The Global Aboutness Topic in German Narrative

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1   Introduction

There is a growing body of psycholinguistic evidence for the influence of grammar—the inventory of obligatory grammatical features of a language—on the global structural decisions speakers make at the level of discourse planning (von Stutterheim and Carroll, 2005; Carroll et al., 2008; von Stutterheim et al., 2010). Not only are the concepts to be conveyed by a single sentence selected as to guarantee that all the obligatory features are expressed (cf. Slobin's, 1987, *thinking for speaking*), but also the way speakers distribute information between multiple sentences and group it into larger discourse units appears to be optimized for making the task of satisfying all the constraints at the stage of grammatical encoding as easy as possible. In other words, we find cross-linguistic differences in global discourse structure. It seems that this phenomenon has passed almost entirely unnoticed by discourse theorists concerned with building formally precise accounts of discourse interpretation or generation. The main goal of this paper is to fill this gap and develop a formal theory of discourse that would make provision for the influence of grammar on global discourse structure. In an earlier paper (Jasinskaja and Roßdeutscher, 2009) we have stipulated some language-specific rules for global discourse planning using the framework of Discourse Representation Theory (DRT, Kamp and Reyle, 1993; Kamp et al., 2005) and discussed the interaction between the language-specific and the language-independent in discourse structure. The present paper will go beyond mere stipulation and try to directly derive differences in global discourse planning from differences in grammar.

We will concentrate especially on generalisations gained in studies of spoken narratives from the multilingual "Quest corpus"—a collection of retellings of the silent animation film *Quest*[1] by speakers of languages including English, German, Dutch, French, Spanish, Russian, Japanese, among others. Our focus will be on a phenomenon that could be characterised as the *global aboutness topic*—a tendency to organise the narrative around a single topical entity, such as the protagonist of

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[1]The winner of several film awards, directed by Tyron Montgomery and produced by Thomas Stellmach, 1996

the film in Quest retellings, concentrating on what the protagonist does or what happens to him. This tendency is typical for German and other verb-second (V2) languages, e.g. Dutch. In V2-languages the finite verb of a main clause is always preceded by exactly one constituent, which can but need not be the subject of the sentence. Which constituent is placed in the preverbal position (the *prefield*) usually depends on the information structure of the sentence, i.e. categories such as topic, focus, etc. The global aboutness topic is realised systematically as subject and in the prefield position in these languages. This is less typical, for instance, in English—a strict SVO language—where the aboutness topic seems to play an altogether lesser role both in the choice of the preverbal constituent (i.e. the choice of subject) and in the global organisation of the narrative. It is widely accepted that these two properties—the preference for a global aboutness topic and V2 syntax— are related. The standard explanation is, roughly: Since filling the preverbal position with exactly one constituent is obligatory in V2 languages and since topics, if available, usually go to that position, there is a certain advantage in having a topic over not having one because it makes the choice of the preverbal constituent easy. This creates a preference for discourse structures that readily provide topical entities, and the constancy of the topic is related to considerations of global discourse coherence (see esp. von Stutterheim and Carroll, 2005). The present paper tries to recast (a variant of) this explanation in formal terms.

Our formal apparatus will include: (a) DRT, which will be used for representing the content of discourse units; (b) the formalism of attribute-value matrices (AVMs), which will be employed to represent the structure of discourse units following roughly the same idea as the representation of signs in Head-Driven Phrase Structure (HPSG, Pollard and Sag, 1994), i.e. connecting different levels of linguistic representation from phonologica/textual form, to content, to various pragmatic features; and (c) Optimality Theory (OT, Prince and Smolensky, 1993; Blutner and Zeevat, 2003), as a non-monotonic inference mechanism on these structures.[2] The choice for HPSG-style application of AVMs and Optimality Theory is dictated by the non-modular design of both frameworks, which allows, in principle, for features and constraints at any level of linguistic representation to affect any other level. This is a useful property when the task is to model the influence of grammatical properties of the language related to syntax and word order on global discourse planning.

The application of OT to model discourse structure is a recent development (Beaver, 2004; Zeevat, 2010) and there is nothing like an established framework in

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[2]An OT model of a relationship between two levels of linguistic representation A and B (such as sentence meaning and surface form in OT syntax, or phonological and phonetic respresentation in OT phonology) consists of a set of violable constraints ordered by strength that decide which of a set of *candidate* representations at level A is the best given the *input* representation at level B. Optimal candidates are the ones that do better on the whole system of ranked constraints than all the other competing candidates. Candidate A_1 is better than A_2 if there is a strongest constraint C such that A_1 and A_2 do equally well on all the constraints that are stronger than C, but A_1 does better on C itself, i.e. gives rise to fewer violations of C.

this domain. To the best of my knowledge, the phenomena discussed in this paper have not been addressed in OT before. Therefore a lot of effort will be spent in this paper on drawing up a coherent proposal more or less from scratch. For the most part, we will concentrate on modelling the relationship between the function of word order and the maintenance of the same aboutness topic across multiple sentences. While doing that, we will adopt the more familiar interpretation perspective, talking about (forms of) sentences in discourse and their possible readings. This will allow us to develop the crucial fragment of the model. Only at the end of the paper will we return to the issue of discourse planning proper—i.e. the selection of content from a knowledge base, segmentation of that content into bits to be expressed by individual sentences, grouping and ordering those bits—and the way the preference for a global aboutness topic in German affects these processes. A rough skeleton of this extension to the theory will be sketched out and applied informally to a couple of examples, but it will not be possible to spell it out in full detail.

The paper starts with a presentation of the phenomenon (section 2)—empirical generalisations on cross-linguistic differences in narrative planning based on the observations from the German and English sections of the Quest corpus (section 2.1), later zooming in on the specific constructed minimal pairs that will serve as a starting point for the development of the central fragment of the theory (section 2.2). The central part of the model is developed in section 3, whereas section 4 restates that in formal terms, and discusses the extension to discourse planning. Section 5 rounds up the paper with some conclusions and new questions.

2 Observations

2.1 Topics and subjects in spoken narratives

The picture of cross-linguistic differences in discourse planning that this paper sets out to analyse formally has emerged from the study of spoken narratives elicited from speakers of different languages after they watched the silent animation film *Quest* and were asked to retell what happened in the film (see e.g. von Stutterheim and Carroll, 2005; Carroll et al., 2008). The film shows a clay figure searching for water in a series of desert-like worlds: a sand desert, a paper desert, a stone desert, etc. For example, in the sequence taking place in the paper world the earth's surface is made of pieces of paper and some pieces are carried around by the wind. On his way through this desert, the clay man is twice in danger of being overrun by a large flying piece of paper, whereas the third time he is actually knocked down by one piece. He finally finds a small puddle of water, but while he is trying to collect the water from the ground, the wet paper breaks in and he falls through the hole into the next world.

A typical German solution of the narration task is shown in (1). The most striking feature of the German narratives is that the protagonist of the film, the clay man, preserves his topical status (roughly in the sense of Reinhart, 1981) often through-

(1) a. und er fällt auf dieses papier drauf *1*
   and he falls on this paper on top

b. und äh Ø is etwas benommen
   and eh is somewhat stunned

c. Ø bleibt liegen *
   stays lying

d. und Ø rappelt sich dann wieder auf *1*
   and rattles himself then again up

e. un: Ø schaut sich um
   and looks himself around

f. weil er nich weiß
   because he not knows

g. wo er is
   where he is

h. und Ø sieht ** einzelne papierfetzen durch die gegend
   and sees single pieces of paper around the place
   fliegen * und n kleinen wirbelsturm aus papier *
   fly and a small tornado of paper

i. un: jetzt weiß er nich
   and now knows he not

j. wo er is *
   where he is

k. un Ø macht sich also auf die suche
   and makes himself so on the search

l. die gegend zu erkunden *1*
   the place to explore

m. und Ø läuft durch die gegend *
   and walks around the place

n. und da wird er auf einmal von 'nem fetzen papier *1*
   and there gets he suddenly by a piece paper
   umge / umgeschmissen
   knocked over

o. der ihm die / die sicht verdeckt
   which him the view blocks

out the whole narrative, unchallenged in this function by any other "characters" of the film (pieces of paper, drops of water). This manifests itself in that the protagonist appears overwhelmaingly as the grammatical subject of (main) finite clauses, and in the preverbal position. Subjects in preverbal position which corefer with the subject of the previous main clause can be, and normally are elided, which makes zero ($\emptyset$) one of the most characteristic ways of referring to the protagonist in long sequences of what looks like coordinated VPs, cf. (1a) followed by the $\emptyset$-subject sequence (1b)–(1h), and (1i) followed by (1k)–(1m).

Some of the English solutions are similar in that they use the same protagonist-oriented discourse strategy. However, the majority of the English speakers choose a different global schema which does not seem to assign the protagonist such an exceptional status and in which topichood (as we will see later in the paper) seems to play an altogether lesser role. In particular, these speakers switch more freely between different discourse referents as main clause subjects.

The contrast between the typical German and English solutions can be best seen in descriptions of events where the protagonist is either not involved at all, or another entity behaves more like an agent, i.e. is more in control of the situation, moves, affects the protagonist physically, causes other events to happen, or in other words, exhibits more proto-agent properties in the sense of Dowty (1991) than the protagonist. In such situations German speakers still try their best to find a way and make the protagonist, rather than that other entity, the subject and the topic of the sentence. There are a few ways in which this can be achieved. One way is not to mention such events at all. Of course, one cannot skip events that play an important role in the development of the story, but events that are less crucial in that respect are often skipped by German speakers if the protagonist is not involved or plays a relatively passive role there. For example, the speaker of (1) does not mention the first two near-collisions of the protagonist with the flying sheets of paper. English speakers retell these events more often, as e.g. the speaker of (2). Notice that the piece of paper is the subject in (2g) and the subject of the non-finite clause in a presentational construction in (2d)—in both cases in a higher syntactic position than the protagonist (see Jasinskaja and Roßdeutscher, 2009, for more details).

(2) a. and eh he wakes up
    b. and eh just as he is opening his eyes from the fall [...]
    c. he looks in front of him
    d. and there's this piece of paper coming straight for him
    e. and he's scared
    f. and he jumps up onto his knees
    g. and the piece of paper misses him

Second, German speakers often put such events off the main story-line by expressing them in various kinds of subordinate clauses and embedded constructions, so the protagonist remains subject of the main clause and can serve as antecedent for zero anaphora in the next sentence, or be replaced by zero itself if it occurs in

the preverbal position and the context conditions are met. (1o) is an instance of a finite clause with a non-protagonist subject degraded to a subordinate (relative) clause. Eventualities that do not involve the protagonist, such as the pieces of paper flying, are often presented as being seen by the protagonist, as in (1h) 'and ∅ sees separate pieces of paper flying around'. English speakers realise such events in separate main clauses more often, cf. (2c)–(2d).

Finally, German speakers very often promote a patient or recipient protagonist to subject by means of a passive construction, cf. (1n) 'there he suddenly gets knocked over by a piece of paper', while English speakers do that less frequently, realising the agent non-protagonist as subject, cf. (3b).

(3) a. he keeps walking *1*
     b. then all of a sudden a paper hits him in the face ***
     c. and ∅ knocks him out at his back *2*

In other words, German speakers use all means available to maintain the topical status of the protagonist over long stretches of discourse, by realising the protagonist as the grammatical subject and in the preverbal position of main clauses as much as possible (where it is almost always replaced by ∅, thus giving rise to long sequences of coordinated VPs or clauses with ∅-subjects)—the phenomenon that we will refer to as the *global aboutness topic* preference in German. One might wonder what is exactly the interplay between grammatical subjecthood and the preverbal position in marking topic, especially since in German it is possible to move non-subjects to the prefield. If word order were the decisive factor, why do we not find solutions like (4) in place of (1n) in the corpus, i.e. solutions where the protagonist is moved to the preverbal position but is the direct object of the sentence?

(4) und ihn schmeißt da   auf einmal ein fetzen papier um
     and him knocks   there suddenly   a   piece   paper   over

     'and a piece of paper suddenly knocks him over'

Probably, the principle of alignment of the subject with the topic (Keenan, 1976; Beaver, 2004) plays a crucial role here, overruling agent-subject alignment. Why say something like (4) if one can do better by using a passive construction?[3] This issue will be left aside in the rest of the paper, i.e. we will talk about the maintenance of a global topic (rather than a "global subject") assuming that the step from

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[3]In some less recent syntactic analyses of German (e.g. Travis, 1984) it has been assumed that unstressed object pronouns cannot appear in the prefield. Or put differently, if an object pronoun appears in the preverbal position it must be stressed and therefore associated with a contrastive interpretation. This would explain the lack of sentences like (4) in the Quest corpus. However, Meinunger (2007) and Frey (2006), among others, have questioned that view, offering very natural sounding examples of object *es* 'it'—a pronoun that cannot be stressed at all in German—in the prefield position. This raises the question what is the right context for such sentences (if the narrative context of the kind we find in the Quest corpus is not) in which the passive construction would not be preferred over object fronting. However, this question will not be handled in this paper.

topics to subjects can be explained independently.

