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Varying strategies for processing "loose" argument structure in West Germanic languages

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Permissive subjects are non-agentive subjects combined with action verbs in the active form (e. g., "A few years ago **a penny** would buy you two or three pins"; "**The tent** *sleeps* four people"), hardly found in German compared to English. For this contrast, previous research offers an explanation related to processing constraints, proposing that distinct processing strategies account for varying efficiency of processing permissive subjects. The differences in processing strategies are said to be linked to typological properties, specifically word order. It is argued that if a language has SVO order (like English), permissive subjects should be better processed due to more routinized *look ahead* parsing strategies. In contrast, if a language is SOV (like German), parsers should be more used to *look back* parsing strategies, leading to difficulties in processing permissive subjects. The present study addresses the question how look ahead vs. look back parsing strategies for permissive subjects depend on features like SVO/SOV. Additionally to English and German, we investigate Dutch, as it is also SOV but seems to allow slightly more diverse roles in the grammatical subject than German. In order to demonstrate cross-linguistic differences in the processing of various types of permissive subjects, we conducted an experiment in which native speakers of English ($n = 40$), Dutch ($n = 45$), and German ($n = 45$) performed a self-paced reading task. The results reveal that German speakers experience greater difficulty processing permissive subjects, as evidenced by considerably slower reading times compared to English speakers. Reading times for Dutch speakers fall between those of English and German speakers. This pattern is not limited to documented permissive subjects, but extends beyond allegedly grammatical constructions (e.g., "**The house** *lives* four families"), which are also read faster in English and Dutch than in German. Therefore, our findings suggest fundamental differences in processing strategies for non-agentive subject-verb combinations between English and Dutch (look ahead) on the one hand and German (look back) on the other relating to other typological contrasts than word order influencing the processing of permissive subjects, most likely case.

KEYWORDS

permissive subjects, sentence parsing, West Germanic languages, loose vs. tight fit typology, look ahead vs. look back parsing, SVO/SOV word order, self-paced reading

1 Introduction

1.1 Permissive subjects in the loose vs. tight fit typology

Present-day English allows a wide range of semantic roles to function as the subject (see Rohdenburg, 1974; Callies, 2006; Dreschler, 2020; Heilmann et al., 2021 for contrastive corpus studies; see Hawkins, 2012; Müller-Gotama, 1994; Levshina, 2020 for typological research). Constructions with semantically diverse subjects,

known as permissive subjects (e.g., Dreschler, 2020), combine a non-agentive subject (in bold; i.e., an Instrument in example 1, a Location in 2 and a Theme in 3) with an action verb in the active form (underlined), that normally demands a prototypical agent in subject position within a transitive NP-V-NP structure (Comrie, 1993; Givon, 2001).

(1) a. A few years ago **a penny** would *buy* you two or three pins.
b. *Een paar jaar geleden *kocht* **een cent** twee tot drie speldjes.
c. *Vor einigen Jahren *kaufte* **ein Pfennig** zwei bis drei Stecknadeln.
(2) a. **This tent** *sleeps* four people.
b. ***Deze tent** *slaapt* vier personen.
c. ***Dieses Zelt** *schläft* vier Personen.
(3) a. **The book** *sold* 10,000 copies.
b. **Het boek** *verkocht* 10,000 exemplaren.
c. ***Das Buch** *verkaufte* 10,000 Exemplare.

Examples (1)–(3) demonstrate that non-agentive argument structures like permissive subjects are hardly found in German compared to English, where all the shown examples of permissive subjects are quite common (e.g., Rohdenburg, 1974; Callies, 2006; Dreschler, 2020; Heilmann et al., 2021). These contrasts in language usage between German and English fit into the *loose vs. tight fit typology* established by (Hawkins, 1986; originally as *Semantic Typology*), based on the main contrasts between the two languages (Table 1). In English, they have the effect of producing greater ambiguity and vagueness in surface forms, as seen in permissive subjects, while in German forms map onto less ambiguous meanings, and thus tend toward a stronger one-to-one correspondence between form and meaning. Therefore, (Hawkins, 1986; see also Hawkins, 2012, 2014, 2019) concludes that English can be considered a *loose fit* language and German, on the other hand, can be labeled *tight fit*.

To some extent, the ambiguous mappings in English result from inflectional leveling (e.g., the indicative incorporates meanings formerly associated with subjunctive mood). In addition to that, the broader selectional restrictions on verbs in English imply that verbs are more vague and less specific in meaning with respect to the type of action they describe and compatible with more direct objects (e.g., one can *break* both a branch and a vase in English, whereas German requires lexical differentiation, *abbrechen* for the former, *zerbrechen* for the latter). Raising structures in English, too, produce more systematic structural ambiguities (also known as "garden paths"; e.g., Frazier, 1985) than in German, as their meaning can only be accurately interpreted once additional sentence material appears. This results in less tight form-to-meaning mappings (e.g., subject-to-object raising; the ambiguity is italicized: "*I believe the farmer* to have killed the cow"; WH-movement: "*the student who I believe* you know"). Permissive subjects, as instances of non-agentive combinations of subject and verb, are part of the fit parameter in the typology that describes the semantic diversity of grammatical relations (in bold in Table 1). They show that the NP-V-NP clause type in English can be mapped onto a whole variety of thematic role combinations that are not possible in German. The typology proposed here is not only applicable within the West Germanic languages but also holds relevance from a universal-typological perspective (see Müller-Gotama, 1994; Levshina, 2020). The West Germanic language family provides an especially intriguing area of study for this typology, as it allows for a detailed examination of contrasts between tight fit and loose fit constructions. Furthermore, investigating these contrasts in the West Germanic languages offer a unique opportunity to generate hypotheses regarding the diachronic relevance of the contrasts (see Section 5 for discussion).

TABLE 1 English-German main contrasts (from Hawkins, 1986, p. 121).

German	English
More inflectional morphology	Less inflectional morphology
More specific selectional restrictions	Less specific selectional restrictions
More word order freedom	Less word order freedom
Less semantic diversity of grammatical relations	*More semantic diversity of grammatical relations*
Less raising	More raising
Less extraction	More extraction
More pied piping	Less pied piping
Less deletion of noun phrases	More deletion of noun phrases

According to Müller-Gotama (1994) and Levshina (2020), who established a continuum to capture the correlation between the degree of semantic transparency of grammatical relations and their syntactic behavior, in particular SOV languages generally have a high degree of semantic transparency. Given that Dutch closely mirrors German in terms of word order, as it is also classified as an SOV language (Koster, 1975), one might expect Dutch to show the same tight fit as German concerning the semantic range of the subject. Indeed, Levshina (2020) suggests a classification of Dutch among the tight fit languages with respect to the semantic diversity of the grammatical subject. However, Müller-Gotama (1994) stresses that Dutch seems to be the only SOV language in the typology allowing a wider semantic range of subjects than other SOV languages (see example 3; see also Vandepitte and Hartsuiker, 2011; Doms and De Clerck, 2015; Doms et al., 2016 for contrastive work indicating a strong tendency to adopt permissive subjects from English in Dutch translations). Dutch resembles its SVO relative English also when it comes to other parameters involved in the fit typology. For instance, the absence of case in Dutch also has the result that surface forms are ambiguous with respect to their syntactic functions. Furthermore, Dutch resembles English in some raising processes (Van der Auwera and Noël, 2011). All these contrasts can be linked to the fruitful research line that positions Dutch linguistically between English and German, yielding a pattern commonly known as the "Germanic Sandwich" (see Van Haeringen, 1956; Hüning et al., 2006; Vismans et al., 2010; De Vogelaer et al., 2020). The contrasts and similarities with English and German make the position of Dutch next to its West Germanic relatives in the fit typology especially interesting, specifically with regard to proposed explanations for the present-day contrasts based on theories of varying strategies for processing argument structure. These processing strategies are in the focus of this study and are elaborated on in the following section.

