than theta role. An effect of theta role was only found in experiment 2, where there is a difference between E and F, which is significant, and, as expected, the match condition receives higher ratings. Our results certainly do not support a general constraint [illegible] in thematic prominence.

insert: case

insert: role

16 We also found a significant interaction between form and theta in experiment 1, when same forms are compared against the mean of different and syncretic case forms [$F_1(1,35) = 4{,}7$, $p < 0.4$; $F_2(1,23) = 4{,}97$, $p < 0.4$]. Theta-role mismatches are rated slightly more acceptable with different and syncretic forms (factor case form: syn,diff) while matching theta-roles are rated more acceptable when the case form suits both gaps (factor case form: same).

17 Gisbert Fanselow pointed out to us that the conditions A–D in experiment 2 could also be parsed as instances of asymmetric coordination with the subject of the first conjunct also serving as the subject of the second (see Reich 2009 for more information about the construction). This is indeed a possibility, but it is not clear to us in what way this would affect the judgments. Since asymmetric coordination is acceptable as such (albeit slightly marked), we would probably expect the ratings to come out better than they have in our experiment. Furthermore, since the first experiment does not allow for this interpretation but shows the same results, we are quite confident that an asymmetric coordination parse did not play a role.

There are three notes to be made concerning the theta effect. First, when looking at the low ratings of conditions A–D, one might entertain the possibility that the lack of a theta effect is due to a floor effect. However, this is unlikely because some fillers received clearly lower ratings than items in conditions A–D: in experiment 1, the lowest rating for an ATB item was −0.81 while the lowest rating for a filler was –1.4 (non-extraposed *that*-clause). In experiment 2, the lowest rating for an ATB item was −0.72 while the lowest filler received a rating of –1.74 (the same as above).

Second, it seems that the strength of the theta effect in the conditions E and F depends on the combination of verb types: the theta mismatch resulting from the combination of a transitive verb and a psych verb of type II leads to a clear decrease in acceptability (experiment 2) while the mismatch resulting from the combination of two different types of psych verbs (experiment 1) is only numerically lower than the theta-match condition.

Third, we see that the effect of the factor theta role is reversed in A–D vs. E–F (in both experiments, though only numerically in the first experiment). Surprisingly, match is worse than mismatch in the conditions A–D, while match is better than mismatch in the conditions E–F, as expected. Looking at our material in the two experiments, there is a third factor confounding with the conditions – the combination of verb types in the two conjuncts. This can be clearly seen in the material in experiment 2 (see Table 3), where conditions A, C, and F combine a transitive verb and a psych verb, while conditions B, D, and E combine two transitive verbs. There are two questions arising from these notes. First, is the combination of verb types indeed the decisive factor? Second, why should that be so? We address these questions in a self-paced reading experiment, which we describe and discuss in the next section.

4 Experiment 3: self-paced reading

In this section, we will investigate to what extent the findings of our rating studies are reflected in online processing. More precisely, we intend to show that the global differences in acceptability can be related to processing difficulties in local domains of the sentence. Given that case was found to play the decisive role for the decrease of the judgments, we expect an effect in self-paced-reading (SPR) at the point where the parser encounters the case mismatch, viz. the NP in the second conjunct (= NP3). This prediction is formulated in Hypothesis 1:

(27) Hypothesis 1:
The mismatch in case leads to longer reading times on the noun phrase in the second conjunct (NP3).

The rating studies have shown that the difference between conditions E and F, especially in experiment 2, must have a different cause. Note that in conditions B and E, the conjuncts contain identical verb types, viz. two regular transitive verbs while in conditions A and F we combined an agentive verb with a psych verb of type II. As we will show presently, assuming an incremental parser, the combination of different verb types will require reanalysis of the theta role of the filler. We expect this effect to appear in a different region: on the verb in the second conjunct in conditions A and F. This prediction is formulated in hypothesis 2:

(28) Hypothesis 2:
Theta reanalysis causes longer reading times on the verb in the second conjunct (V2).