2.2 Topics and temporal structure

Our ultimate goal is a formal model that shows how properties of the grammar, such as the rules for filling the prefield position in German, affect speakers' choices at the level of global discourse planning, such as organising the discourse around a single global aboutness topic. To be able to make a first step in applying our theoretical machinery to this complex problem, we will have to look at strongly simplified discourses, stripped of all the irrelevant context-specific complexities that we find in the real examples from the corpus cited in the previous section. We will therefore consider constructed German and English minimal pairs, given in (5)–(6) and (7)–(8), respectively, presenting two actions in two main clauses, either carried out by the same agent as in (5) and (7), or by two different agents, (6) and (8), such that the other agent is not involved in any other role in the same action. The agents always appear as subjects and in the preverbal position. Finally, the present tense in these sentences is intended in the same sense as it is used in the Quest narratives—to report events "as if happening now", i.e. from a temporal perspective point located in the time while the events are in progress, the fictitious *now* of the observer (Rossdeutscher and Carroll, 2005). (In fact, we will also switch to the more familiar comprehension perspective at this point, looking at sequences of utterances as input and analysing their possible interpretiatons. We will come back to the relationship between comprehension and production in section 4.)

(5) a. Peter überquert die Straße
  Peter crosses the street
 b. Er kauft eine Zeitung
  He buys a newspaper

(6) a. Peter überquert die Straße
  Peter crosses the street
 b. Max kauft eine Zeitung
  Max buys a newspaper

(7) a. Peter crosses the street
 b. He buys a newspaper

(8) a. Peter crosses the street
 b. Max buys a newspaper

Thus the members of each minimal pair differ in whether or not the subject of the second sentence corefers with that of the first.[4] The central difference between

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[4]Where the subjects corefer, the subject of the second sentence is normally expressed by zero in German Quest narratives such as (1). Whether we have to do with null subjects or some kind of conjunction reduction here, we will assume that in some underlying representation those unexpressed subjects are present as in (5) and (7).

the German and English examples, which we will claim is ultimately responsible for the global preferences in the structuring of narrative, concerns their temporal interpretation. The sequences with the same subject both in German (5) and in English (7) are most naturally interpreted as reports of events occurring in a sequence, where the textual order of the sentences iconically reflects the order of occurrence of the events. In contrast, if the subject changes in German this temporal inference is blocked, (6) is interpreted as a list of temporally unrelated events. Apparently, the same contrast is not present in English, at least not to the same extent. The temporal interpretation of (8) depends strongly on intonation. If the sentences are pronounced with expressed enumeration or list intonation (e.g. a rising nuclear accent with a subsequent high or slightly declining plateau), the interpretation is like that in the German example (6)—a list of events without temporal inferences. The same holds if *Peter* and *Max* in (8) are accented as constrastive topics. However, if the sentences are pronounced with "neutral" intonation, i.e. the accentuation pattern is consistent with broad sentence focus (the nuclear accent on the direct object and no other meaningful accents) and the boundary tones do not signal anything special except that the two utterances belong together (e.g. a final rise on the first and a final fall on the second utterance), then the temporal interpretation is as in (7): first Peter crosses the street and then Max buys the newspaper. In the German example (6) this interpretation seems dispreferred regardless of intonation.

A substantial part of this paper is concerned with modelling this difference between English and German. It will be shown that it is caused by a grammatical difference—the preverbal postition in German can be and is often used for marking information-structural categories like topic, while in English it is reserved for grammatical subjects. In the end we will argue that the mechanisms that establish the dependency between these properties of the grammar and the temporal interpretation in examples (5)–(8) lead ultimately to the different preferences in narrative structure discussed in section 2.1. Admittedly, the contrasts illustrated by examples (5)–(8) are not very sharp. So far we have not been able to attest the differences in a methodologically rigorous way. The task is complicated by a number of factors. First, the difference between (5) and (6) in German is not between the temporal relation feature being set in two different ways, but between the feature being set to sequential interpretation in (5) and being unspecified in (6), which is also compatible with sequential interpretation. Second, the claim for (8) in English is also not that it necessarily receives a sequential interpretation, but that both options exist, sequential or unspecified, partly depending on intonation. That is, one would expect a higher percentage of sequential interpretation than in German if other factors affecting the intepretation could be switched off. But of course, last but not least, one of the main problems is that those interfering factors cannot be switched off. Considerations of plausibility seem to play a huge part in determining the temporal relation, which means that the type of events described has the decisive influence and judgements differ a lot from example to example. For the examples (5)–(8) we got that all four of the German speakers we consulted established a sequential relation in (5), and simultaneity or no temporal relation in (6). Similarly, all the five

English speakers we asked confirmed a sequential interpretation in (7), but only two of the five also interpreted (8) as sequential, the rest following the German pattern. This seems to give some weak corroboration to our claim, but the results for other examples we tested were less clear. In other words, the examples (5)–(8) can be taken to illustrate a hypothesis, but not an empirical generalisation. Finding a way to test this hypothesis remains a task for the future. Nevertheless, the greater part of this paper is devoted to developing a theory that predicts the hypothesised pattern. The resulting theory will constitute the essential part of the explanation to the cross-linguistic patterns in narrative planning discussed in the previous section, which are much better established by previous empirical studies.

3 Basic building blocks

3.1 The Quaestio and the update mode

The differences in temporal interpretation discussed in the previous section are standardly viewed as dependent on the choice of coherence relation between the sentences. The interpretation as a sequence of events that we find in (5) and (7) is characteristic of such coherence relations as *Narration* and *Result* (Asher and Lascarides, 2003).[5] The interpretation as a temporally unordered list is characteristic of the class of relations that Kehler (2002) calls *resemblance* relations and which includes e.g. *Parallel* and *Contrast*. Resemblance relations are characterised in terms of similarities and differences between the propositions they connect. Example (6) is presumably an instance of the *Parallel* relation. The two sentences share a common template: someone does something (at a certain time and location), but differ in terms of who does it, *Peter* vs. *Max*, and what he does, cross the street vs. buy a newspaper.

It is well known that linguistic devices that signal resemblance, or whose use is restricted to resemblance relations in one way or another, also block the temporal and causal inferences. The classical observation concerns gapping and is due to Levin and Prince (1986): while the sentence without gapping (9a) can be interpreted causally—Nan became downright angry *because* Sue became upset—this reading is not available in the version with gapping (9b).

(9) a. Sue became upset, and Nan became downright angry.
     b. Sue became upset, and Nan ∅ downright angry.

Other known devices that produce a similar effect include e.g. the additive particle *also* and contrastive topic accentuation (Hendriks, 2004). Enumeration intonation is presumably another such device that blocks the *Narration* interpretation in the English example (8), which is otherwise interpreted as a *Narration* by default.[6] At

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[5] Alias *Occasion*, *Cause-Effect* (Kehler, 2002), *Sequence* (Mann and Thompson, 1988).

[6] In many German dialects there are distinct utterance/phrase-final rising intonation contours for narrative sequences and atemporal lists (Gilles, 2005).

first glance, the German example (6) does not contain any markers of resemblance. However, we will argue that it is the special role played by the preverbal position in German in marking information structure combined with the fact that it is filled by two disjoint entities *Peter* and *Max* in (6) that establishes a resemblance relation between the sentences and blocks the interpretation as a narrative sequence.

To begin with, let's set up our basic vocabulary for talking about intersentential connections and discourse structure in general, so the generalisation concerning the blocking effect of resemblance on temporal and causal inferences can be reformulated in those terms.

Our first assumption will be that discourse generation/interpretation has two basic information update modes: the normal, non-iconic, and the *iconic* update. The iconic mode integrates information about reported events into the context (or the common ground, or the speaker's/hearer's belief state) in a manner that mimicks the way in which we integrate information about events directly observed.

A crucial difference between update from direct experience and the (normal, non-iconic) update of communicated content in human communication is in the way we treat 'now'—the *update time*.[7] When we talk, time stops. That is, all the references to 'now' within a single discourse typically point to the same entity which is more abstract and more extended than the times of individual utterances, and is usually assumed to comprise the whole discourse (see esp. Reyle et al., 2007, pp. 607–609).

In contrast, when we perceive events as they are happening, the relationship between the update time and the event time is much more direct. Events are not marked for tense. Rather, every event happens *now*, and we cannot directly observe past or future events. That is, the moment when the information of the event enters our mind (the update time) is the only handle we get on the actual event time. In this case it makes more sense to treat all update times as distinct. Otherwise, we would not be able to store the observed events in the right temporal order.

The iconic update mode treats the update time in the same way, i.e. *as if* the information were coming through direct experience, *although* it is in fact coming by means of communication. Let us illustrate how this works in the explicit representation of discourse content. The discourse representation structures (DRS) in Figures 1 and 2 represent the content of the utterances (8a), *Peter crosses the street*, and (8b), *Max buys a newspaper*, respectively. For example, the DRS in Figure 1 states that there is an event e_1 of Peter (p) crossing the street (x). In accordance with a standard assumption in DRT (Kamp et al., 2005; Reyle et al., 2007), the event is included in its location time t_1—$e_1 \subseteq t_1$—which reflects the "punctual" character of events, in contrast to states which comrise their location times, e.g. $t \subseteq s$. In the present case, the $e_1 \subseteq t_1$ condition results from the combination of the intrinsic aspect of the expression *cross the street* (an accomplishment) and the simple tense form (in contrast to progressive). The condition $t_1 = now$ is contributed by the

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[7]The update time corresponds to speech time in speech communication, and to the observation time in direct observation.

10

semantics of the present tense.[8] This DRS, which represents the discourse context by the time the second utterance (8b) is processed, is updated with the DRS in Figure 2. The result of iconic update is shown in Figure 3. The whole context DRS "moves into the past" and becomes a *memory* of a past perception, that is, i.e. it is embedded under the MEM operator taking two arguments, the context DRS and the temporal location t_1' which represents the time when that 'past' was 'present'. Crucially, all occurrences of *now* (now_1 in Figure 3) in the original context DRS are mapped to t_1' in the new top level DRS;[9] t_1' in turn precedes the new 'now' of the top level DRS (now_2), as shown in Figure 4. Obviously, the addition of a new event description to the discourse will push now_2 into the past in a similar way, so ultimately the order of event times will reflect the order of update.[10]

For comparison, the result of non-iconic update of the DRS in Figure 1 with the DRS in Figure 2 is shown in Figure 5. This is an istance of the standard update procedure in DRT. Both occurrences of *now* in this DRS refer to the same temporal object. The events e_1 and e_2 are both included in this *now*, but their relative order is not specified.[11] This is an illustration of how non-iconic update does not give rise to the temporal progession characteristic of narrative discourse.

In narrative generation, iconic update makes the speaker's task easier in the sense that s/he does not have to employ any additional methods for managing the

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[8]We ignore all presuppositions here, including the one associated with the definite description *the street*.

[9]Technically speaking, t_1' serves as an external anchor for the internal anchor *now* of the DRS under MEM. Within the framework of Kamp et al. (2005), MEM(t, K) introduces an attitude context of, presumably, direct perception, whose agent may be the speaker, or some fictitious observer, the DRS K represents the propositional content of that perception, while t serves as the external anchor for the anchor *now* internal to K.

[10]The present notion of iconic update will work in a most straightforward way for present tense narrations (historical or reportive present), but it is also intended to capture the temporal progression in past tense narratives. In order to achieve this, the past tense has to be represented as the present of some (fictitious) observer, whose observations take place in the past, along the same lines as this is implemented in the MEM operator. In this case it is the (past) belief state of the observer that undergoes iconic update.

[11]As Reyle et al. (2007) point out, the "normal" uses of the present tense (i.e. not historical, not reportive) do not admit events in this way. On the one hand, 'now', as we said, is shared across utterances and communication participants in normal communication, and in that sense it is extended. On the other hand, it behaves like a single instant, as if discourse had no duration within which events could occur. The normal uses of present tense are optimised for referring to states that begin before the discourse begins and end after the discourse ends, while reference to changes in the world that occur while discourse proceeds seem to require special treatment. However, this is a (partly) independent issue. The proposal presented here should not be misunderstood in the sense that non-iconic update implies a "normal" use of the present tense. Although it is perhaps generally true that, for instance, historical present is a narrative tense, it is nevertheless also possible in non-narrative sequences (perhaps embedded in narratives), as the example below shows. Especially if uttered with a contrastive topic/focus intonation, the conjoined clauses are related by resemblance in the sense of Kehler (2002) and the discourse does not imply a commitment to any temporal order of the two coronations.