1.2 Explanations for present-day contrasts in terms of processing constraints

A number of linguistic theories have advocated that the verb constrains and determines information that will be available in the sentence because of its power to project relationships with the other constituents (see Comrie, 1993 for an overview). A good deal of psycholinguistic research has been devoted to determining how the verb indeed guides parsing decisions by applying various methods such as self-paced reading, visual world eye-tracking and EEG methods (see Tanenhaus et al., 1989; Melinger et al., 2009; Friederici and Frisch, 2000 for a summary of relevant studies). The general assumption is that verbs are better predictors of their arguments than vice versa (Gentner, 1981; Pritchett, 1992; Hawkins, 2012, p. 628). Engelhardt et al. (2024) emphasize that in particular the semantic information contained in the lexical verb allows speakers to draw on real-world knowledge about the likelihood of certain events as well as on their linguistic knowledge of noun-verb co-occurrence frequencies from prior linguistic experience. More precisely, a lexical verb (unlike its arguments NPs) activates and predicts various predicate frames in the mind during online parsing, along with frequency-based or contextual preferences (Engelhardt et al., 2024, pp. 355–356). Although the term prediction (or look ahead, anticipation, expectation, context effects, top-down processing) has been used in different ways by different researchers and fields (see Onnis et al., 2022 for a summary of experimental studies), prediction enables the brain to prepare for anticipated linguistic input in advance, thereby enhancing the speed and efficiency of processing (Kuperberg and Jaeger, 2016; Pickering and Gambi, 2018; Onnis et al., 2022; Traxler, 2023).

Given the importance of the lexical verb's predictive role in parsing argument structure, processing strategies are expected to depend on a language's word order properties. Hawkins (1995) first proposed that parsing argument structure may be different in languages with different "basic" word orders. He hypothesized processing routines to relate to grammatical contrasts between English and German, including contrasts in the diversity of the grammatical subject function, which includes the preponderance toward non-agentive subjects (see Hawkins, 1995, 2012, 2014). With this theory, Hawkins extends traditional constraint-based and frequency-dependent parsing theories assuming that high-frequency (vs. low-frequency) constructions are cognitively easier to activate, and therefore easier to produce and process (e.g., Gibson et al., 1996; Jurafsky, 2003; see Traxler, 2023 for a more recent overview). Instead, it is argued that a language's grammar adapts to the processing strategies employed by its speakers, as these strategies facilitate efficient processing of corresponding grammatical constructions. Hawkins (1995) refers to this hypothesis as the "Performance-Grammar Correspondence Hypothesis," emphasizing that grammars are deeply shaped by processing (see also Christiansen and Chater, 2008 on how "language has been shaped to fit the human brain"; see also Sinnemäki, 2014).

In what follows, we will outline Hawkins (2012, 2014); Engelhardt et al. (2024) argument regarding why distinct parsing strategies should derive from a language's word order properties. Hawkins relates these properties to "basic" word order. However, for our purposes, the crucial property relates to surface word order, in particular to the fact that in German and Dutch clauses lexical verbs predominantly appear in sentence final position. In order to account for the variable position of verbs in German and Dutch, and for the fact that processing strategies involve the order in which lexical verbs and arguments are commonly processed, we will use the term "*predominantly lexical verb-final*," abbreviated hereafter as "V_{lex}*-final*," to refer to the surface word order in German and Dutch. Word order differences between English, German and Dutch are addressed in more detail after the theory of parsing strategies has been specified.

Speaking in general, typological terms, Hawkins (2012, 2014) and Engelhardt et al. (2024) argue that speakers of SVO and SOV languages use distinct parsing strategies deriving from the different positions of the lexical verb. In an SVO language like English, where the lexical verb always occurs before its object(s), the activated predicate frames can be predicted and at the verb and gradually reduced and selected from when post-verbal material is parsed. Any preferences will be confirmed or adjusted as the input continues. In particular, users of English are said to have routinized prediction of upcoming syntactic material, i.e., they are consistently used to looking ahead in the parsing string as a parsing strategy (see Rösler et al., 1998; Soshi and Hagiwara, 2016; Huang et al., 2023 for experimental work concerning look ahead processing in other contexts). Routinely looking ahead in English is said to leave room for vague semantics, temporary ambiguity, and garden paths (Hawkins, 2012, 2014). To give an example, in sentences with non-agentive subject-verb combinations, such as "this tent sleeps four people" (example from Hawkins, 2012, p. 631), processing the subject-verb pair alone can already generate clear expectations about what will follow. With the processing of subsequent syntactic material semantic roles and the correct frame can be selected (Hawkins, 2012, p. 631). Similarly, in raising structures (garden paths), it is also possible to predict forthcoming sentence material in order to interpret them correctly. The sentence "Mary happened to win the prize" likewise allows the semantic role of Mary to be anticipated when processing the verb "happened" (example from Hawkins, 2012, p. 631). Hence, *look ahead* results into tolerance for looser semantic constraints in SVO languages, which gives rise to more possibilities for semantically diverse roles in the subject function, as in permissive subjects, leading to vagueness, garden paths, and temporary or full ambiguity in syntactic forms (see Hawkins, 2012 for a detailed overview of phenomena in contemporary English).

In contrast, speakers of SOV languages are said to employ different processing mechanisms (Hawkins, 2014; Engelhardt et al., 2024). If the arguments in a sentence occur before the verb, like in SOV languages, the arguments allow for a high degree of semantic variability in the verb (Keenan, 1979). To assign the correct predicate frame while parsing the verb, this variability must be resolved by evaluating the possibilities evoked by the arguments, meaning that speakers of SOV languages are generally more accustomed to integration or looking back to the arguments rather than prediction.[1] Onnis et al. (2022) provide experimental

1 This does not imply that speakers of SOV languages do not predict or look ahead to upcoming syntactic material during processing, nor does it

evidence from studies of look ahead and look back processing in English, supporting the idea that a language's word order promotes different processing strategies (see Ueno and Polinsky, 2009, for a corpus study on how verbs can shape processing in languages with various word orders, such as English, Japanese, Spanish, and Turkish).

To facilitate *look back* at the clause-final verb and to avoid extra processing effort through reanalysis, verb-final languages exhibit greater predicate frame differentiation and argument differentiation, i.e., semantic tightness (Hawkins, 2012; Levshina, 2020). To reduce the number of possible frames and limit the possibilities for assigning semantic roles to NPs, less semantically diverse, non-agentive subjects occur (Hawkins, 2012, p. 628). A strong link between the subject function and agentive semantics helps to interpret subject-verb combinations more rapidly and accurately during online processing, because there are fewer possible choices and combinations (in line with the efficiency principle "Maximize Online Processing"; see Hawkins, 2004). Consequently, the possibilities for non-agentive semantic roles to appear as the subject of an action verb—such as in permissive subjects—remain relatively limited.