4.1 Design of experiment 3

4.1.1 Factors and conditions

To tease apart the effects of case and theta reanalysis, we tested the following two factors. In what follows, we only include two levels for the factor Case as the difference between syncretic and morphologically different case forms was not significant in the previous experiments.

replace with verb type

(29) Factor 1: Case form: syncretic-same
Factor 2: Verb type: match-mismatch (≈ [– theta reanalysis] vs. [+theta reanalysis])

Note that the second factor is the reverse of the factor theta role in the rating studies, i.e. the initial condition A is now grouped with F and B with E. If ~~this effect~~ is indeed the relevant factor for the interactions we find in the rating study, we expect to find reflections of this in the SPR study. More concretely, Hypothesis 2 predicts that the verb mismatch/theta reanalysis gives rise to longer reading times on the verb.

4.1.2 Materials

We constructed 20 lexical variants and distributed the resulting test sentences across 4 lists in a Latin Square design. The test items were intermixed with 52 filler sentences. The test items were drawn from experiment 2, but they were expanded with additional material for the purpose of an SPR study: since we expect processing difficulty both on NP3 and on V2 (case vs. theta reanalysis), we added

an adverb as a spill-over region to separate the two. Furthermore, we added a continuation clause with *aber* ('but') to provide a spill-over region for the V2. The length of the verbs was controlled in the match vs. mismatch conditions. A sample item is given in (30); note that case and theta reanalysis of the filler is indicated below the examples, with the crucial reanalyses appearing in boldface:[18]

(30) a. [syn – verb-match: trans+trans] (formerly: B)

Diese	Komödiantin/	hat/	der	Hans/	besucht/	und/
This	comedian.NOM.ACC/	has/	the:NOM	Hans/	visited/	and/
	Nom/Ag		Acc/Th		(Acc/Th)	

den	Peter/	wahrscheinlich/	vorgestellt,/	aber ...
the:ACC	Peter/	probably/	introduced, /	but ....
Acc/Th → **Nom/Ag**			(Nom/Ag)	

b. [syn – verb-mismatch: trans+exp] (formerly: A)

Diese	Komödiantin/	hat/	der	Hans /	besucht/	und/
This	comedian:NOM.ACC/	has/	the:NOM	Hans /	visited/	and/
	Nom/Ag		Acc/Th		(Acc/Th)	

den	Peter/	wahrscheinlich/	amüsiert,/	aber ...
the:ACC	Peter/	probably/	amused, /	but ....
Acc/Th → **Nom/Ag**			Nom/***Ag*** → ***Th***	

c. [same – verb-match: trans+trans] (formerly: E)

Diesen	Komödianten/	hat/	der	Hans/	besucht/	und/
This	comedian:ACC /	has/	the:NOM	Hans/	visited /	and/
	Acc/Th				(Acc/Th)	

der	Peter/	wahrscheinlich/	vorgestellt,/	aber...
the:NOM	Peter/	probably/	introduced,/	but ...
			(Acc/Th)	

d. [same – verb-mismatch: trans+exp] (formerly: F)

Diesen	Komödianten/	hat/	der	Hans/	besucht/	und/
This	comedian:ACC/	has/	the:NOM	Hans/	visited /	and /
	Acc/Th				(Acc/Th)	

der	Peter/	wahrscheinlich/	amüsiert,/	aber ...
the:NOM	Peter/	probably/		but ...
			Acc/***Th*** → ***Exp***	

18 Note that since the factor THETA-ROLE has been replaced by the factor VERB TYPE, the syncretic condition that used to be a theta-mismatch condition (i.e., B) now appears as a match condition, whereas the formerly matching condition (i.e., A) now appears as a mismatch condition. This is why we have reversed the order between the former A and B in what follows.