(i)   In 1066, William the Conqueror is crowned King of England, and Magnus II is crowned King of Norway.

$$\boxed{\begin{array}{l} e_1, t_1, p, x \\ \hline happen(e_1) \\ e_1 : cross(p, x) \\ street(x) \\ e_1 \subseteq t_1 = now \end{array}}$$

Figure 1: The DRS for (8a).

$$\boxed{\begin{array}{l} e_2, t_2, m, y \\ \hline happen(e_2) \\ e_2 : buy(m, y) \\ newspaper(y) \\ e_2 \subseteq t_2 = now \end{array}}$$

Figure 2: The DRS for (8b).

$$\boxed{\begin{array}{l} e_2, t_1', t_2, m, y \\ \hline \text{MEM}(t_1', \boxed{\begin{array}{l} e_1, t_1, p, x \\ \hline happen(e_1) \\ e_1 : cross(p, x) \\ street(x) \\ e_1 \subseteq t_1 = now_1 \end{array}}) \\ happen(e_2) \\ e_2 : buy(m, y) \\ newspaper(y) \\ e_2 \subseteq t_2 = now_2 \end{array}}$$

Figure 3: Iconic update.

$$\boxed{\begin{array}{l} e_1, e_2, t_1', t_1, t_2, p, m, x, y \\ \hline happen(e_1) \\ e_1 : cross(p, x) \\ street(x) \\ e_1 \subseteq t_1 = t_1' \\ t_1' \prec now_2 \\ happen(e_2) \\ e_2 : buy(m, y) \\ newspaper(y) \\ e_2 \subseteq t_2 = now_2 \end{array}}$$

Figure 4: Iconic update: The content of MEM unpacked.

$$\boxed{\begin{array}{l} e_1, e_2, t_1, t_2, p, m, x, y \\ \hline happen(e_1) \\ e_1 : cross(p, x) \\ street(x) \\ e_1 \subseteq t_1 = now \\ happen(e_2) \\ e_2 : buy(m, y) \\ newspaper(y) \\ e_2 \subseteq t_2 = now \end{array}}$$

Figure 5: Non-iconic update.

temporal structure of discourse except producing the event descriptions in the same order and in the same way the knowledge of those events has been acquired. Following a widely accepted line of thought, we will assume that there is a pragmatic principle that expresses a preference for iconic update where such update is possible.[12] In the OT system to be developed in this paper this is expressed by an ICONICITY constraint:

(10) ICONICITY: The update mode is iconic.

As will become clear, this constraint expresses a rather low ranked default which is easily overridden by other semantic and pragmatic principles.

Our second main assumption concerns the topic structure of discourse. The 'discourse topic' is understood as a (often implicit) question that the discourse answers, or the *quaestio* (Klein and von Stutterheim, 1987, 1992; von Stutterheim and Klein, 1989). Smaller discourse segments, such as paragraphs, as well as individual sentences also have questions as discourse topics. Discourse topics as questions play a special role in resemblance relations since they provide the templates according to which the states of affairs are compared. The variables of the questions (roughly, the *wh*-words) correspond to the points of difference, whereas the rest of the question expresses the common part. For example, the sentences in (6) can be analysed as addressing the question *Who does what (at location L at time T)?*

As several studies have shown (Büring, 2003; Jasinskaja and Zeevat, 2008), it is often useful to distinguish discourse topics according to the number of variables in the topic question: single vs. multiple variable questions. For example, single variable questions include *wh*-questions with a single *wh*-word, e.g. *What happened?*, *Who is the murderer?*, or simple *yes/no*-questions, e.g. *Will the hero win the battle?* Prototypical multiple variable questions are questions with multiple *wh*-words: *What happened to whom?*, *Who ate what?*, *Who gave what to whom?*, etc. There is a relationship between the question type and the update mode which accounts for the atemporal character of resemblance relations: the iconic update mode is only compatible with single variable questions about events, i.e.: *What happens/ed?*, *What happens/ed to x?*, *What does/did x do?*, etc. This can be expressed as an OT constraint:

(11) ICON-TOP: If the update mode is iconic, the discourse topic is a single variable question about events, such as *What happens/ed?*, *What happens/ed to x?*, *What does/did x do?*, etc.

This, in turn, is a strong, highly ranked constraint, certainly stronger than ICONICITY. This means that iconic interpretations are preferred only if the discourse topic is of a kind listed in (11). Otherwise, iconic update is impossible, which does not automatically mean that the sequence of sentences cannot present events in

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[12]Cf. the Gricean 'be orderly', or the *Narration* default in Segmented Discourse Representation Theory (Lascarides and Asher, 1993).

chronological order, but the temporal structure of that sequence has to be managed by other means, e.g. by explicit temporal adverbials like *then*.

If our assumption that (6) addresses the question *Who does what?* is correct, then it is clear why it is interpreted as a list of temporally unrelated events, namely because the double variable question excludes the possibility of iconic update, the non-iconic update does not establish any constraints on the temporal order of the events, and the sentences do not contain any linguistic means, such as the adverbial *dann* 'then', that would explicitly relate the events in time. The question that remains is why (6) should address the topic *Who does what?*, and not, let's say, *What happens?* This question will be taken up in the following sections.

On the other hand, normal update can go with any kind of question, including single variable questions about events. For instance, enumeration intonation can be seen as a conventional marker of a *List* relation, which in turn requires non-iconic update. Thus (8) with enumeration intonation could have *What happens?* as a discourse topic, but the default preference for iconic update (applied otherwise) is overriden here by an explicit linguistic signal, so the winning interpretation is a temporally unordered list of events.

3.2   Aboutness topic and contrastive topic

In order to be able to explain the special role played by the preverbal position in German in relation to information structure and the discourse topic, we should first spell out our assumptions concerning the relationship between the three notions of topic: discourse topic, aboutness topic and contrastive topic. Discourse topics were defined in the previous section as questions, or sentence templates—sentences where certain constituent have been replaced by variables (*wh*-words).

We will adopt a widely accepted notion of aboutness topic proposed by Reinhart (1981). According to this view, the aboutness topic of a sentence is the entity the sentence is about. Though the 'aboutness' relation that underlies this notion is, in a way, primitive, in the sense that it is difficult to define entirely in terms of other notions of semantics and pragmatics, it does impose certain constraints on what an aboutness topic could be. For instance, an aboutness topic could only be something that, using the file card methaphore, could serve as an address of a file card that stores inormation about that entity. This is usually taken to mean that aboutness topics must denote specific referents. That is, the best aboutness topics are definites. A specific indefinite can be an aboutness topic, or a universally quantified DP, e.g. every student, if it is taken to refer to the entire set of students. Another constraint inspired by Reinhart that we will adopt establishes the relationship between the aboutness topic and the discourse topic, or the quaestio:

(12) The aboutness topic is specified in the quaestio.

That is, the aboutness topic has to be part of the template that expresses what is common between the sentences connected by the quaestio, and cannot correspond to one of the question variables. Thus *Peter* can be an aboutness topic if the quaes-

tio of the sentence is *What does Peter do?* or *What happens to Peter?*, but not if the quaestio is *Who crosses the street?* or *What happens?* This also implies that sentences that address questions like *What happens/ed?* will normally lack an aboutness topic.

Specification in the quaestio is a necessary but not a sufficient condition for aboutness topics. Non-topical entities can also be specified in the quaestio. A good example are temporal and spatial frames, which rather often constitute part of the topic question, e.g. *What did Peter do there and then?*, but are less often the actual target of the message.[13] A sufficient condition for aboutness topics could be expressed at the level of the quaestio by making the aboutness relation part of the question, e.g. *What about Peter?*—a question that only specifies the aboutness topic and asks for any sort of information concerning *Peter*. But the question can also be more specific. If questions are represented as formulas under a ?-operator in the formal language of Groenendijk and Stokhof (1997), $?x[about(Peter, buy(Peter, x))]$ would express a question *What did Peter buy?* explicitly marking *Peter* as an aboutness topic, or in other words *What about Peter? What did he buy?* (The explicit representation of the aboutness relation in the question will be suppressed most of the time, unless indispensable.)

Finally, the notion of contrastive topic to be used in this paper is perhaps broader than most commonly accepted definitions, but it is essentially inspired by the idea depeloped by Büring (2003). Somewhat simplifying, contrastive topics are licensed whenever a double (or multiple) *wh*-question like *Who ate what?* is under discussion and is split into a series of single variable subquestions. There are always two ways to address a double question like *Who ate what?* You can go by people, or you can go by food. In the first case, the double question *Who ate what?* is split up into a series of single variable questions like *What did John eat?*, *What did Bill eat?*, etc., where the *who*-variable is instantiated by different persons from the relevant domain. In the second case, the double question is split up into subquestions *Who ate the beans?*, *Who ate the carrots?*, etc. According to Büring (2003), the choice between these two strategies determines which constituent is marked as contrastive topic and which one as focus: contrastive topic is the variable that is instantiated in the subquestion, i.e. people when you go by people, and food when you go by food; the focused constituent corresponds to the *wh*-variable in the subquestion.

Since contrastive topics are instantiated in the local quaestio addressed by the sentence, they are eligible as aboutness topics according to the criterion mentioned above, cf. (12). That is, a contrastive topic can be an aboutness topic, though it does not have to. Conversely, an aboutness topic is a contrastive topic whenever the aboutness topic shifts. This is a crucial observation that the present account will be built upon, so let us spend some time substantiating this claim.

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[13]Some tend to regard the temporal and spatial location as topical whenever it (implicitly) functions as a restriction on questions about events like *What did Peter do (there and then)?* For the purposes of the present account it does not make any difference whether to make this stronger assumption or not.

Suppose *Peter* is the aboutness topic of (13a) and *Max* is the aboutness topic of (13b). Then the quaestio for (13a) must contain *Peter*, e.g. *What does Peter do?* (14a), and the quaestio for (13b) must contain *Max*, e.g. *What does Max do?* (14b).

(13) a. Peter crosses the street
　　 b. Max buys a newspaper

(14) a. *What does Peter do?*: $?e[Agent(Peter, e) \wedge happen(e)]$
　　 b. *What does Max do?*: $?e[Agent(Max, e) \wedge happen(e)]$

If (13a) and (13b) are to form a discourse unit, there should be an overarching quaestio that the sentences jointly answer, or put differently, their respective queastiones (14a) and (14b) should form a *strategy* addressing the overarching quaestio. What could such an overarching question be for (14a) and (14b)? Following Roberts (1996), conditions on possible strategies are formulated in terms of Groenendijk and Stokhof's notion of question entailment $\models$ (e.g. Groenendijk and Stokhof, 1997). An ideal strategy must be both effective and economical (15). A series of questions $?\psi_1, ..., ?\psi_n$ is an effective strategy of addressing question $?\psi$ if $?\psi_1, ..., ?\psi_n$ entails $?\psi$, i.e. the sum of complete answers to each of $?\psi_1, ..., ?\psi_n$ gives a complete answer to $?\psi$ (15a). The strategy is economical if $?\psi$ entails each of $?\psi_1, ..., ?\psi_n$, that is if we know the complete answer to $?\psi$ we also know the complete answer to each of the subquestions $?\psi_1, ..., ?\psi_n$, or in other words, the subquestions do not ask for more information than $?\psi$ does.

(15) Conditions on strategies:
　　 a. EFFECTIVE STRATEGY:
　　　　 A series of subquestions $?\psi_1, ..., ?\psi_n$ is an effective strategy of addressing question $?\psi$ iff the sum of complete answers to each of $?\psi_1, ..., ?\psi_n$ gives a complete answer to $?\psi$, or $?\psi_1, ..., ?\psi_n \models ?\psi$.
　　 b. ECONOMIC STRATEGY:
　　　　 A series of subquestions $?\psi_1, ..., ?\psi_n$ is an economic strategy of addressing question $?\psi$ iff the sum of complete answers to each of $?\psi_1, ..., ?\psi_n$ does not give more information than a complete answer to $?\psi$, or for each of $?\psi_i \in \{?\psi_1, ..., ?\psi_n\}$, $?\psi \models ?\psi_i$.

According to these conditions, the questions *What does Peter do?* (14a) and *What does Max do?* (14b) form an optimal strategy for answering the question *Who (of Peter and Max) does what?* (16)—a double variable question, where in addition to the event variable e ranging over the possible actions (inherited from both subquestions), the respective aboutness topics *Peter* and *Max* are replaced by another variable x, whose domain is restricted to the set of Peter and Max.

(16) *Who does what?*: $?x, e[x \in \{Peter, Max\} \wedge Agent(x, e) \wedge happen(e)]$

Thus the resulting discourse topic structure consists of a double variable question split up into two single variable subquestions—the configuration that licenses

contrastive topics in Büring's theory. Moreover, the aboutness topics *Peter* and *Max* are specified in the subquestions, but correspond to a variable in the overarching question, therefore they are the contrastive topics. In short, the aboutness-topichood guarantees that the respective terms are specified in the most local quaestio, while the aboutness topic *shift* ensures that those terms are replaced by a variable at the next level of discourse topic structure, so that a shifting aboutness topic automatically fulfills the conditions for contrastive topics.