These contrasts in parsing strategies between SVO and SOV languages cannot be straightforwardly extrapolated to explain differences between English, German and Dutch. While German is classified as having SOV word order (Thiersch, 1978; Den Besten and Edmondson, 1983; Vikner, 2019), as is Dutch (Koster, 1975), SOV is realized on the surface only in (most) embedded clauses. To assess the effect of word order for strategies available to parse verb-second clauses, the crucial property seems to be the order in which the lexical verb and its arguments are commonly processed. While German and Dutch show both surface orders in which the lexical verb precedes its arguments (surface VO), lexical verbs frequently appear in clause-final position, following all arguments, in particular in all main clauses with auxiliaries (S Aux OV surface order). Unlike English, German and Dutch have many clause-final lexical verbs (V_{lex}-final), i.e., in SOV and S Aux OV surface structures. This constrains the availability of look ahead parsing strategies (cf. Hawkins, 2014). The prominence of OV surface orders for language processing is underscored by data from language acquisition. It is well-known that children acquiring German or Dutch around the age of two tend to place lexical verbs in sentence-final position (see Grimm, 1973; Miller, 1976 on German; Klein, 1974; Gillis and Schaerlaekens, 2000 on Dutch). Children's preference for sentence-final lexical verbs also makes it plausible that they will acquire parsing strategies commonly associated with SOV languages, even if their input is not consistently SOV.

The hypothesis that speakers of SVO languages systematically employ look ahead processing strategies, while speakers of SOV languages are more accustomed to look back strategies, is supported by experimental work by Engelhardt et al. (2024). They investigated cross-linguistic differences in prediction in English and Japanese, specifically with respect to verb-object relations, by implementing cloze probability tasks. The experiments show that, when given a subject and a verb in English, prediction of an upcoming object is routinely possible whereas speakers of Japanese as a pure verb-final language show less prediction. In Japanese, in contrast, the clause final verb serves an integrating function gathering in this previous material, checking it for compatibility with its listed frames in the mental lexicon (Engelhardt et al., 2024, pp. 375–376).

1.3 The present study

No experimental attempts have yet been made to test the theory of different parsing strategies based on VO/OV word order properties in direct relation to the processing of ambiguous or vague argument structures (e.g., permissive subjects), that are said to be affected by dominant look ahead vs. look back parsing across different languages with varying word orders. This study therefore conducted a self-paced reading experiment to investigate the mechanisms of processing various non-agentive subject-verb combinations in permissive subjects in English, Dutch, and German. By adopting this approach, we (i) address the question if fundamental differences in the processing of permissive subjects can be revealed indicating look ahead or look back parsing, and if parsing strategies depend on typological features like VO vs. OV word order. Given that both Dutch and German commonly use sentence-final lexical verbs, it can be assumed, based on Hawkins (2012, 2014) and Engelhardt et al. (2024), that routines such as look ahead are not as prevalent among speakers as they are for speakers of English as an SVO language. Since Dutch and German speakers should be more accustomed to look back strategies for processing verbs, they should be likely to encounter greater difficulties when processing verbs in non-agentive subject-verb combinations. According to Hawkins (2012) and Levshina (2020), semantic tightness helps to avoid reanalysis and extra processing effort in verb-final languages. Building on a fruitful tradition of comparative research, the results of our experiment (ii) allow us to determine the positions of English, Dutch, and German in the loose vs. tight fit typology based on processing differences. Also, this approach enables us to contribute to the understanding of cross-linguistic trade-offs and diachronic-causal relations from an efficiency-related processing perspective (as discussed in Hawkins, 2014; Levshina, 2021; see Section 5.2 for discussion).

2 Categorization of permissive subjects

To systematically investigate the processing of permissive subjects, we classified the constructions into four categories based on the presumed degree of (syntactic-)semantic violation they cause in Dutch and German. The categorization presented and applied here is grounded in the results of previous contrastive

suggest that speakers of SVO languages do not integrate preceding syntactic material (see Engelhardt et al., 2024:355-356 for a discussion; see also Onnis et al., 2022 for experimental work and an overview of studies emphasizing the significance of 'prediction' and 'integration' in processing cross-linguistically). However, Engelhardt et al. (2024) see a greater and more systematic role for online prediction in an SVO language like English, compared with SOV languages, because these languages differ in the relative order in which object nouns and lexical verbs are processed.

corpus studies and translation experiments (e.g., Rohdenburg, 1974; Hawkins, 2012; Callies, 2006, 2010; Vandepitte and Hartsuiker, 2011; Doms and De Clerck, 2015; Doms et al., 2016; Dreschler, 2020; Heilmann et al., 2021). First, existing contrastive research on permissive subjects is limited, comparing Dutch-English or German-English data. Thus, a critical gap in the current body of research is the direct comparison of permissive subjects across English, Dutch, and German. Second, previous research does not offer a robust framework for categorization of the constructions. Early attempts at categorizing permissive subjects have either focused on the semantic roles of NPs in subject position (e.g., roles as "instrument," "theme," "location," "time"; see Hawkins, 2012) without accounting for the action verbs they combine with, on verb-specific classifications (e.g., verbs of directed removal, omission, and alteration; verbs of selling, distributing, and allocating; see Rohdenburg, 1974), or individual verbs (*give*, *demonstrate*, *show*, *suggest*, *offer* and *tell*; see Doms and De Clerck, 2015; Doms et al., 2016). These classifications, however, are not able to reveal systematic patterns behind the acceptance of non-agentive subject-verb combinations in the three languages. Indeed, Doms and De Clerck (2015, pp. 290–291) emphasize the "complexity of restrictions" and argue that the acceptance of permissive subjects varies significantly based on specific subject-verb combinations, suggesting that a new categorization framework is required. In response, we propose a completely novel categorization and approach, differing from what previous corpus studies had demonstrated. In what follows, we will describe and motivate the four distinct categories of permissive subjects tested in our self-paced reading experiment.

In the first category, which we call *transitivity-altering permissive subjects* (TPS), the subject's non-agentive nature results in a semantic violation. Additionally, TPS involve a syntactic violation where an intransitive verb (e.g., to sleep) is used in a transitive construction, e.g., "**The tent** *sleeps* four people." Permissive subjects from this category have only been found in English so far (Los, 2018, p. 39; Van Gelderen, 2011), but remain undocumented in Dutch and German (Rohdenburg, 1974; Hawkins, 2012; Dreschler, 2020). Even within English, TPS are relatively rare, although becoming more prevalent in recent decades. Dreschler (2020) points out that these constructions belong to the newly emerging variants of permissive subjects. For example, constructions like *Objects sleep* have only been found since the early twentieth century.