replace NP1 with NP2

We presuppose an incremental parser that immediately updates case and theta information on the filler as soon as it has sufficient evidence. We assume that initial syncretic DPs are interpreted as subjects with an agent role (see the findings in Meng 1997, Schlesewsky et al. 2000). Upon encountering NP1, which is unambiguously nominative, the filler is reanalyzed as an accusative theme.[19] This analysis is compatible with the verb of the first conjunct. In the second conjunct, there is another reanalysis in Conditions a/b when NP3 is read as it also bears accusative. Consequently, the filler is reanalyzed as a nominative agent. Although this specification is compatible with the second verb in example a, it is not in example b so that another reanalysis is necessary. This reanalysis only involves thematic role. In examples c and d, the filler starts out as an accusative theme. This specification is compatible with all elements in example c whereas theta reanalysis is necessary in example d when the second verb is encountered. Given the reanalyses we have postulated in (30), we expect c and d to be read faster than a and b. Furthermore, we expect a (= formerly B) to be read faster than b (formerly A) and c faster than d.

4.1.3 Method and procedure

We conducted the self-paced reading experiment using a moving window presentation with the help of the E-prime software in the laboratory in Tübingen. The individual sentences were presented in phrasal chunks (indicated by "/" in the material above). Thirty-two participants read each sentence and answered a control question after half of the sentences. Control questions were systematically balanced across conditions.

4.2 Results experiment 3

The following table and the corresponding figures illustrate the average reading times up to the adverb for a and b (B,A) and c and d (E,F), respectively. These pairs of conditions were collapsed as the material did not differ between them up to the adverb in the second conjunct.

19 Note that we assume that case reanalysis entails theta reanalysis.

Table 4: Mean reading times per segment (in ms)

	Conjunct 1		Conjunct 2	
	NP2 der Hans	V1 besucht	NP3 der/den Peter	ADV wahrscheinlich
a,b (B,A)	646	897	729	711
c,d (E,F)	614	808	666	644

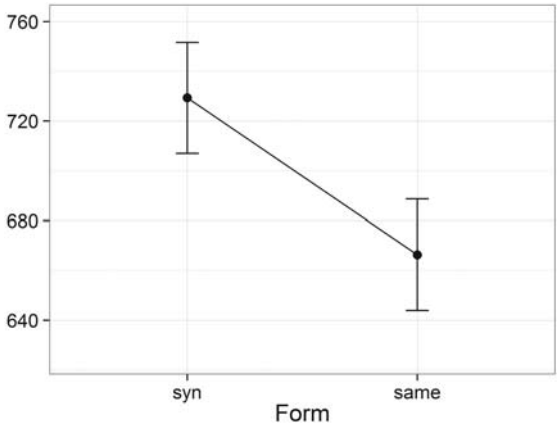


Figure 3: Mean reading times (in ms) on NP3 by condition

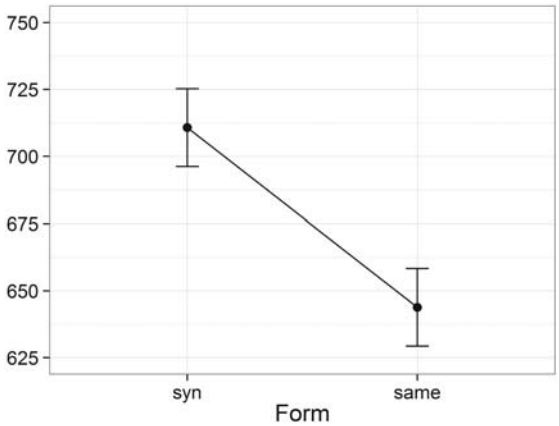


Figure 4: Mean reading times (in ms) on ADV by condition

replace comma with semicolon

The figures show that case reanalysis leads to longer reading times on NP3 and ADV: the conditions with a case mismatch, i.e., a,b (B/A), are read more slowly than those with case-matching, i.e., c,d (E/F).[20]

The statistical analysis reveals that the effect is numerically present on NP3 and significant on the ADV: $t_1(31,1) = 2.3$, $p < 0.05$, $t_2(19,1) = 2.9$, $p < 0.01$.