The above reasoning is based on the assumption that the discourse topics of (13a) and (13b) are *What does Peter do?* and *What does Max do?*, respectively, and that the double question is the only option for the overarching topic. Of course, there are a few alternative construals of the discourse topic for (13), but it can be shown that they are less optimal for various reasons. First, one might wonder if the question *What happens?* or *What do Peter and Max do?* would make equally good overarching topics for *What does Peter do?* and *What does Max do?* However, this is not so. The question *What happens?* (17a) is broader, i.e. asking for more information than the conjunction of *What does Peter do?* and *What does Max do?* does—answering these two questions does not give a complete answer to the *What happens?*-question, so the strategy is not effective. The question *What do Peter and Max do?* is ambiguous (the same kind of ambiguity as the one discussed by Krifka, 2001). On one reading, it is asking for a specification of events in which both Peter and Max are involved as agents (17b), that is the question operator takes scope over the conjunction. This reading is weaker than the conjunction of the questions *What does Peter do?* and *What does Max do?* For example, the difference between the possibilities where Peter (only) crosses the street and Max (only) buys a newspaper and where neither one does anything does not matter to this question, because in both cases there is no event in which *both* Peter and Max are involved. However, this difference matters if we ask about Peter and Max individually. Knowing the answer to *What does Peter do?* and *What does Max do?* we also know the answer to (17b), but not vice versa. Thus the strategy is efficient but not economical. The other reading of the question *What do Peter and Max do?* is simply a conjunction of the questions *What does Peter do?* and *What does Max do?* (17c), i.e. the conjunction takes scope over the question operator. Of course, in this case the strategy is both efficient and economical, but (17c) is equivalent to the double variable question (16), so in all relevant respects it *is* a double variable question which can license contrastive topics, and all the above reasoning concerning the relationship between shifting aboutness topics and contrastive topics applies equally to this case.[14]

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[14]Adding appropriate domain restrictions to a question like *What happens?* could perhaps also narrow it down to (16). However, as soon as it is equivalent to (16) it is a double variable question by the same reasoning and can also license contrastive topics.

(17) a. *What happens?*: $?e[happen(e)]$
   b. *What do Peter and Max do?* (1):
      $?e[happen(e) \wedge Agent(Peter, e) \wedge Agent(Max, e)]$
   c. *What do Peter and Max do?* (2):
      $?e[Agent(Peter, e) \wedge happen(e)] \wedge ?e[Agent(Max, e) \wedge happen(e)]$

One could also question our assumption that the sentences (13a) and (13b) address the topics *What does Peter do?* (14a) and *What does Max do?* (14b). Indeed, there is a whole range of questions about *Peter* and *Max* that (13a) and (13b) could answer, e.g. *What does Peter cross?*, *Where does Peter go?*, *Does Peter cross the street?*, etc., as well as *What does Max buy?*, *Does Max buy anything?*, etc. Even if we assume that (13a) and (13b) have an unmarked accentuation pattern with a nuclear accent on the direct object and a strong version of focus projection rules such as Selkirk (1995), which would dramatically restrict the set of possible information structures of the sentences and the set of possible congruent questions, it would still allow at least for the topics *What does Peter cross?* (18a) and *What does Max buy?* (18b).

(18) a. *What does Peter cross?*:
      $?x\exists e[cross(e) \wedge Agent(Peter, e) \wedge Theme(x, e) \wedge happen(e)]$
   b. *What does Max buy?*:
      $?x\exists e[buy(e) \wedge Agent(Max, e) \wedge Theme(x, e) \wedge happen(e)]$

Suppose these are the quaestiones behind (13a) and (13b). What could their overarching quaestio be? Obviously, (16) is not good in this role, because (18a)–(18b) is not an effective strategy of addressing (16). If we know, for instance, what Max bought, we do not necessarily know if he did anything else beside bying things, so it is unknown what he did in general. But obviously, (19)—the straightforward conjunction of the questions (18a) and (18b)—gives rise to a strategy that is both effective and economical by definition.

(19) *What does Peter cross and what does Max buy?*:
   $?x\exists e[cross(e) \wedge Agent(Peter, e) \wedge Theme(x, e) \wedge happen(e)] \wedge$
   $?x\exists e[buy(e) \wedge Agent(Max, e) \wedge Theme(x, e) \wedge happen(e)]$

According to the constraints formulated so far there is nothing wrong with (19). However, there is one consideration that motivates a preference for questions like (16) over those like (19). Questions like (16) are *expressible* by a single interrogative sentence, and define a single focus-background partition for a sentence, which makes it possible for them to be answered by a single sentence (as well as by a series of more than one sentences). Questions like (19) can only be answered by a series of sentences, and should one try to give a one-sentence answer to such a question, its partition into focus and background would be undefined. In other words, natural language is optimised for expressing questions like (16), they are easier to keep track of by means of information-structural marking when the questions are implicit, which might be a reason why they are generally preferred

as quaestio at all levels of discourse topic structure. This will be captured by the following constraint:

(20) EXPRESSIBILITY:
   The discourse topic (quaestio) is expressible, i.e. it defines a single
   focus-background partition for a congruent one-sentence answer.

This constraint is certainly violable. Occasionally we do have to deal with strategies comprising sets of questions that cannot be fit into any general formal scheme. A tax form is a case in point, which can be seen as a conjunction of questions like *What is your income?* and *How many dependents do you have?* which are related by the nature and function of tax forms, but not by any formal pattern. However, in order to justify an implicit strategy of this sort in discourse it should be activated in conjunction with some salient scenario (such as filling out a tax form), and since no such scenario appears prominent in (13), there is no reason to assume one, and a formally-motivated strategy is preferred.

In sum, the trade-off between strategic effectiveness, economy, and expressibility of topic questions establishes a preference for the construal of the discourse topic as *Who does what?–What does Peter do?–What does Max do?* for (13) on the assumption that *Peter* and *Max* are the aboutness topics of (13a) and (13b). More generally, this is an illustration for the claim that whenever the aboutness topic shifts between sentences ϕ and ψ, it provides an additional question variable that ranges between the two instantiations of the aboutness topic, so the overarching question that connects ϕ and ψ is always a multiple variable question. The shifting aboutness topic corresponds to a variable in that question, but is instantiated in the respective single variable subquestions for ϕ and ψ, which implies that the shifting aboutness topic is a contrastive topic.

Linguistic literature contains observations that speak both for and against viewing shifting aboutness topics as contrastive topics. One of the points in favour is that linguistic marking patterns for aboutness topic shift resemble those for contrastive topics and are distinct from the linguistic expression of continuing aboutness topics. Both shifting aboutness topics and contrastive topics tend to be accented, fronted, expressed by accented or strong pronouns (if pronominalised), or otherwise phonologicaly heavy (cf. Frascarelli and Hinterhölzl, 2007). In contrast, continuing aboutness topics tend to be unaccented, expressed by weak pronouns or zeroes, tend to cliticise and more generally occupy syntactic positions reserved for light material. Most linguistic expressions that figure in the literature as tests for aboutness topics, such as *as for X* and *as far as X is concerned* are reserved for shifted aboutness topics (Reinhart, 1981) and appear clause-initially, i.e. in typical contrastive topic positions.

On the other hand, there are arguments for keeping these two notions apart. For example, Frey (2004) points out that only contrastive topics activate a set of alternatives and give rise to an implicature that those alternatives do not hold. However, it is well-known that implicatures of this sort—exhaustivity implicatures—depend

very much on how specific the information on the intended domain of alternatives is. For example, it is easy to see (22) as an exhaustive answer to (21a)—Mary painted the fence blue and no other colour—because the question makes it very clear that the alternative set is the set of colours. In contrast, the exhaustivity in (22) as an answer to (21b) is by far less obvious. It is certainly not the only event altogether that happened. It could be seen as the only event that happened among a certain domain of relevant events, but the question does not give us any further information on what those relevant events are. In general, we will adopt the view that exhaustivization takes place always by default as a result of general pragmatic processes (Schulz and van Rooij, 2006), but under certain conditions it may not lead to any visible effects. The indeterminacy of the relevant domain is one of such conditions.[15]

(21) a. What colour did Mary paint the fence?
    b. What happened?

(22) Mary painted the fence blue.

The lack of exhaustivity effects with plain, "non-contrastive" shifted aboutness topics could be due to the same reason. Compare Reinhart's example (23) of a shifted aboutness topic marked by the *as for* construction, and a version of the same sentence (24) with a constrastive topic accent on *Felix* and a focus accent on *Rosa*. Whereas (24) can be taken to imply that other guys invited other girls, and not Rosa, to dance with them, there is no such implication in (23) if it is uttered with "neutral" intonation.

(23) As for Felix, he invited Rosa to dance with him.

(24) FELIX invited ROSA to dance with him.

This can be explained if we assume that the intonational pattern of (24) projects a *Who invited whom to dance with them?* discourse topic, split up by the first *wh*-variable ranging over guys (present at a particular party) along the lines of Büring (2003): *Who did Felix invite?*, *Who did John invite?*, etc. Whoever John invited to dance must include some other girl, while the exhaustive interpretation of that answer implies that he *only* invited that girl, and not Rosa. These inferences are possible because the question, as indicated by the information structure of the

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[15]Formally this could work out as follows: a question like *Who P?* with an underspecified domain of *who* could be seen as a "disjunction" of questions *Who of $\{a, b, c\}$ P?*, *Who of $\{a, b\}$ P?*, *Who of $\{a, c\}$ P?*, ..., *Who of $\{a\}$ P?*, so an exhaustive answer to such a question would be a disjunction of the exhaustive answers to the respective questions, e.g. $[P(a) \wedge \neg P(b) \wedge \neg P(c)] \vee [P(a) \wedge \neg P(b)] \vee [P(a) \wedge \neg P(c)] \vee ... \vee P(a)$. If we allow for singleton domains like $\{a\}$, the exhaustive interpretation of $P(a)$ with respect to this domain does not exclude any alternatives to a since there are none, i.e. the exhaustive interpretation is equivalent to the non-exhaustive one, and when $P(a)$ appears as one of the disjuncts, it makes the whole disjunction equivalent to $P(a)$. Even if we forbid singleton domains by some general principle, the disjunction of exhaustive answers would amount to $P(a)$ and there is some individual that does not have property P but it is unknown which one. This is a bit stronger than the plain non-exhaustive answer to *Who P?*, but not that much stronger.

sentence—the background relation that we get by abstracting over the contrastive constituents—gives us enough information to form reasonable alternatives sets: the possible inviters and invitees on a particular dancing occasion.

In contrast, (23) is in the worst case just an answer to a *What about Felix?* question. Assuming that *as for X* conventionally indicates that X is a new aboutness topic, it signals that the present sentence addresses the question *What about X?*, and since this is a *new* aboutness topic, it also presupposes that the question *What about Y?*, where $X \neq Y$, has been, or will be, addressed in the same discourse. The overarching double-variable discourse topic is in that case *What about whom?* or *What about what?* If the intonational pattern of the sentence does not support a more specific background relation, the alternative pieces of information about X and Y that constitute possible answers can be more or less anything. Applying the same reasoning as in the case of (24), (23) would be expected to suggest that something else has been or can be said about someone else, let's say P about Y, and exhaustivization results in the inference that P is the only relevant thing that can be said about Y in the given context, so in particular, the information that Felix invited Rosa to dance with him (an alternative to P) is not about Y. First of all, this is a much weaker implicature than in (24). It will normally be true for any referent not mentioned in the sentence, e.g. *Peter*, simply because the information that Felix invited Rosa to dance with him is not about Peter. It could be about Rosa though. If $Y = Rosa$, the exhaustive interpretation of *about*($Rosa, P$) with respect to the *What about Rosa?* question would imply that only P, and not that Felix invited her to dance with him, can be relevantly said about Rosa in the given context. But what is relevant about Rosa is strongly underdetermined, so if the hearer allows for the possibility that this information is not relevant about Rosa (while it is relevant about Felix), the exhaustivization does not lead to any visible effect, just like in the case of (21b)–(22).

Moreover, aboutness topics tend to persist in discourse. That is, (23) could be the first sentence of a whole paragraph about Felix. In that case it is not just the information that Felix invited Rosa to dance with him, but the content of the whole paragraph that provides an alternative to P, so the sentence (23) by itself does not even provide the full parameters for exhaustivization. When the hearer has reasons to expect that the talk about Felix will go on, he or she might temporarily suspend exhaustivization until the end of the paragraph.

In sum, shifted aboutness topics are subject to exhaustivization inferences to the same extent as contrastive topics are, but those inferences will often lead to very weak or no effect, or apply to larger text passages than just the sentence that expresses the aboutness topic, so the usual effects cannot be observed at the sentence level. In other words, considerations of exhaustivity do not prevent us from viewing shifted aboutness topics as a special case of contrastive topics.

The fact that aboutness topic shift leads to establishing a multiple variable quaestio in the same way as contrastive topics do, has far-reaching consequences due to the interaction of the quaestio with the update mode as was described in section 3.1. The ICON-TOP principle (11) says that the iconic update mode is only

possible if the quaestio is a single variable question about events, whereas double variable questions are incompatible with it. Thus aboutness topic shift switches off iconic update. Coming back to the contrast between the German and the English examples (25) vs. (26), the lack of temporal inferences in (25) could be explained, if *Peter* and *Max* were indeed preferentially interpreted as aboutness topics. Then the aboutness topic shift from *Peter* to *Max* would lead to non-iconic update, which does not establish any temporal relationship between the described events. At the same time, if one could show that English does not force us to interpret *Peter* and *Max* as aboutness topics, it would be possible to analyse (26a) and (26b) as sentences without an aboutness topic altogether, in which case they could address single variable questions like *What happens?* which are compatible with iconic update. The following section will take the first basic steps to motivate this difference between German and English by the difference in the function of the preverbal position in these two languages with regard to topic marking.