The second category we call *material permissive subjects* (MPS), representing a material action, characterized by an event with an internal time structure, a defined endpoint, and a visible outcome in the form of a product, e.g., "**The flour** *bakes* three pizzas." In English, MPS have been common since 1500 (see Dreschler, 2020 about *Money buys* constructions; see example 1 in the introduction). Even though the violation in Dutch and German is maybe less strong than in the TPS category, as there is no additional violation of transitivity, restrictions are nevertheless significant: Based on examples from Rohdenburg (1974) and Hawkins (2012), Doms and De Clerck (2015, pp. 289–296) describe that Dutch and German allow few MPS, with German permitting even fewer than Dutch (e.g., Callies, 2010; see examples in Rohdenburg, 1974, p. 328; see also example 3 in the introduction). Vandepitte and Hartsuiker (2011) found in a translation experiment that sentences like "**This pension** only *bought* cheap things" were translated literally into Dutch by native speakers, suggesting a slight degree of flexibility in MPS in Dutch.

The third category, called *immaterial permissive subjects* (IPS), represent permissive subjects with an immaterial action related to the addition of knowledge or information, e.g., "**The passport** *describes* the air passenger." In English, IPS are very common (see Callies, 2006, 2010; Van Gelderen, 2011; Los and Dreschler, 2012; Komen et al., 2014; Los, 2018; Dreschler, 2020). Also in Dutch and German, the semantic violation seems to be less strong than in the TPS and MPS category. Dutch-English corpus research by Doms and De Clerck (2015) and Doms et al. (2016) shows that more than 60% of IPS in English texts were translated into Dutch in the same way. Vandepitte and Hartsuiker (2011) report the same, even stronger tendency (70-80%) in a translation experiment. German-English corpus studies indicate that IPS are more frequently avoided in German, with other translation strategies being applied (see Heilmann et al., 2021).

Non-agentive subject-verb combinations of the last category we tested, i.e., *pseudo-agentive permissive subjects* (PPS), can be described as functionally motivated and primarily utilized for rhetorical purposes, particularly within the context of media, such as newspaper articles and news reports. In these constructions, non-agentive constituents occupy the subject position when the actual agent is either unknown or intentionally avoided, e.g., "**The train doors** *injured* the passenger." Consequently, pseudo-agentive noun phrases can serve to deflect responsibility and obscure specific events (Callies, 2010). The semantic violation associated with pseudo-agentive permissive subjects in both Dutch and German is even less pronounced than in category IPS, resulting in the lowest hypothesized degree of semantic violation among the categories. PPS seem to be on the rise in both Dutch and German, becoming increasingly prevalent, similar to their status in English (see also Rissman et al., 2022). Regarding these constructions, Doms and De Clerck (2015, p. 292) note that the gap between English on the one hand and German and Dutch on the other may be slightly smaller than it used to be. Moreover, Callies (2010) observes a tendency to relax selectional restrictions on German verbs in which non-agentive subjects are also attested in combination with verbs like "kill" and "injure," also possible in English. (König and Gast, 2018, p. 110) further emphasize that "a growing number of attestations of these non-agentive subjects in German are slowly creeping into journalese as a result of sloppy translations from English, having a clearly non-idiomatic flavor."

3 Materials and method

3.1 Participants

To investigate the processing of the different categories of permissive subjects in English, Dutch, and German, a self-paced

reading experiment was conducted with native speakers of the three languages (English: $n = 40$; 23 male and 17 female; Dutch: $n = 45$; 21 male and 24 female; German: $n = 45$; 25 male and 20 female). The participants were students aged between 18 and 33 years (mean age: 25 years). They all reported to have normal hearing, normal or corrected eyesight and no cognitive or motoric impairments. In addition, participants were asked whether they had any other native languages apart from English, Dutch, or German, which additional languages they had learned, and where they had grown up. To capture any potential influences of language contact, participants rated their exposure to English, Dutch, and German on a scale from 1 to 5, indicating both their active use of the languages and passive contact through activities such as watching TV series. The analyses revealed that neither age nor gender, nor language contact were significant factors affecting RTs. Therefore, we will not further address these aspects in the analysis.

3.2 Materials

The data presented in this study originate from a self-paced reading experiment designed to investigate the processing of two constructions involving non-agentive subject-verb material: permissive subjects (as discussed here) and middles (e.g., Ackema and Schoorlemmer, 2006). The overall design comprised 197 stimuli, including 96 target stimuli related to permissive subjects, 48 targets focusing on middles, and 53 filler items. Of the filler items, 13, 13, and 27 were semantically anomalous, syntactically anomalous and well-formed and plausible, respectively. The middles will not be discussed here; see Renzel et al. (2025) for details.[2]

The experimental design manipulated AGENTIVITY of the subject phrase, distinguishing between non-agentive (N-A) and agentive (AG) conditions across the four distinct syntactic-semantic categories (TPS, MPS, IPS, PPS) mentioned in the preceding section (see Table 2 for all conditions and examples). Thus, in N-A conditions (the permissive subjects) the initial noun is an inanimate, non-agentive subject. AG control stimuli contain the same critical verb as N-A stimuli but begin with an animate noun phrase, which is a plausible agent for the critical verb. All target items were carefully designed so that the verbs in both the N-A and AG conditions, as well as in English, Dutch, and German, were matched in terms of syllable count, and the verbs were equivalent across all languages. This ensured that the RTs for the verbs—which were measured and analyzed here as the critical region—could be adequately compared in the analyses.

In addition to AGENTIVITY and CATEGORY, we also manipulated DOCUMENTEDNESS by including both in English documented permissive subjects (DOC) as well as extended (EXT) ones within each category (split evenly). The EXT conditions represent non-agentive subject-verb combinations that, according to Rohdenburg (1974), are not accepted in English and thus considered ungrammatical across all three languages. This distinction allows us to investigate how the processing of documented vs. extended constructions differs, providing insight into whether permissive subjects are restricted to hitherto attested non-agentive combinations, or if a deeper contrast in processing strategies can be revealed, independent of the frequencies of the constructions. The inclusion of extended constructions provides an opportunity to investigate whether speakers apply similar processing strategies to both existing and non-existent constructions, thereby shedding light on how constraints on permissive subjects are shaped not only by linguistic norms but in particular processing routines.

Also, we tested various word orders: SVO and SOV, which involved permissive subjects in embedded clauses. This condition naturally yielded SOV word order only in the German and Dutch sentences. Half of the stimuli in each condition in Table 2 were SOV in German and Dutch, while the other half were SVO. We did so to test for a direct effect of word order on the processing of permissive subjects, and to determine whether, in Dutch and German, different strategies are employed depending on the lexical verb's position: in SVO sentences, the semantically richer verb indeed appears before the arguments, raising the question of whether Germans and Dutch speakers employ look ahead strategies in this context. In our analysis, we included WORD ORDER as a fixed factor in the linear mixed-effects model. However, there was neither a significant main effect of word order nor any significant interaction involving this factor. Model fitting further indicated that excluding WORD ORDER as a fixed factor improved the AIC, showing no statistically significant gain in model fit from including it. Changes in the position of the semantically more informative lexical verb have no effect on parsing strategies, and there is no direct effect of word order on the reading times. Consequently, we did not pursue this factor further in our analyses (but see Section 5.1 for discussion).