The following table and the corresponding figures illustrate the reading times on the V2 and the following region (*aber* 'but'):

Table 5: Reading times per segment (in ms)

	Verb2	*aber*
a. Syncretic – verb-match (B)	1105	489
b. Syncretic – verb-mismatch (A)	1165	538
c. Same – verb-match (E)	1217	472
d. Same – verb-mismatch (F)	1399	540

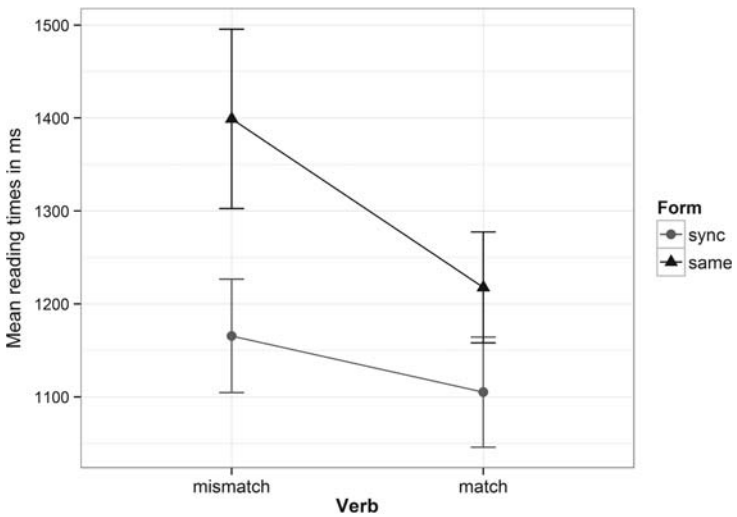


Figure 5: Mean reading times (in ms) on V2 per condition

20 The longer reading times in conjunct 1 on NP2/V1 in a, b (B,A) are also related to case reanalysis: since the initial case-ambiguous DPs are interpreted as subjects/nominatives, reanalysis to accusative is necessary when NP2 is encountered (see (30)). No such reanalysis is necessary in the Conditions c,d (E,F), which is why they are read faster.

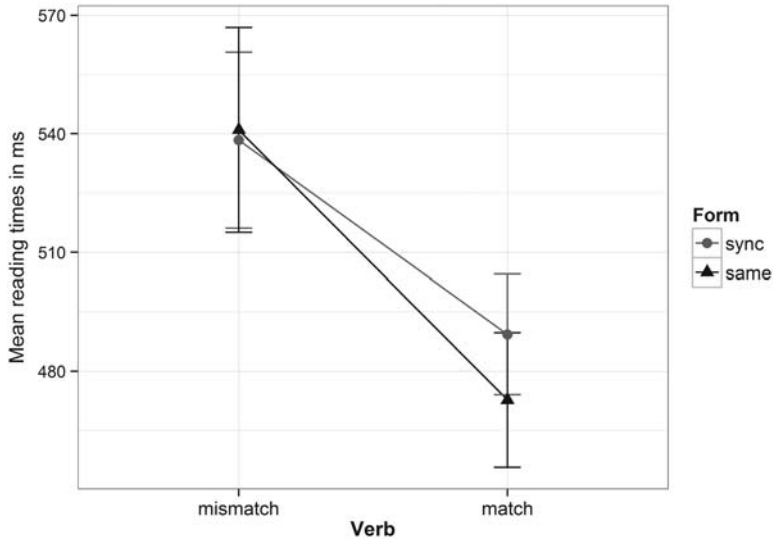


Figure 6: Mean reading times (in ms) on *aber* per condition

The figures show that the combination of different verb types leads to longer reading times on V2 and the following region (*aber*).[21]

We analyzed the effects of the two factors (case form and verb type) with two repeated measures ANOVAs in the spill-over region *aber* 'but'. The statistical analysis revealed a main effect for the factor verb type [$F_1(1,31) = 7.2$, $p < 0.05$; $F_2(1,19) = 7.5$, $p < 0.05$]. There is no significant main effect for the factor case form in this region [$F_1(1,31) = 0.06$, $p = 0.81$; $F_2(1,19) = 0.06$, $p = 0.81$]. This means that theta reanalysis is responsible for the difference in reading times.