(25) a. Peter überquert die Straße
   Peter crosses the street
  b. Max kauft eine Zeitung
   Max buys a newspaper

(26) a. Peter crosses the street
  b. Max buys a newspaper

3.3 Aboutness topic and word order

Why should *Peter* and *Max* be preferentially interpreted as aboutness topics in (25)? The most straight-forward way of capturing this would be by stipulating that the preverbal position in German main clauses, or the *prefield*, is a kind of topic position, in the sense that the constituent in that position is understood as (aboutness) topic, unless signalled otherwise. The TOP-V constraint in (27) implements this idea:

(27) TOP-V: The preverbal constituent is a topic.

Obviously, this should be a relatively weak constraint. Conventional means signalling directly or indirectly that the preverbal constituent is not topical, such as focal accent, or focus sensitive particles (*selbst Max* 'even Max'), or indicators of non-specificity (*kein Mädchen* 'no girl'; *wer* 'who'), as well as expressions that by their nature are immune to categories of information structure (sentence adverbials like *leider* 'unfortunately'), should be able to override TOP-V.

 Since the German prefield must contain exactly one constituent and cannot be empty, the application of this constraint creates a preference for sentences with topics over those without (in the spirit of von Stutterheim and Carroll (2005) and their explanation of the language-specific global choices in narrative planning). The crucial point of our proposal is that TOP-V should be ranked above ICONICITY in German:

(28) German:
   TOP-V > ICONICITY

ICONICITY favours iconic over non-iconic update, and therefore works against double-variable quaestio due to ICON-TOP. In cases like (25) this implies a preference for a *What happens?* quaestio and thereby a construal without a topic (because if these sentences had aboutness topics they would have to have distinct topics which would lead to an additional variable in the quaestio and be incompatible with iconic update). Obviously, in German TOP-V wins from ICONICITY, (25) is interpreted as having contrastive aboutness topics, the update mode is non-iconic, and the temporal order of the events remains unspecified.

In contrast, the preverbal position in an English declarative sentence is reserved, by and large, for the grammatical subject (SUBJ-V), while the categories of information structure do not play such a prominent role in filling this position as they do in German. This means that either the TOP-V constraint does not exist in English at all, or it is ranked so low that it is made practically inoperative by the whole host of constraints ranked above it. For our purposes it is essential that in contrast to German, TOP-V is ranked below ICONICITY in English:

(29) English:
   ICONICITY > ... > TOP-V

This is what accounts for the difference between (25) and (26). Since there is no pressure to interpret *Peter* and *Max* in (26) as aboutness topics in English, the topicless construal with a *What happens?* quaestio which makes iconic update possible is preferred by the ICONICITY constraint. The temporal order of the events is therefore understood to match the textual order of the sentences.

The status of the TOP-V constraint, however, is not entirely unproblematic. It would be more appealing to derive the effects of TOP-V from a more general syntactic theory of the German prefield. However, the standard view on the matter among syntacticians (Fanselow, 2002; Frey, 2004) does not seem to support TOP-V. It is assumed that the prefield can be filled either by direct semantically/pragmatically meaningful $\overline{A}$-movement (fronting *wh*-constituents, contrastive topics or focal constituents); or by semantically empty "formal" movement, which takes whatever constituent happens to be highest in the middle field (positions between the finite verb and the clause-final non-finite lexical verb form or a verbal particle, if available) and puts it in the prefield position. The result of the latter obviously depends on the structure of the middle field. According to Frey (2004), the highest position in the German middle field is a base position for aboutness topics, followed by sentence adverbials (*leider*, *wahrscheinlich*), followed by the subject, followed by frame adverbials (e.g. the reference time *dann*), followed by other constituents of the sentence. Since aboutness topics are highest in the middle field, they are given priority as prefield candidates over the rest (except for the triggers of $\overline{A}$-movement). Thus topichood plays a role in filling the prefield position in two ways. A constituent can move to the prefield directly by $\overline{A}$-movement if

it is a contrastive topic; and it can end up in the prefield by formal movement via the aboutness topic position, if it is an aboutness topic. Obviously, if it is both an aboutness topic and contrastive, both movement options are available.[16] In sum, if some consituent of the sentence is a topic of one or the other kind it is very likely to end up in the prefield. Only few factors can interfere: a *wh*-element or a focal constituent can get there first, but those are recognizable by their form and accentuation and would fall under the rule of principles responsible for overriding TOP-V in the presence of explicit marking (cf. above). However, if a sentence has no topic, then other, non-topical constituents will move to the prefield. Thus the theory predicts that either the constituent in the prefield is a topic (contrastive or aboutness, disregarding marked exceptions), or the sentence has no topic. This theory implies no preference for the first option, so it is just not strong enough to replace TOP-V.[17]

Admittedly, without a deeper syntactic underpinning TOP-V retains its stipulative flavour. Note that the required motivation must be syntactic, or more generally, grammatical, i.e. sensitive to language-specific features, otherwise the contrast between German and English that the relative ranking of TOP-V accounts for cannot be explained. Another possible way to go would be to treat TOP-V as a purely interpretational preference, which operates in production at the level of self-monitoring, while the standard syntactic picture presented above (or some translation of that into OT) describes the production grammar. In the framework developed by Zeevat (2009), during interpretation the candidate meanings are pre-filtered by an associative process based on statistical tendencies before the production grammar selects the final winner by reproducing the input utterance. TOP-V could be a reflection of such a statistical tendency (and thus not a real constraint in the grammar). We made a preliminary count on the basis of 176 sentences quasi-randomly selected from the German original texts of the Oslo German-English-

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[16]If a sentence has both a continuing aboutness topic and a distinct contrastive topic, it seems that the contrastive topic is normally the preferred candidate for the prefield.

[17]This touches upon an interesting and rather fundamental issue. The V2 property of the present stage of German syntax has developed from an earlier stage where a topicless sentence would exhibit the V1 order, whereas the aboutness topic would appear before the finite verb in sentences that do have an aboutness topic, thus giving rise to a V2 structure (Hinterhölzl and Petrova, 2010). This is the case in Old High German, where obviously it makes much more sense to talk about the preverbal position as a topic position. Hinterhölzl and Petrova (2010) argue that as V2 generalises and becomes obligatory, the topic function of the preverbal position neutralises. Indeed, this kind of neutralisation frequently accompanies grammaticalisation processes.

However, if the topic function of the preverbal position were completely neutralised we would not find a preference for a global aboutness topic in V2 languages. Rather, it looks as if we have to do with two alternative ways of resolving the same conflict between constraints. The speaker is faced with the situation where she must put a constituent before the verb (the new V2 requirement) and that constituent must be the aboutness topic (the old topic function of the preverbal position), but the sentence as planned so far does not have an aboutness topic. One way to deal with it is to weaken the topic function requirement. The other way is to avoid producing topicless sentences and plan the discourse in such a way that, as far as possible, every sentence has an aboutness topic. It appears that the present state of the German grammar and usage is a result of some sort of trade-off between these two strategies.

Norwegian Parallel Corpus of literary prose. In about 85% of the sentences, the prefield constituent was a topic—either continuing, contrastive, or a shifted aboutness topic. In other words, it makes sense to talk about a "topic bias" associated with the preverbal position in German even if it cannot be considered a topic position categorically.

3.4   Does aspect marking matter?

The general layout of the theory that should explain the differences in temporal intepretation between English and German discussed in section 2.2 is now complete. However, before proceeding to the matters of formal modelling one more issue deserves some discussion. Aspect is another typological parameter in which German and English differ. The English grammar requires an obligatory marking of aspect. The progressive form (30a) indicates that the eventuality s of Peter crossing the street is "viewed from within", it is presented as extended in time and subsumes its temporal location: $t \subseteq s$. The simple form presents eventualities as "punctual" or "completed" *events*, and included in their temporal location: $e \subseteq t$, cf. (30b). In contrast, aspect marking is not obligatory in German, so the sentence *Peter überquert die Straße* is in fact ambiguous between the "progressive" and the "simple" interpretation and can be used both in contexts where (30a) and where (30b) is appropriate.

(30) a. Peter is crossing the street.
    b. Peter crosses the street.

One might wonder whether this typological difference between German and English might provide an alternative, and perhaps a simpler explanation to the same phenomenon. In early formal theories of tense and aspect such as Hinrichs (1986), the temporal progression characteristic of the narrative was generally attributed to events in the narrow sense, i.e. "punctual" eventualities, and thus made ultimately part of the semantics of tense/aspect morphology. Thus the simple aspectual form would not only relate the event to its location time t, but also to a reference time r, $r \prec t$, which would be resolved anaphorically to the location time of the event mentioned previously in discourse.[18] This would predict the relation of temporal succession between the events described in (31), just as much as with coreferential subjects, cf. (7).[19]

(31) a. Peter crosses the street
    b. Max buys a newspaper

States, including progressive "states", do not "push the narrative forward" in

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[18]This wording is more faithful to the version in Kamp and Reyle (1993) than to Hinrichs (1986), but the crucial idea is the same.

[19]The original theories were developed for past progressive and simple in English, as well as for the French *passé simple* and *imparfait*, but the essential aspects can be applied to present forms as well.

those theories, in the sense that the location time t_2 of the second state equals the reference time r which is again resolved to the time t_1 of the previously mentioned state. So Peter crossing the street is predicted to overlap in time with Max buying a newspaper.

(32) a. Peter is crossing the street
   b. Max is buying a newspaper

If the German example (33) is understood as ambiguous between (31) and (32)—or in fact between all possible combinations of (31a) and (31b) with (32a) and (32b)—then the temporal relation between the eventualities in (33) is either overlap ($t_1 = t_2$, $t_1 \subseteq s_1$, $t_2 \subseteq s_2$, hence s_1 overlaps s_2) or precedence ($t_1 \prec t_2$, $e_1 \subseteq t_1$, $e_2 \subseteq t_2$, hence $e_1 \prec e_2$), which comes close to saying that the temporal relation is not specified,[20] as was our original observation in section 2.2.

(33) a. Peter überquert die Straße
       Peter crosses   the street
    b. Max kauft eine Zeitung
       Max buys   a   newspaper

In the version with coreferential subjects (34) simultaneity could be ruled out by plausibility considerations: the same person is not likely to cross the street and buy a newspaper at the same time, so $t_1 \prec t_2$ is the preferred reading.

(34) a. Peter überquert die Straße
       Peter crosses   the street
    b. Er kauft eine Zeitung
       he buys   a   newspaper

A theory of this kind would ultimately amount to saying that German narrators avoid to change the referent of the grammatical subject (or agent, or the most prominent participant of the situation) because coreference of the subjects presents an additional constraint on the temporal relation between the events, giving preference to succession over temporal overlap, and thus making it a narrative. In English this is not necessary because the obligatory aspect marking does the job. The problem with this approach is that it only works if temporal relations (particularly the relation of precedence between the reference time and the location time for simple tenses) are made part of the semantics of aspectual markers. However, this idea has long been dropped, the main reason being the well-known dependency of temporal relations on the so-called rhetorical, or discourse relations (see esp. Lascarides and Asher, 1993). As we have seen in section 2.2, the English example (31) can also be understood as a list of temporally unrelated events if uttered with a typical list intonation or with a contrastive topic accent on the subjects. This observation is hard to accommodate under the aspect-based view, whereas it follows naturally from the topic-based theory developed in the previous sections. In other words, the aspect

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[20]This is not quite so, however, since the $t_2 \prec t_1$ option is not accounted for.

parameter is probably not as important for explaining the differences in question between the English and German narratives as it might seem at first glance.

4 The formal architecture

This section is not much more than a "formal summary" of the theory developed in section 3, except that it puts it in a framework that allows to connect the interpretation perspective, which has dominated our discussion so far, with the generation perspective.

4.1 Discourse units

Let us start with an illustration. The representation of the discourse structure for (35) is given in Figure 6.

(35) a. Peter überquert die Straße
      Peter crosses   the street
   b. Er kauft eine Zeitung
      he buys   a   newspaper

As Figure 6 shows, each discourse unit—the elementary discourse units corresponding to utterances/sentences (35a) and (35b), as well as the discourse constituent comprising both of them—is assigned a multilayered DISCOURSE UNIT (DU) structure, represented as an attribute-value matrix, which contains slots, or *attributes*, for the unit's phonological or textual FORM, its semantic CONTENT, its recursive structure given by an ordered list of daughter nodes (DAUGHTERS, or DTRS) which are discourse units themselves, and a number of attributes representing the pragmatic features of the discourse unit, such as the aboutness topic (A-TOPIC) and the QUAESTIO.

The recursive structure of a discourse unit is defined in the DAUGHTERS attribute which specifies the list of DUs that the present DU consists of. For elementary discourse units, the DAUGHTERS list is empty, cf. $\langle\rangle$ in Figure 6. For non-elementary DUs it is a tuple of DU structures. In Figure 6 the DAUGHTERS value of the overarching DU is given as $\langle\boxed{1},\boxed{4}\rangle$, but $\boxed{1}$ and $\boxed{4}$ are simply placeholders for the whole DU structures of the terminal nodes in the tree representation, in accordance with a common convention.

The value of the FORM attribute (in its most simplistic interpretation) is a finite sequence of letters of the alphabet of a given language—the sequences in (35a) and (35b) for the elementary discourse units and the concatenation of those sequences for the mother node.