Each stimulus exemplar consists of the following sequence: a noun phrase (e.g., *the tent*), a critical verb (e.g., *sleeps*) and post-verbal material (e.g., four *people*; see Supplementary material for all target items). The stimuli were presented in a pseudo-randomized order in 48 blocks of 2–6 sentences (mixing target and filler items). After each block, a comprehension question served as a distractor task, asking about one of the items in the block (alternating between target and filler items), which the participants had to answer

2 Given that middles and permissive subjects differ substantially with respect to their syntactic and semantic properties, we will not discuss middles here. The general assumption that non-agentive constructions are harder to process in German holds, but, while permissive subjects occur in an active NP-V-NP transitive sentence structure, middles, by contrast, carry both a generic and a passive interpretation. An implicit agent (as an external argument) is semantically present but syntactically absent (e.g., active transitive sentence: *John cuts the meat* > middle: *The meat cuts easily*) (Marelj, 2004; Ackema and Schoorlemmer, 2006; Bruening, 2024). Another characteristic feature of middles in languages like Dutch, German, and English is the evaluative modifier, such as *easily*, which, under specific conditions, may not be strictly required (e.g., Roberts, 1987). The two constructions also diverge in their occurrences across Dutch, German, and English (Marelj, 2004; Ackema and Schoorlemmer, 2006), which leads to different theoretical implications.

TABLE 2 Analyzed conditions in the experiment.

Conditions	DOC		EXT	
	N-A	**AG**	**N-A**	**AG**
TPS	a. The tent sleeps four people. b. De tent slaapt vier personen. c. Das Zelt schläft vier Personen.	a. The child sleeps 4 h. b. Het kind slaapt vier uren. c. Das Kind schläft vier Stunden.	a. The racetrack runs 10 sprinters. b. De renbaan loopt tien sprinters. c. Die Rennbahn läuft zehn Sprinter.	a. The sprinter runs a 100 m. b. De sprinter loopt honderd meters. c. Der Sprinter läuft hundert Meter.
MPS	a. The flour bakes three pizzas. b. Het meel bakt drie pizza's. c. Das Mehl backt drei Pizzen.	a. The mother bakes a cake. b. De moeder bakt een taart. c. Die Mutter backt eine Torte.	a. The steak cuts three pieces. b. De steak snijdt drie stukken. c. Das Steak schneidet drei Stücke.	a. The butcher cuts a piece of meat. b. De slager snijdt een stuk vlees. c. Der Metzger schneidet ein Stück Fleisch.
IPS	a. The passport describes the air passenger. b. Het paspoort beschrijft de luchtreiziger. c. Der Ausweis beschreibt den Flugreisenden.	a. The lady describes the air passenger. b. De dame beschrijft de luchtreiziger. c. Die Dame beschreibt den Flugreisenden.	a. The cycle path confirms a safe ride. b. Het fietspad bevestigt een veilige rit. c. Der Radweg bestätigt eine sichere Fahrt.	a. The tour guide confirms a safe ride. b. De bewaker bevestigt een veilige rit. c. Der Wachmann bestätigt eine sichere Fahrt.
PPS	a. The bus injures the pedestrians. b. De bus verwondt de voetgangers. c. Der Bus verletzt die Fußgänger.	a. The thief injures the customer. b. De dief verwondt de klant. c. Der Dieb verletzt den Kunden.	a. The diesel price murders the agriculture. b. De dieselprijs vermoordt de landbouw. c. Der Dieselpreis ermordet die Landwirtschaft.	a. The burglar murders the old lady. b. De inbreker vermoordt de oude vrouw. c. Der Einbrecher ermordet die alte Frau.

correctly by clicking "yes" or "no" with the mouse. Participants received no feedback on their responses. Two stimulus lists were used, differing in the order of the break sentence blocks.

3.3 Procedure

The self-paced reading experiment, which participants completed on a DELL Latitude 3330, was programmed using PsychoPy (see Peirce et al., 2019 for details). Self-paced reading (Aaronson and Scarborough, 1977; Mitchell and Green, 1978) is an automated real-time method used to record reading times (RT) for each word in a sentence. Fast RTs indicate easy processing, while slow RTs reflect more difficult processing (see more in Dijkstra and Kempen, 1993; Jegerski and VanPatten, 2013). The test sentences were presented word by word, with each word appearing centered on the screen in a clear, legible font. Pressing the space bar replaced the current word with the next one. The experiments were conducted at universities and schools in Germany (Münster), the Netherlands (Aalten and Utrecht), and England (Lancaster) in quiet meeting rooms, with only one participant at a time and the researcher present. The task started with instructions and a practice round. Participants first completed the reading experiment (on average, 3 sessions of 10 min each, with two breaks of at least 60 s), followed by a second phase in which they answered some questions about their personal background. The questionnaire included questions addressing handedness, age, gender, native and foreign language proficiency, self-assessment of language skills, and contact with foreign languages (English/German/Dutch). During the experiment, communication took place in the participant's native language to match the experimental setting to the language of the reading task.

4 Results

4.1 Data analysis

4.1.1 Preprocessing

Following Winsorizing procedure, extreme values (RTs below 100 ms and above 2,500 ms) were replaced with alternative values adjusted to the next lowest or highest non-extreme value (Dixon, 1980). All RTs were log-transformed to reduce right skew (Baayen and Milin, 2010). To determine which transformation should be applied, we ran the Box-Cox procedure (Box and Cox, 1964). Lambda was close to −0.3, which suggested a reciprocal square root transformation: $1/\sqrt{(RT)}$.

4.1.2 Statistical analysis

The transformed RTs were analyzed using linear mixed-effects models to account for both fixed effects and random effects for participants and items. The model was fitted using the lme4 package (Bates et al., 2015) in R (R Core Team, 2020). We started with a maximal random effect structure (intercepts and slopes for all of the predictors and their interactions) and checked model assumptions using the buildmer package to streamline the selection of random structures finding the maximal model (Voeten, 2021). Based on theoretical grounds and for

further streamlining the model, we fitted the maximal model from buildmer by performing model comparison (Baayen et al., 2008) and a stepwise model simplification (both random and fixed factors), guided by likelihood ratio tests. The final optimal model retained predictor interactions, random intercepts for participants and items, as well as random slopes for AGENTIVITY by participants. It includes fixed effects for LANGUAGE, AGENTIVITY, CATEGORY, and DOCUMENTEDNESS, as well as their interactions (see next Section 4.2 for the final model). Model fit was assessed using the marginal (R^2m) and conditional (R^2c) coefficients of determination, reflecting the variance explained by fixed effects and the combined fixed and random effects, respectively. The resulting model explained 19% of the variance in RTs through fixed effects ($R^2m = 0.19$) and 60% through both fixed and random effects ($R^2c = 0.60$), which can be considered strong with respect to the overall explanation (Nakagawa and Schielzeth, 2013). Pairwise comparisons for interactions were performed using the emmeans package (Lenth, 2023), applying Tukey adjustments for multiple hypothesis testing. Data visualizations were created using the ggplot2 package (Wickham, 2016).