4.3 Discussion

comma after region

As predicted, case mismatch (condition: syn) leads to longer reading times on NP3 in the second conjunct; the effect is significant in the spill-over region. Furthermore, a mismatch in verb type leads to significantly longer reading times in the post-verbal region cf. a vs. b (B vs. A) and c vs. d (E vs. F). We take this

21 Note that contrary to our expectations, the syncretic conditions are read faster on V2 than the case-matching conditions. T. Weskott (p.c) suggested to us that this could point towards non-committal parsing of these structures.

effect to show that thematic reanalysis on the verb is necessary. The results from the self-paced reading study thus confirm our hypothesis that case mismatches and theta mismatches lead to processing difficulty in the respective regions. Case reanalysis leads to longer reading times on NP3 and ADV whereas theta reanalysis leads to longer reading times on V2 and the post-verbal region.[22]

5 Conclusion and outlook

Given the mostly theoretical approach taken in the previous literature we intended to verify empirically to what extent case mismatches with and without syncretic forms are acceptable in ATB movement in German.

We have carried out two rating studies which both show that case mismatches in German ATB movement lead to a strong decrease in acceptability. The crucial and surprising result of our studies is that syncretic forms do not lead to an increase in acceptability; they are rated just as low as case mismatch examples where the filler bears an unambiguous case specification. The effects found in the rating studies are reflected in online processing where case reanalysis (with syncretic case forms) leads to longer reading times.

Our results thus have the following implications for theories of ATB movement: German ATB movement requires strict (syntactic) identity in abstract case (contrary to what previous work suggests). Our results thus support theories of ATB movement that predict both gaps to have identical properties, like the sideward movement approach assuming prespecified case values and sharing approaches that disallow the assignment of conflicting (abstract) case features to the shared DP.

Given the observations in Franks (1995) about constraints on thematic prominence, our experiments also included the factor theta role. However, our results provide no evidence for a systematic theta-effect, i.e., for a requirement that the gaps must match in terms of thematic prominence. We did find some effects in experiment 2, but given the results from our self-paced reading study, these are best related to thematic reanalysis in processing (rather than to some global syntactic constraint like (8)).

22 Given the structure of experiment 1, we would expect similar effects in an SPR study based on that material with E/F being read faster than A/B on NP3 and with B being read faster than A and E being read faster than F on V2. We leave this point to future research.

Before closing, we would like to mention that other examples with a syncretic case mismatch seem quite acceptable, certainly more acceptable than those we used in our experiments:[23]

(31) a. Was/Das hat in der Zeitung gestanden$_{Nom}$ und
What/that has in the newspaper stood and
wohl auch jeder gelesen$_{Acc}$?/.
PRT also everyone read
'That/What has been reported in the newspaper and {has} every one {has} read?/.'

b. Was/ Das hat dir/mir gefallen$_{Dat}$ aber
What/ that has you:DAT/me:DAT pleased, but
Karl sich nicht angesehen$_{Acc}$?/.
Karl REFL not looked.at
'What/that pleased you/me, but Karl didn't look at?/.'

replace Dat with Nom

(32) Was für Frauen hat der Hans (in der Stadt) getroffen$_{Acc}$ und
What for women has the Hans (in the city) met and
(mit ihren Einkäufen) geholfen$_{Dat}$?
(with their shopping) helped
'What women did Hans meet (in the city) and help with (their shopping)?'

(31) involves a nominative/accusative syncretism, (32) an accusative/dative syncretism. We are not quite sure what causes these differences, which are not yet empirically confirmed. What is certainly striking is that the fillers in these examples are short proforms. Furthermore, (31a) involves an intransitive verb in the first conjunct and in (32) we have VP-/vP-coordination and parallel extraction of two internal arguments. Additionally, it seems to us that the *wh*-movement cases are better than the topicalization cases. We suspect that some of these factors may facilitate processing. Without further speculation, we leave the empirical investigation of the correctness and interpretation of the intuitions about (31) and (32) for future research.

23 Thanks to the two anonymous reviewers of a conference abstract who provided the examples in (31) and (32).

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