The CONTENT of a discourse unit is a DRS representing its content. The content value of a non-elementary DU is a function of the content values of its DAUGHTERS. In section 3.1 we made a distinction between two modes of update: the iconic and the non-iconic update. In the present architecture these correspond
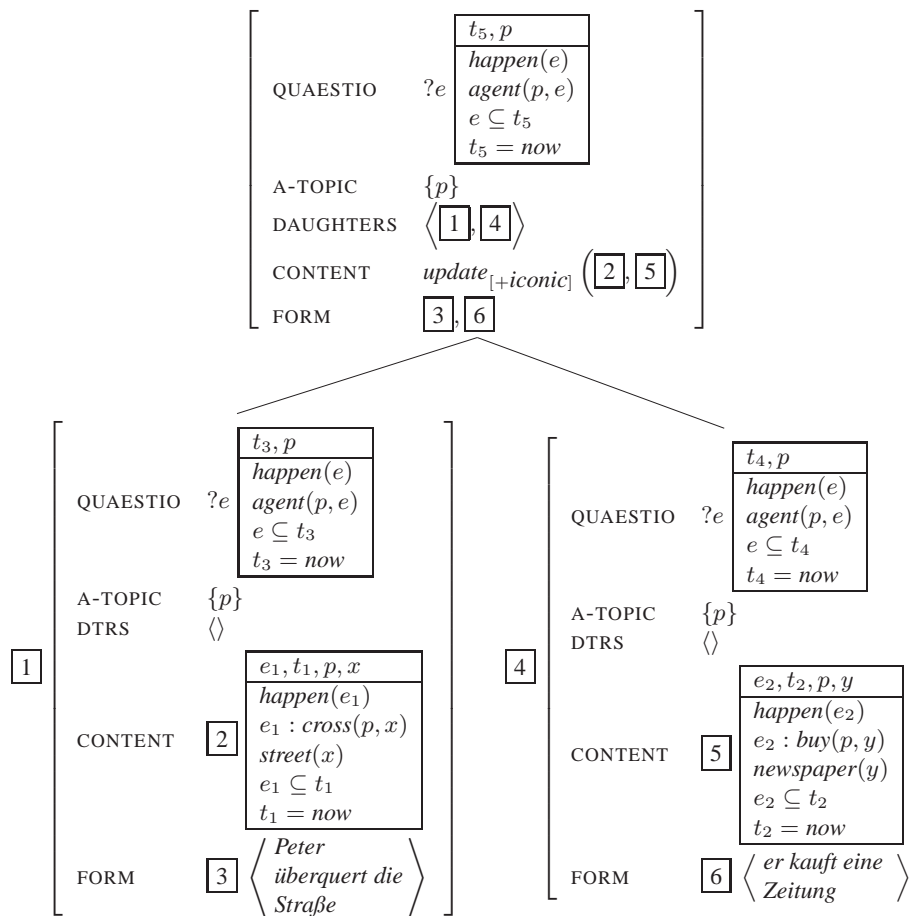
$$
\begin{bmatrix}
\text{QUAESTIO} & ?e\; \begin{array}{|l|}\hline t_5, p \\\hline \mathit{happen}(e) \\ \mathit{agent}(p,e) \\ e \subseteq t_5 \\ t_5 = \mathit{now} \\\hline\end{array} \\[2em]
\text{A-TOPIC} & \{p\} \\
\text{DAUGHTERS} & \left\langle \boxed{1}, \boxed{4} \right\rangle \\
\text{CONTENT} & \mathit{update}_{[+\mathit{iconic}]}\left(\boxed{2}, \boxed{5}\right) \\
\text{FORM} & \boxed{3}, \boxed{6}
\end{bmatrix}
$$

$$
\boxed{1}\;
\begin{bmatrix}
\text{QUAESTIO} & ?e\; \begin{array}{|l|}\hline t_3, p \\\hline \mathit{happen}(e) \\ \mathit{agent}(p,e) \\ e \subseteq t_3 \\ t_3 = \mathit{now} \\\hline\end{array} \\[2em]
\text{A-TOPIC} & \{p\} \\
\text{DTRS} & \langle\rangle \\
\text{CONTENT} & \boxed{2}\; \begin{array}{|l|}\hline e_1, t_1, p, x \\\hline \mathit{happen}(e_1) \\ e_1 : \mathit{cross}(p,x) \\ \mathit{street}(x) \\ e_1 \subseteq t_1 \\ t_1 = \mathit{now} \\\hline\end{array} \\[2em]
\text{FORM} & \boxed{3}\; \left\langle \begin{array}{l}\mathit{Peter} \\ \mathit{überquert\ die} \\ \mathit{Straße}\end{array} \right\rangle
\end{bmatrix}
$$

$$
\boxed{4}\;
\begin{bmatrix}
\text{QUAESTIO} & ?e\; \begin{array}{|l|}\hline t_4, p \\\hline \mathit{happen}(e) \\ \mathit{agent}(p,e) \\ e \subseteq t_4 \\ t_4 = \mathit{now} \\\hline\end{array} \\[2em]
\text{A-TOPIC} & \{p\} \\
\text{DTRS} & \langle\rangle \\
\text{CONTENT} & \boxed{5}\; \begin{array}{|l|}\hline e_2, t_2, p, y \\\hline \mathit{happen}(e_2) \\ e_2 : \mathit{buy}(p,y) \\ \mathit{newspaper}(y) \\ e_2 \subseteq t_2 \\ t_2 = \mathit{now} \\\hline\end{array} \\[2em]
\text{FORM} & \boxed{6}\; \left\langle \begin{array}{l}\mathit{er\ kauft\ eine} \\ \mathit{Zeitung}\end{array} \right\rangle
\end{bmatrix}
$$

Figure 6: Discourse structure for (35): iconic update; quaestio *What does Peter do?*; global aboutness topic *Peter*.

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to two different ways of combining the content values of the daughters, i.e. two functions *update*$_{[+iconic]}$ and *update*$_{[-iconic]}$ which take two DRS-s as input, and return a DRS which is the result of updating the first argument DRS with the second "iconically" or "non-iconically" as described in section 3.1. If a discourse unit has more than two DAUGHTERS the update function is first applied to the first two, then to the resulting DRS and the third daughter, and so on (as update is standardly assumed to work).

The value of A-TOPIC is a (possibly empty) set of discourse referents, e.g. $\{p\}$ for *Peter* in both the mother and the daughter nodes in Figure 6. A non-empty A-TOPIC set shared by a series of discourse units and their common mother node, such as $\{p\}$ in Figure 6, is what we refer to as the *global aboutness topic*.

Finally, the QUAESTIO is a question DRS, i.e. a DRS preceded by a ?-operator which binds some of the variables occurring in the DRS (the question variables) if it is a *wh*-question (Groenendijk and Stokhof, 1997). For example, the value of QUAESTIO of the mother node in Figure 6 is the question of which event $(?e)$ happens at time t_5, which is *now*, such that Peter (p) is the agent of that event, or in other words: *What does Peter do?*

4.2 Constraints on discourse units

A set of ranked constraints is defined on DU structures. The felicitous FORM–CONTENT–...–QUAESTIO combinations of a given language must be optimal with respect to the constraint ranking defined for that language in the standard sense of Optimality Theory (Prince and Smolensky, 1993; Blutner and Zeevat, 2003). The constraints discussed in section 3 are summarised below. The first group of constraints are all ranked high. We did not discuss cases of violation or the ranking of these constraints with respect to one another since those do not play a role for the problem at hand.

- ICON-TOP: For a non-elementary DU, if the value of CONTENT is *update*$_{[+iconic]}$ of the CONTENT values of its DAUGHTERS, then the value of QUAESTIO is a question DRS of the form $?eK$ with exactly one question variable ranging over events.

- ABOUTNESS TOPIC: Every element of the A-TOPIC set is part of the universe of the QUAESTIO DRS and not a question variable.

- EFFECTIVE STRATEGY: If the DU's QUAESTIO value is ψ and $?\psi_1, ..., ?\psi_n$ are the QUAESTIO values of its DAUGHTERS, then $?\psi_1, ..., ?\psi_n \models \psi$

- ECONOMIC STRATEGY: If the DU's QUAESTIO value is ψ and $?\psi_1, ..., ?\psi_n$ are the QUAESTIO values of its DAUGHTERS, then for each $\psi_i \in \{\psi_1, ..., ?\psi_n\}$ $\psi \models \psi_i$.

- EXPRESSIBILITY: The value of QUAESTIO is expressible, i.e.: there exists an optimal simple interrogative sentence such that QUAESTIO is CONTENT of that sentence.[21]

The last two constraints are ranked lower than the first group, and their ranking is different in German and English. In German TOP-V is ranked higher than ICONICITY, while in English it is ranked lower.

- TOP-V: There is a constituent before the verb that refers to an element of the A-TOPIC set.[22]

- ICONICITY: The CONTENT value of a non-elementary DU is $update_{[+iconic]}$ of the CONTENT values of its DAUGHTERS.

4.3 Interpretation

A standard OT grammar operates on a certain *input* and *candidate set*. What kinds of linguistic objects constitute the input and the candidate set, respectively, depends on whether the grammar is applied in the direction of generation or interpretation. Roughly speaking, in the interpretation direction the input is the linguistic form (or some "closer-to-surface" representation) of an expression, while the candidate set is constituted by alternative meanings (or "deeper" representations). The constraints are applied to select the optimal meaning for a given form. In the generation direction, the input is a representation of meaning, and the candidate set is a set of forms. The constraint system selects the optimal form for a given meaning. In the present framework, the same idea is implemented as follows: The candidate set rated by the constraint system is always a set of DU structures both in the direction of generation and of interpretation. However, in the interpretation direction that set is restricted to structures with a given value for FORM, while the values for CONTENT, QUAESTIO, A-TOPIC, and other features run through all theoretically possible instantiations. One could say that the input is an underspecified DU structure with a fixed FORM value and underspecified values of other attributes.

Before we turn to the question of input and candidate set in the generation direction, let us consider an application of this approach to interpretation and analyse the main motivating examples of this study. Table 1 illustrates the optimisation procedure for the discourse in (35). For reasons of space, the candidates are not represented as full-fledged DU structures but as combinations of relevant

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[21]In section 3 this constraint was formulated in terms of the notion of information-structural background. The difference is not essential as long as there is a straightforward mapping between interrogative sentences and the information-structural backgrounds (of declarative sentences) as is standardly assumed. In both cases, however, the constraint cannot be fully formalised with the tools provided so far. Information structure would have to be explicitly represented and the relationship between questions, interrogative sentences and backgrounds would have to be formally specified.

[22]This constraint cannot be fully formalised without an explicit representation of the syntax of elemenary DUs (sentences) and a specification of content of sub-sentential units (esp. NPs that express aboutness topics). However, the formalisation is fairly straightforward.

semantic and pragmatic features QUAESTIO, A-TOPIC, and the CONTENT update mode for the mother node, as well as the two daughter nodes (DTR1 and DTR2). The constraints are applied as to find the optimal combination(s) of these features for the given FORM value. We will only consider candidates that comply with the high-ranked constraints ABOUTNESS TOPIC, and the constraints related to the quaestio—EFFECTIVENESS, ECONOMY, and EXPRESSIBILITY. Also, we restrict our attention to candidates that respect question-answer congruence (presumably, another high-ranked principle). That is why questions like *What does Max do?* and *Who does what?* do not appear in Table 1. Neither the sentence *Peter überquert die Straße* nor *Er [Peter] kauft eine Zeitung* could be an answer to *What does Max do?*, and since there is no switch from a question like *What does Peter do?* to *What does Max do?*, the question *Who does what?* is not motivated according to the quaestio-related principles (see discussion in section 3.2). Similarly, Peter (p) cannot be a member of the aboutness topic set if the quaestio is *What happens?*, since aboutness topics must be specified in the quaestio (cf. ABOUTNESS TOPIC). In other words, we are not skipping any candidates that are likely to turn out more optimal than the ones we consider in Table 1.[23] Since all the quaestio values of the remaining candidates are single-variable questions about events, there are no violations of ICON-TOP. An empty A-TOPIC set creates a violation of TOP-V, since the referent of the preverbal constituent *Peter/Er* is not an element of that set. The constraint only applies to elementary DUs that correspond to single sentences, therefore we get two violations for each of the daughter nodes DTR1 and DTR2 in the first and the second candidate in Table 1. The ICONICITY constraint only applies to non-elementary DUs, i.e. only to the mother node in our example, which gives us one violation whenever the update mode is $[-iconic]$. This leaves us with the optimal candidate in the third line of Table 1, which does not violate any constraints. This is the structure represented in Figure 6 with a global aboutness topic *Peter* and the iconic update mode, which results in a chronological interpretation of the event descriptions.

The analysis of example (36) with switching subjects is given in Table 2. This time the candidate with *What does Peter do?* as the QUAESTIO value for DTR2 is not among the "short-listed" alternatives since it fails question-answer congruence for *Max kauft eine Zeitung*. Instead, the QUAESTIO configuration with a double-variable question *Who does what?* in the mother node and the questions about *Peter* and *Max* in the daughter nodes passes the filter of the higher ranked constraints.