4.2 General picture

The German, Dutch and English participants' mean RTs in all conditions are shown in Figure 1. A total of 12,480 RTs were included in the analysis, corresponding to the number of sentences read by the participants. The selected linear mixed-effects model for log-transformed RTs and a summary of statistical results are given in Table 3. The intercept for RT was significantly positive, with an estimated value of 1.69 ($\beta = 1.69$, $p < 0.001$), indicating a strong baseline in the model. This baseline corresponds to RTs for target items in German (LANGUAGE) in conditions AG (AGENTIVITY)/TPS (CATEGORY)/DOC (DOCUMENTEDNESS). The analysis revealed a highly significant main effect of AGENTIVITY. Specifically, non-agentive target items were read significantly slower compared to agentive items ($\beta = -0.54$, $p < 0.001$). In general, this suggests that participants processed non-agentive items with greater difficulty, leading to longer RTs. However, Figure 1 demonstrates that this effect varies between the three languages and also between the categories. Indeed, the statistical model reveals a significant interaction between LANGUAGE and AGENTIVITY indicating that in English, non-agentive items were processed significantly faster than in the other languages ($\beta = 0.46$, $p < 0.001$), while in Dutch, the effect was weaker but still significant ($\beta = 0.17$, $p < 0.001$). Moreover, the results of the model show strong three-way interactions involving LANGUAGE, AGENTIVITY, and CATEGORY. Notably, for English, non-agentive test items in the MPS, IPS and PPS categories lead to significantly faster reaction times compared to the baseline category TPS (MPS: $\beta = -0.08$, $p = 0.0321$; IPS: $\beta = -0.48$, $p < 0.001$; PPS: $\beta = -0.45$, $p < 0.001$). Similar patterns can be observed in Dutch, but with smaller effect sizes (IPS: $\beta = -0.18$, $p < 0.001$; PPS: $\beta = -0.21$, $p < 0.001$). Details regarding the three-way interaction of LANGUAGE x AGENTIVITY x CATEGORY will be addressed in the following Section 4.3. Furthermore, all interactions involving the factor DOCUMENTEDNESS are non-significant (all $p > 0.5$) and are therefore not included in the model summary. This suggests that DOCUMENTEDNESS does not substantially modulate RTs and the effects of LANGUAGE, AGENTIVITY, or CATEGORY in our dataset. It is also evident in Figure 1 that there are hardly any discernible differences in RTs with regard to DOCUMENTEDNESS. Given the importance of the absence of differences in RTs between the DOC and EXT conditions within the context of our study, we will also discuss this result in greater detail in the following Section 4.4.

4.3 Zooming in on the effects of language, agentivity, and category

To systematically map the effects of the factors LANGUAGE, AGENTIVITY, and CATEGORY, we analyze the three-way interactions in the model which are displayed in Figure 2. The figure reveals striking contrasts in RTs between non-agentive and agentive conditions across German, Dutch, and English, as well as across the different categories. In a nutshell, it appears that in English, all conditions are processed at similar remarkable fast speeds, regardless of agentivity or the category. In contrast, both agentivity and the category of permissive subjects play a significant role in processing in German. This effect is also observed in Dutch, though it is notably less pronounced.

Zooming in on the contrasts between the three languages in detail, the most remarkable differences can be found in the non-agentive condition for the TPS and MPS categories. Permissive subjects in these categories are read the slowest in German, significantly slower than in Dutch (TPS: $p = 0.0082$, MDiff = 0.16, 95% CI [−0.31, −0.02]; MPS: $p = 0.0011$, MDiff = 0.19, 95% CI [−0.34, −0.04]) and especially slower than in English (TPS: $p < 0.0001$, MDiff = 0.44, 95% CI [−0.59, −0.29]; MPS: $p < 0.0001$, MDiff = 0.35, 95% CI [−0.50, −0.20]). German also shows a much wider distribution of data compared to Dutch and, especially, English. Also Dutch exhibits a wider distribution than English, which is further reflected in *post-hoc* tests, where significant differences between the processing of non-agentive structures in Dutch and English are revealed. These differences are evident in both TPS and MPS categories, although slightly less pronounced for MPS (MPS: $p = 0.0179$, MDiff = 0.16, 95% CI [0.01, 0.31]; TPS: $p < 0.0001$, MDiff = 0.27, 95% CI [0.12, 0.42]). Our findings indicate that German speakers face significantly more difficulty in processing permissive subjects of both categories, particularly in TPS, compared to English speakers. This aligns with corpus studies, which demonstrate that permissive subjects of the TPS and MPS categories are almost non-existent in German, while they are well-established in English (Rohdenburg, 1974; Hawkins, 2012; Callies, 2006; Dreschler, 2020; Heilmann et al., 2021). Dutch occupies an intermediate position between German and English. It is noteworthy that while TPS permissive subjects are considered ungrammatical also in Dutch and generally absent, comparable to German, they are still processed significantly faster in Dutch than in German. Similarly, although MPS permissive subjects appear to be documented more frequently in Dutch than in German, they remain relatively rare in Dutch. This makes their faster processing

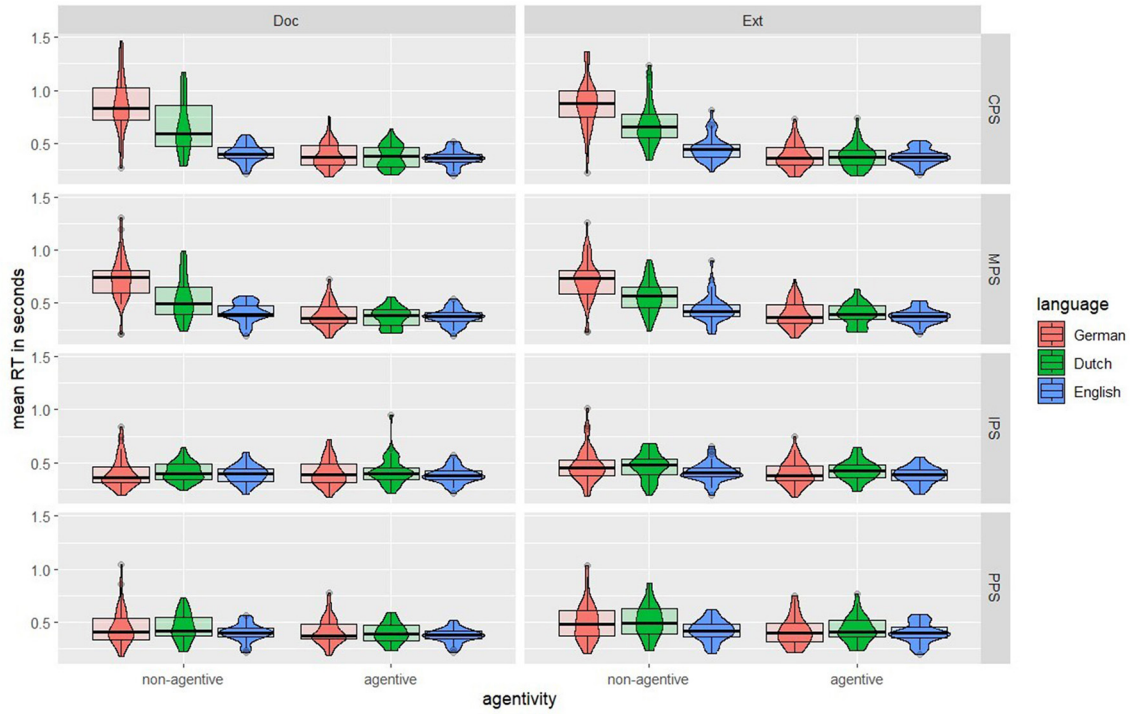

FIGURE 1
Violin plots with integrated box plots showing mean RTs by conditions.

in Dutch all the more remarkable, bringing Dutch closer to English than to German in this regard (see Figures 1, 2; *Post-hoc* results).

When comparing non-agentive to agentive conditions in the TPS and MPS categories across the three languages, it is particularly striking that English speakers process non-agentive conditions in MPS just as quickly as agentive conditions (no significant differences in *post-hoc* tests), while agentivity in Dutch ($p < 0.001$, MDiff = 0.25, 95% CI [0.16, 0.34]) and German ($p < 0.001$, MDiff = 0.44, 95% CI [0.35, 0.53]) results in significant differences. This observation supports the view that permissive subjects of the MPS category have become well-established and productive constructions in English (e.g., Dreschler, 2020). However, non-agentive subject-verb combinations in TPS are processed more slowly in English than their agentive counterparts ($p = 0.0225$, MDiff = 0.10, 95% CI [0.01, 0.19]). This aligns with Dreschler (2020) observation that TPS in English are not as common as MPS and represent a more recent phenomenon that is still somewhat limited in usage and form. Nevertheless, the difference between agentive and non-agentive conditions in the TPS category in English remains relatively small, much smaller than in German and Dutch, as also reflected in the *post-hoc* tests (German: $p < 0.0001$, MDiff = 0.54, 95% CI [0.45, 0.63]; Dutch: $p < 0.001$, MDiff = 0.39, 95% CI [0.30, 0.48]). Overall, English speakers maintain consistently fast processing times across all constructions.

However, the contrasts between the three languages do not hold across all categories of permissive subjects. In contrast to the TPS and MPS categories, which we classified as implying high syntactic-semantic and high semantic violation, respectively, in German and Dutch, permissive subjects in the IPS and PPS categories, which are classified as implying lower semantic violation, do not present significant processing difficulties compared to agentive constructions in any of the three languages. Although this lack of contrasts is not entirely expected, it is observed in the categories most prone to non-agentive subjects in usage data, and therefore, our category-based analysis appears well-justified.

4.4 Evidence for varying processing strategies

In the previous section discussing the data, the factor of DOCUMENTEDNESS was excluded, as it does not significantly influence RTs. Extended permissive subjects (we refer to examples in Table 2), which (according to Rohdenburg, 1974) do not exist in any of the three languages, were processed at comparable speeds across all categories in German, Dutch, and English as in English documented permissive subjects. This, however, is a particularly intriguing result from which meaningful conclusions regarding processing strategies across the three languages can be drawn. The fact that DOCUMENTEDNESS has no statistical effects on RTs is also visible from the visualized RTs. It is not only evident in Figure 1 showing the overall data of all conditions, but it becomes especially clear in Figure 3 comparing DOC and EXT conditions with categories summarized.

In English, non-agentive subject-verb combinations in extended constructions are processed at the same high speed as documented permissive subjects. There is even hardly

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TABLE 3 Summary of the results of the Linear mixed-effects model for log-transformed RTs.

Model: RTtrans ~ language * agentivity * category * documentedness + (1 + agentivity | participant) + (1 | itemnr)				
Fixed effects	**Estimate**	**St. Error**	***t* value**	***p*-value**
(Intercept)	1.69	0.04	39.25	<0.001
Language (ENG)	0.01	0.05	0.29	0.7707
Language (DUT)	0.02	0.05	0.46	0.6445
Agentivity (N-A)	−0.54	0.04	−12.59	<0.001
Category (MPS)	0.01	0.04	0.14	0.8866
Category (IPS)	−0.02	0.04	−0.60	0.5476
Category (PPS)	−0.04	0.04	−1.05	0.2982
Documentedness (EXT)	0.02	0.04	0.39	0.6963
Language (ENG) * agentivity (N-A)	0.46	0.03	13.83	<0.001
Language (DUT) * agentivity (N-A)	0.17	0.03	5.41	<0.001
Language (ENG) * agentivity (N-A) * category (IPS)	−0.48	0.04	−12.54	<0.001
Language (DUT) * agentivity (N-A) * category (IPS)	−0.18	0.04	−4.88	<0.001
Language (ENG) * agentivity (N-A) * category (MPS)	−0.08	0.04	−2.14	0.0321
Language (ENG) * agentivity (N-A) * category (PPS)	−0.45	0.04	−11.73	<0.001
Language (DUT) * agentivity (N-A) * category (PPS)	−0.21	0.04	−5.56	<0.001

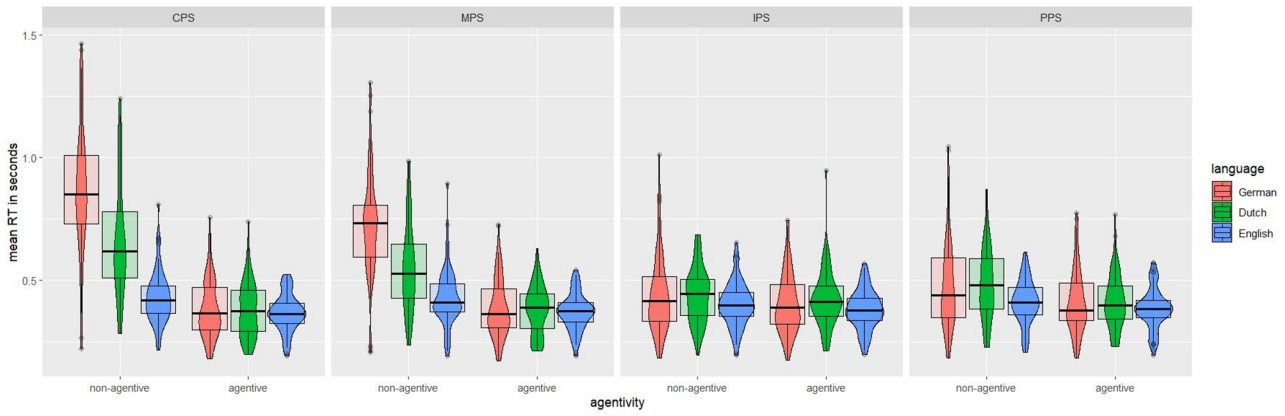

FIGURE 2
Violin plots with integrated box plots showing effects of LANGUAGE, AGENTIVITY, and CATEGORY on RTs.

any noticeable difference between the processing of non-agentive conditions and agentive conditions in English. This is a noteworthy result, as it contradicts theories based on frequency and ungrammaticality, which predict that extended permissive subjects in English should be harder to process than documented ones because they do not appear in actual usage. These findings align with the argument in Hawkins (2014) and Engelhardt et al. (2024) that there should be differences in processing strategies in English and German, as our results point to deeper, underlying differences with German in how non-agentive sentences are processed. Our findings demonstrate that English speakers, compared to German speakers, indeed seem to employ different strategies for processing loose argument structures, regardless of whether permissive subjects are documented or non-existent. One possible explanation could be that in particular English speakers, as speakers of an SVO language, indeed routinely rely on look ahead as processing strategy, anticipating upcoming syntactic material, which allows for more efficient processing of flexible semantics in syntactic forms. In fact, English speakers process all types of permissive subjects almost as easily as prototypical agentive structures, reflecting the language user's ability to efficiently handle various forms of semantic vagueness in processing. On the other hand, we suggest that German speakers, as speakers of a language with V_{lex}-final surface order, tend to employ look back as processing strategy to process permissive subjects, referring back to previous material once the verb is reached. This process is made more difficult by non-agentive subjects which inhibit semantic tightness (Hawkins, 2012, 2014), and could be the reason for the delayed RTs