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[23]There are a few feature combinations that comply to all the high-ranked principles considered so far, but are missing in Table 1. For example, the *What does Peter do?* QUAESTIO is compatible with an empty A-TOPIC set. Furthermore, the question *What happens?* contains an implicit reference to *now*, cf. the QUAESTIO values in Figure 6, so *now* could be an A-TOPIC. However, as will become clear presently, all these alternatives violate TOP-V for the input (35) and ultimately turn out to be less optimal than the winner of the optimisation process. Therefore we skip them to save space.

Table 1

	FORM ⟨ *Peter überquert die Straße* / *Er kauft eine Zeitung* ⟩			Icon-Top	Top-V	Iconicity
	QUAESTIO	A-TOPIC	CONTENT *update*			
	What happens?	∅	[+*iconic*]			
DTR1	*What happens?*	∅			**	
DTR2	*What happens?*	∅				
	What happens?	∅	[−*iconic*]			
DTR1	*What happens?*	∅			**	*
DTR2	*What happens?*	∅				
	What does Peter do?	{p}	[+*iconic*]			
DTR1	*What does Peter do?*	{p}				
DTR2	*What does Peter do?*	{p}				
	What does Peter do?	{p}	[−*iconic*]			
DTR1	*What does Peter do?*	{p}				*
DTR2	*What does Peter do?*	{p}				

Table 1: Optimisation of quaestio, aboutness topic and update mode in the interpretation of (35).

Table 2

	FORM ⟨ *Peter überquert die Straße* / *Max kauft eine Zeitung* ⟩			Icon-Top	Top-V	Iconicity
	QUAESTIO	A-TOPIC	CONTENT *update*			
	What happens?	∅	[+*iconic*]			
DTR1	*What happens?*	∅			**	
DTR2	*What happens?*	∅				
	What happens?	∅	[−*iconic*]			
DTR1	*What happens?*	∅			**	*
DTR2	*What happens?*	∅				
	Who does what?	∅	[+*iconic*]			
DTR1	*What does Peter do?*	{p}		*		
DTR2	*What does Max do?*	{m}				
	Who does what?	∅	[−*iconic*]			
DTR1	*What does Peter do?*	{p}				*
DTR2	*What does Max do?*	{m}				

Table 2: Optimisation of quaestio, aboutness topic and update mode in the interpretation of (36).

$$\begin{bmatrix}
\text{QUAESTIO} & ?e?z & \begin{bmatrix} t_5 \\ happen(e) \\ agent(z,e) \\ e \subseteq t_5 \\ t_5 = now \end{bmatrix} \\[2pt]
\text{A-TOPIC} & \emptyset \\
\text{DAUGHTERS} & \langle\,\boxed{1}\,,\,\boxed{4}\,\rangle \\
\text{CONTENT} & update_{[-iconic]}\left(\boxed{2}\,,\,\boxed{5}\right) \\
\text{FORM} & \boxed{3}\,,\,\boxed{6}
\end{bmatrix}$$

$$\boxed{1}\;\begin{bmatrix}
\text{QUAESTIO} & ?e & \begin{bmatrix} t_3, p \\ happen(e) \\ agent(p,e) \\ e \subseteq t_3 \\ t_3 = now \end{bmatrix} \\[2pt]
\text{A-TOPIC} & \{p\} \\
\text{DTRS} & \langle\,\rangle \\
\text{CONTENT} & \boxed{2}\;\begin{bmatrix} e_1, t_1, p, x \\ happen(e_1) \\ e_1 : cross(p,x) \\ street(x) \\ e_1 \subseteq t_1 \\ t_1 = now \end{bmatrix} \\[2pt]
\text{FORM} & \boxed{3}\;\left\langle \begin{array}{l} Peter \\ \ddot{u}berquert\ die \\ Stra\ss{}e \end{array} \right\rangle
\end{bmatrix}$$

$$\boxed{4}\;\begin{bmatrix}
\text{QUAESTIO} & ?e & \begin{bmatrix} t_4, m \\ happen(e) \\ agent(m,e) \\ e \subseteq t_4 \\ t_4 = now \end{bmatrix} \\[2pt]
\text{A-TOPIC} & \{m\} \\
\text{DTRS} & \langle\,\rangle \\
\text{CONTENT} & \boxed{5}\;\begin{bmatrix} e_2, t_2, m, y \\ happen(e_2) \\ e_2 : buy(m,y) \\ newspaper(y) \\ e_2 \subseteq t_2 \\ t_2 = now \end{bmatrix} \\[2pt]
\text{FORM} & \boxed{6}\;\left\langle \begin{array}{l} Max\ kauft \\ eine\ Zeitung \end{array} \right\rangle
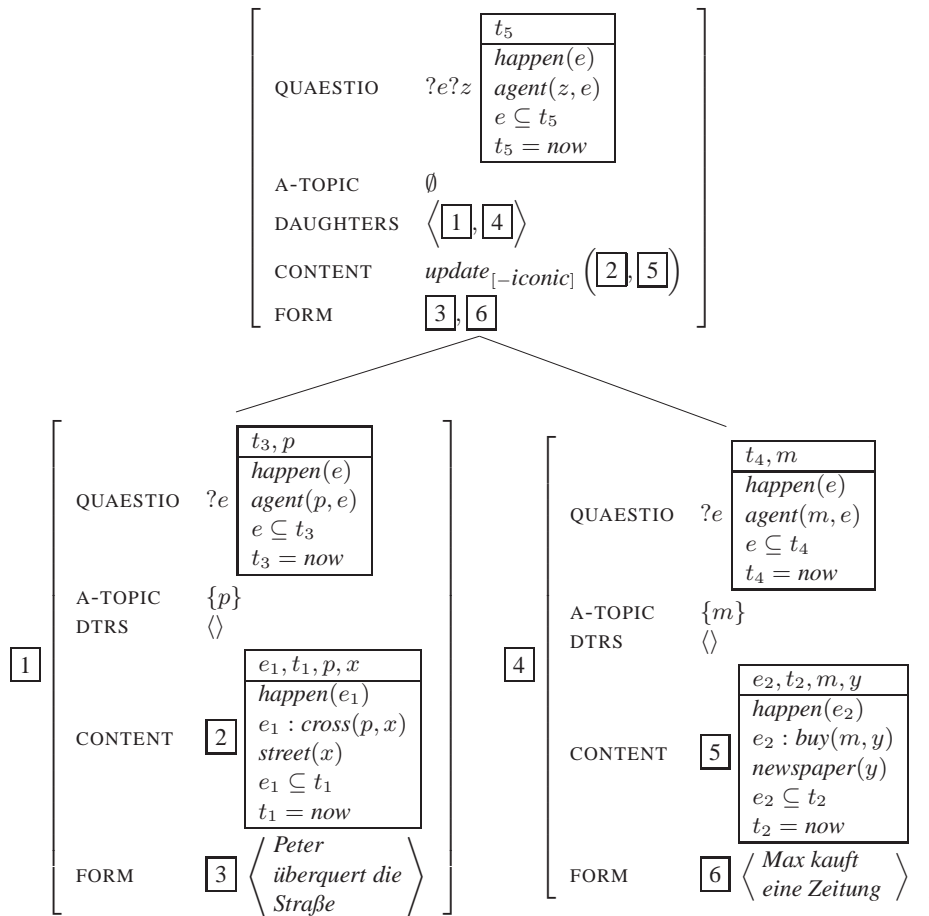\end{bmatrix}$$

Figure 7: Discourse structure for (36): non-iconic update; quaestio *Who does what?–What does Peter do?–What does Max do?*; no global aboutness topic.

(36) a. Peter   überquert   die   Straße
        Peter   crosses   the   street
     b. Max   kauft   eine   Zeitung
        Max   buys   a   newspaper

The results for the first two candidates in Table 2 are identical to those in the previous example. The third candidate violates ICON-TOP since the update mode [+*iconic*] conflicts with the double-variable question of the mother node. The fourth candidate with the double-variable QUAESTIO configuration but non-iconic update mode is the winner since it only violates the lowest ranked ICONICITY constraint. The corresponding DU structure is shown in Figure 7. As we assumed in section 2.2, the discourse in (36), where the occupants of the prefield positions have distinct reference, is most naturally interpreted as a temporally unrelated list of events. This is exactly what we get: the non-iconic update mode relates the

described events to the same update time *now*, so the order of events remains unspecified (cf. section 3.1). In sum, the ranking of TOP-V above ICONICITY in German creates a preference for the quaestio configurations that readily provide aboutness topics and thereby motivate the choice of the prefield constituent.

The OT analyses of the corresponding English examples (37) and (38) are shown in Tables 3 and 4, respectively.

(37) a. Peter crosses the street
     b. He buys a newspaper

(38) a. Peter crosses the street
     b. Max buys a newspaper

Since ICONICITY is stronger than TOP-V in English, structures with a quaestio suitable for iconic update, i.e. questions like *What happens?* and *What does Peter do?*, are generally preferred, and it does not matter that much whether the questions provide good aboutness topics. Thus candidates in lines 1 and 3 of Table 3 win from those in lines 2 and 4. For (37), TOP-V also implies a preference for *What does Peter do?* over *What happens?* (the candidate in line 3 of Table 3), however this result should not be taken to seriously for English. As was argued in section 3.3, the TOP-V constraint basically does not exist in English. In a framework where all constraints are universal this would mean that TOP-V is ranked so low that it is made inoperative by higher ranked constraints. That is, presumably there is a whole range of constraints between ICONICITY and TOP-V in English which might overrule whatever preferences established by TOP-V.

For (38), in contrast to the corresponding German example (36), the winner is *What happens?* for QUAESTIO with no aboutness topic whatsoever (line 1 of Table 4), rather than a double variable question with a changing aboutness topic (line 4). Once again, this is the effect of stronger ICONICITY in combination with ICON-TOP. Thus in accordance with our original observation, the English example is interpreted as a sequence of events as a result of iconic update (under "neutral" intonation, cf. section 2.2), unlike its German counterpart understood as a list of temporally unrelated events.

4.4 Generation

The analysis of the above examples illustrates the application of the proposed OT constraint system in the direction of interpretation taking the phonological or textual form of the discourses as input. Now we come back to the question of what the optimisation problem looks like in the generation direction. Which features of the DU structures are fixed in the input, and which are subject to variation in the candidate set? One might be tempted to assume, and it has in fact been assumed in previous OT accounts of semantic phenomena (Zeevat, 2000; Blutner and Zeevat, 2003) that the input is (a) the *content* to be expressed—a semantic representation in some suitable logical formalism—and (b) the *context* representing the common

	QUAESTIO	A-TOPIC	CONTENT *update*	ICON-TOP	ICONICITY	TOP-V
FORM ⟨ *Peter crosses the street* / *He buys a newspaper* ⟩						
	What happens?	∅	$[+iconic]$			
DTR1	*What happens?*	∅				**
DTR2	*What happens?*	∅				
	What happens?	∅	$[-iconic]$			
DTR1	*What happens?*	∅			*	**
DTR2	*What happens?*	∅				
	What does Peter do?	{p}	$[+iconic]$			
DTR1	*What does Peter do?*	{p}				
DTR2	*What does Peter do?*	{p}				
	What does Peter do?	{p}	$[-iconic]$			
DTR1	*What does Peter do?*	{p}			*	
DTR2	*What does Peter do?*	{p}				

Table 3: Optimisation of quaestio, aboutness topic and update mode in the interpretation of (37).

	QUAESTIO	A-TOPIC	CONTENT *update*	ICON-TOP	ICONICITY	TOP-V
FORM ⟨ *Peter crosses the street* / *Max buys a newspaper* ⟩						
	What happens?	∅	$[+iconic]$			
DTR1	*What happens?*	∅				**
DTR2	*What happens?*	∅				
	What happens?	∅	$[-iconic]$			
DTR1	*What happens?*	∅			*	**
DTR2	*What happens?*	∅				
	Who does what?	∅	$[+iconic]$			
DTR1	*What does Peter do?*	{p}		*		
DTR2	*What does Max do?*	{m}				
	Who does what?	∅	$[-iconic]$			
DTR1	*What does Peter do?*	{p}			*	
DTR2	*What does Max do?*	{m}				

Table 4: Optimisation of quaestio, aboutness topic and update mode in the interpretation of (38).

ground and various aspects of the discourse situation. The former corresponds to the CONTENT feature in the present formal set-up, while QUAESTIO and A-TOPIC belong to the set of relevant contextual features. In order to appreciate the implications of taking these features as input, a few words should be said about their real meaning.

To begin with CONTENT, we have been using this attribute so far to store the meaning of a discourse unit to the extent that it can be assembled from the meanings of the constituent words, phrases and daughter DUs, and the semantics of connection between the daughter DUs (iconic vs. non-iconic update). Roughly speaking, CONTENT reflects all and only what is there in the sentences. In generation this corresponds to the specific content already *selected* for verbalisation in the utterance or sequence of utterances under construction. It is not the whole stock of the speaker's knowledge on the subject, and it is also not some abstract semantic carcas with details to be filled in. Every piece of the selected content will be either encoded by a linguistic expression in that utterance (or sequence), or implied in a way recoverable by some regular inference mechanisms.

Similarly, the QUAESTIO of an elementary DU stands in a close relation to its form, while the QUAESTIO of larger DUs strongly depends on its daughter's QUAESTIO values due to the planning constraints of EFFECTIVENESS, ECONOMY, etc. In generation this implies that QUAESTIO is the question taken up by the *speaker* in the given utterance or sequence of utterances, which need not be the same as the interlocutor's query, or the speaker's task in a more general sense determining what is relevant in a given situation (though of course there is a systematic relationship between the speaker's QUAESTIO and the task or query). The following examples illustrate such mismatch. In (39) the interlocutor's query is a *yes/no*-question, while speaker B is obviously addressing a *wh*-question *Which credit cards do you accept?* In (40), the parallel structure and the distribution of prosodic prominence suggests that speaker B is addressing a double *wh*-question *Who broke what?*, while the query is a single-*wh What happened?*, with the consequence that the update mode is non-iconic and the temporal order of the two breaking events is not specified, which makes it a no less relevant contribution on the issue raised by the interlocutor. Thus in both cases, the speaker's QUAESTIO is the question we recover by looking at the answer, which is not identical with the question explicitly asked.

(39) **A:** Do you accept credit cards?
   B: Visa and Mastercard.

(40) **A:** What happened?
   B: PETER broke the VASE, and MAX broke the MIRROR.

Since the set of aboutness topics is strongly dependent on the QUAESTIO, similar considerations apply to the A-TOPIC feature. The interlocutor may explicitly suggest a certain aboutness topic, e.g. *Talking about Peter, what did he do?*, but it is ultimately the speaker's responsibility, which topics he or she picks up in his or

her utterances.

In other words, the values of all the three features are the output rather than the input of discourse planning processes: what to say next (CONTENT), how to split up the global communicative task into subtasks (mother node QUAESTIO into daughter node QUAESTIO-nes), and even the choice of the global communicative task itself (the top node QUAESTIO). Since the ultimate goal of this study is to model the influence of grammar on discourse planning, and in particlar the influence of obligatory choice of the prefield constituent in German (TOP-V) on global narrative planning decisions (choice of QUAESTIO and A-TOPIC), none of these features can be fixed in the input. Moreover, none of the features of the DU structures as defined so far can be treated as an input feature in the present modelling task.

The input that is needed instead is roughly of the same kind as what we find in computational generation systems (see e.g. Vander Linden, 2000): (a) a knowledge base, representing the whole stock of the speaker's knowledge (in a given domain); and (b) a query, representing the type of information asked from the speaker. In the setting of the Quest narratives, the knowledge base is the speaker's representation of the content of the film, and the query is the experimentor's question *What happened in the film?*[24] Applying Optimality Theory at this level would amount to handling the mapping from the knowledge base and the query (input) to DU structures with all their features from FORM to CONTENT to QUAESTIO (output) as an optimisation problem. That is, unlike the most existing production OT grammars, the task is not to find the optimal form for a given meaning, but to select optimal meanings *and* forms for a given query and knowledge base. On the other hand, in contrast to the standard computational generation system setup, where discourse planning (mapping from query and knowledge base to sentence meanings) and surface realisation (mapping from meanings to forms) are treated as separate pipelined modules, in the present setting meanings and forms should be optimised simultaneously. This is precisely what will make it possible for considerations related to form (filling the prefield position in German) to influence decisions related to discourse planning (quaestio and aboutness topic selection).

Developing a full-scale formal proposal of this kind goes far beyond what can be done in this paper. An approach to content selection and discourse planning developed in a different formal framework with an application to Quest data can be found in Jasinskaja and Roßdeutscher (2009). We will not attempt to recast that proposal in OT here, but will limit ourselves to some informal remarks. The

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[24]Another part of the input typically assumed in computational generation systems is a user model, i.e. a specification of e.g. the user's prior knowledge, in order to avoid overinformative answers, for instance. This aspect of the input will be ignored for the time being. In the Quest narratives elicitation setup, this parameter can be viewed largely as a random factor, as is evident, in particular, from the huge variation in the level of detail applied by different speakers in their retellings of the film. Moreover, since the whole situation was rather artificial—the participants of the study most certainly realised that the experimentor knew what happened in the film, and nevertheless played along and answered the question—we can only guess how they "modelled" the experimentor's real demand for information.

essence of the view developed in this paper is roughly this: Because there is a preference in German to interpret the constituent in the preverbal position as topic, German-speaking storytellers are discouraged to change the occupant of that position from sentence to sentence, because that almost automatically implies a topic change, and topic change switches off the iconic update mode—the most effortless and "comfortable" way of presenting events chronologically. Of course, the speakers can maintain the chronology of events by other means, e.g. the use of explicit adverbials like *dann* 'then' if otherwise the topic change is unavoidable. But why do that if topic change can be minimised? There are many ways to avoid topic change in the first place as long as not only the form but also the meanings of the sentences to be produced, as well as their order, can be manipulated.

First, one could simply skip and not tell certain events if their mention would lead to a topic change. This is particularly relevant in cases where a sequence of actions by a single agent (the protagonist of the whole story) is occasionally interrupted by events that do not involve that agent and where a different agent plays a prominent role so that it is likely to surface in the preverbal position due to syntactic constraints. If those interrupting events are not esssential to the flow of the story or the specific informational needs of the hearer (which would have to be captured by a set of highter-ranked constraints), they can simply be skipped. In case of example (36) this would amount to completely leaving out the sentence about Max buying the newspaper if the surrounding discourse is about Peter. In the OT setting, this result is achieved by letting DUs whose CONTENT value contains descriptions of both events compete with DUs whose CONTENT only specifies the event of Peter crossing the street. If no stronger constraints are violated, the latter will win due to TOP-V (a consideration related to FORM).

Second, if events of this kind cannot be skipped altogether, one can put them in syntactically and/or discourse-structurally subordinate position. The QUAESTIO-values of subordinate discourse units do not add up in the same way as those of DUs at the same structural level (cf. main vs. side structure in Klein and von Stutterheim, 1987; van Kuppevelt, 1995). In the present framework, one would have to assume that the QUAESTIO of the mother node is the same as that of the head daughter, while the subordinate daughter does not contribute to the mother node QUAESTIO, and does not add an extra question variable, even if it has a different aboutness topic. Using subordination instead of simple juxtaposition of sentences comes at a price, since one has to use some subordinative linguistic devices and they contribute their own bits of semantics, presupositions, etc. For example, instead of (36) one could say: *Peter überquert die Straße und ∅ sieht Max eine Zeitung kaufen* 'Peter crosses the street and ∅ sees Max buy a newspaper'. This does not mean the same as (36), as it also states that Peter perceives the event of Max buying a newspaper while (36) does not. However, as long as this extra information is consistent with the specifications in the knowledge base, it can be added if this saves the speaker a change of topic. Once again, candidate DUs whose meanings contain and do not contain the information of Peter's perception will run against each other, and other things being equal, the former will win since they can be

expressed without changing the reference of the prefield constituent at the level of the main story line (TOP-V, the same FORM-related consideration).

Both strategies of maintaining a global aboutness topic and avoiding topic change in German narratives are well documented in the Quest database, cf. section 2.1. One can imagine yet another way of minimising topic change, which we do not find in Quest narratives due to the specifics of the film content, but which our approach would predict for other kinds of input. Suppose two sequences of events involving two different agents occur in parallel without causal interference with one another up to a certain point. For example, Peter crosses the street, turns around the corner and passes by a book shop. In the meantime, Max buys a newspaper in that book shop, goes out of the shop, and bumps into Peter. Concerning the strict chronology of the events, Max buying the newspaper occurs after Peter crossing the street, but before him turning around the corner; Peter passing the book shop and Max going out of the same book shop occur simultaneously. One has the option of presenting the sequences strictly chronologically switching between Peter and Max all the time, or reordering the events first presenting the whole sequence about Peter and then the whole sequence about Max, with only one topic change. The latter would be favoured by TOP-V and would be expected to be used more frequently by German speakers, than by the English speakers. Of course, in order to be able to use the purely chronological strategy, the English speakers would need a way to know that the events occurred in that order, which is rather unusual in normal experience, since we normally cannot continuously observe events happening at locations as different as the street and the book shop around the corner. However, in a film retelling setup this kind of conditions can be created if the camera switches from one location to the other following the temporal order of events. In roughly similar situations in the Quest retellings, English speakers have been found to follow more closely what the film literally presents, than the German speakers. This might be another situation where one would expect differences of the same kind.

In sum, by taking a non-modular approach to production and optimising forms and meanings simultaneously for a given knowledge base and query we can make it possible for constraints related to core grammar, such as the principles of filling the prefield position in German, which apply at the level of meaning to form mapping, to take effect at the level of discourse planning and content selection. A question that arises in this connection is whether this non-modular view is psychologically realistic. Do speakers really select meanings to express while taking into consideration aspects of their surface realisation, or is this rather an offline process—one that leads to the emergence of language-specific constraints on discourse planning from strong grammatical constraints in the course of language acquisition? In the latter case, TOP-V would create a "twin constraint" formulated in terms of topics rather than positions in the sentence (something like, a sentence has an aboutness topic, or the A-TOPIC set is non-empty), which would apply in the discourse planning module to constrain the mapping from the knowledge base and query input to the sentence meanings, while TOP-V itself would apply in the surface realisation

module (meaning to form). Findings on narrative production by advanced second language learners rather favour the modular view (von Stutterheim and Carroll, 2005). If Top-V took direct effect on discourse planning decisions as suggested by the non-modular approach, one would expect learners of German to start structuring their narratives "the German way" as soon as they acquire Top-V and its correct ranking, that is, as soon as they master the appropriate use of word order possibilities. However, this is not what is usually observed. Even very advanced learners who hardly make any mistakes of grammar usage tend to keep applying discourse strategies from their first language. This suggests that they have acquired the grammar proper including the high ranking of constraints like Top-V, but not the "twin constraint". In other words, it is possible that the model of discourse generation sketched out in this section cannot be taken as a model of discourse production as an online process. However, in an evolutionary setting (e.g. Zeevat and Jäger, 2002) it could be developed into a model of aquisition of discourse planning competence. In the present version, our model provides a formal motivation for language-specific constraints on discourse planning.

5   Conclusions and new challenges

The main accomplishments of this paper are two. First, it has been shown how a preference to interpret the occupant of the obligatory prefield position as an aboutness topic in German leads to a more general preference for sentences with topics over sentences without topics. The resulting model has been applied to explain differences in temporal interpretation of German and English discourses with superficially identical structure. Since German speakers are under pressure of interpreting the prefield constituent as topic, they have to assume a topic shift whenever the referent of the prefield constituent changes. Topic shift in turn blocks the inference of temporal progression characteristic of the narrative, presenting the events as a temporally unordered list. In contrast, since the preverbal position in English is largely reserved for subjects and is not affected by information-structural categories, English speakers are freer in their choice between the 'subject is topic' interpretation and the interpretation without an aboutness topic whatsoever. In the latter case, a new subject does not automatically mean a new topic, i.e. there is no aboutness topic shift (because there is no aboutness topic) and the normal narrative temporal inferences go through. This part of the model has been implemented in the framework of Optimality Theory.

Second, we have sketched out an extention of that model to cover discourse generation from discourse planning (a mapping from knowledgbe base and query to sentence meanings) to surface realisation (a mapping from sentence meanings to sentence forms). Within the extended model, the German preference for sentences with topics leads to a preference for maintaining the same topic over longer stretches of discourse. Topic change introduces discontinuity in the temporal structure of the narrative regardless of the language. The German way to avoid it is to

select the order, the content and the information structure of utterances as to maintain the same topic as long as possible, while the English speakers have the option of producing a sequence without an aboutness topic at all—a series of holistic event descriptions where no entity is assigned a privileged information-structural status. Thus we have gone one step further than Jasinskaja and Roßdeutscher (2009), not just stipulating language-specific rules in discourse planning, but deriving the differences from differences in grammar.

There are many more open and problematic issues that we had to cut short while trying to achieve our main goals. Very little effort has been spent on motivating the proposed constraints in a broader context of optimality-theoretic syntax, semantics and pragmatics. For example, it would be more elegant to have the effects of TOP-V (topic before the verb) in German and the lack of such effects in English follow from a more general account of German and English syntax.

The issue of the respective roles played by the prefield position and the grammatical subject in expressing topics in German had to be skipped entirely, although it crucially bears on the analysis of the German corpus data discussed in section 2.1, which does not only show a preference for a constant sentence topic (entity in the prefield position), but also a constant subject.

In order to turn our sketch of the OT-based discourse generator into a proper theory one would have to spell out all the other relevant constraints on content selection and the choice of quaestio, such as relevance to the interlocutor's query, storiness (which e.g. makes sure that no events important to the flow of the story are left out), etc. These constraints would have to be integrated with the fragment developed in this paper to yield a discourse planner sensitive to the grammatical properties of the language.

Finally, if the proposed non-modular design of the discourse generator proves implausible as an online model of human discourse production, one would have to take an evolutionary turn and show how grammatical constraints in the meaning-to-form module lead to the emergence of their "twin constraints" in the discourse planner in the course of language acquisition or language change.

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