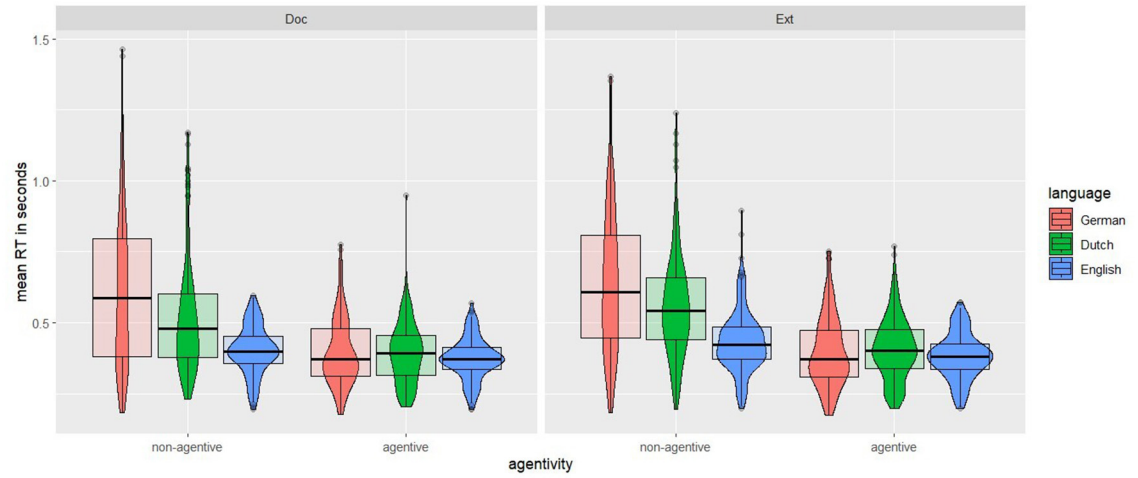

FIGURE 3
Violin plots with integrated box plots showing effects of LANGUAGE, AGENTIVITY, and DOCUMENTEDNESS on RTs.

observed in German speakers. Interestingly, despite Dutch being V_{lex}-final like German, Dutch speakers process both documented permissive subjects of category TPS, which are also only present in English, MPS, as well as extended constructions significantly faster than German speakers. In some respects, contrasts in processing between Dutch and German are even greater than those between Dutch and English (in the MPS category). All these effects cannot be attributed to usage-based frequency data and the prevalence of these constructions in the three languages. Therefore, our findings go beyond the established understanding that high-frequency constructions are cognitively easier to activate, and therefore easier to produce and process. Since we also observe a tendency among Dutch speakers to process non-documented permissive subjects significantly faster than speakers of German, our results not only indicate fundamental differences between English and German in how vague semantics in permissive subjects are processed, but, importantly, also between Dutch and German. In Dutch, processing strategies more similar to look ahead mechanisms, as observed in English, seem to be ingrained, facilitating the processing of permissive subjects.

5 Discussion

5.1 Typological classification of West Germanic languages based on varying processing strategies

In this study, we conducted a self-paced reading experiment to investigate differences in the processing of non-agentive subject-verb combinations in various types of permissive subjects in English, Dutch, and German. The primary aim was (i) to determine whether fundamental differences in processing strategies for this type of loose form-to-meaning mapping can be observed across the three languages, and to what extent these differences are influenced by word order properties. Our results indicate that German speakers experience substantial difficulties in processing permissive subjects, particularly in the TPS and MPS categories with high semantic and syntactic violation. English speakers, in contrast, demonstrate consistently fast processing across all constructions. Dutch speakers were expected to show comparable difficulties in processing permissive subjects as in German due to the V_{lex}-final surface word order in Dutch similar to that of German. However, reading times in Dutch reveal a significantly faster processing of permissive subjects in both the TPS and MPS categories. Reading times for Dutch speakers fall between those of English and German speakers but in some ways even exhibit greater similarity to English (in the MPS category). Importantly, this pattern is not limited to permissive subjects documented in English; our experiment suggests that these contrasts extend even beyond the known constructions. Extended, non-existent permissive subjects (e.g., "**The house** *lives* four families"), too, are read faster in English and Dutch than in German. Therefore, our findings suggest fundamental differences in processing strategies for semantically diverse subject-verb combinations between Dutch and English on the one hand and German on the other. This result is not only observed for permissive subjects; Renzel et al. (2025) report similar processing patterns in English, Dutch and German for non-agentive subject-verb combinations in documented and extended middle constructions. We interpret these findings to suggest that English speakers, as speakers of SVO languages, routinely employ look ahead strategies, which, according to Hawkins (2014) and Levshina (2020) should facilitate the processing of permissive subjects. In contrast, speakers of languages with V_{lex}-final surface order like German encounter greater challenges in processing permissive subjects, which we interpret as evidence of a reliance on look back strategies to earlier sentence material that must be integrated into the parsing string. This is in line with Hawkins (2014) and Levshina (2020) argument that this process should be hindered by the vague semantics inherent to permissive subjects. The observation that speakers of Dutch, as language that is much more similar to German than to English in terms of word order, show comparable processing speeds than English indicating look ahead processing mechanisms, however, appears to

conflict with the hypothesis that look ahead parsing routines are directly related to SVO word order (as claimed by Hawkins, 2014; Engelhardt et al., 2024). In Dutch, other mechanisms than word order appear to facilitate the processing of semantic looseness in permissive subjects (see next paragraph for a discussion of other possible mechanisms).

The results of our experiment (ii) allow for the classification of the West Germanic languages within the loose vs. tight fit typology based on processing differences related to the fit parameter which describes the diversity of grammatical functions. Both documented non-agentive constructions and non-existent extended permissive subjects are processed fast in English, at speeds comparable to agentive structures. Thus, English can clearly be categorized among the loose fit languages, allowing for greater ambiguity and vagueness in surface forms and still efficient processing. The slow processing of permissive subjects in German, on the other hand, reflects the tight fit nature of the language and the speaker's preference for one-to-one mappings of meaning and forms, also when it comes to processing (aligning with Hawkins, 2012; Müller-Gotama, 1994; Levshina, 2020). Dutch occupies its traditional intermediate position between German and English (Van Haeringen, 1956; Hüning et al., 2006; Vismans et al., 2010; De Vogelaer et al., 2020). Speakers of Dutch process documented as well as extended permissive subjects notably faster than German speakers, but slower than English speakers. The analyses show that the processing of permissive subjects in Dutch in some ways comes closer to that in English. Therefore, Dutch, despite being a language with V_{lex}-final surface order, tends to align more with the loose fit languages with regard to its flexibility in assigning semantic roles to the subject function and the processing of these (cf. Müller-Gotama, 1994). Our findings based on the processing of permissive subjects significantly weaken the predictions made by (Hawkins, 2012, p. 629, 2014, p. 143) and Levshina (2020) that "if SOV, then narrow semantic range of grammatical relations." Additionally, we did not detect any direct effect of word order. SOV vs. SVO word order in Dutch and German as a factor in our experiment had no effect on processing. This indicates that look back strategies, particularly in German, are also used in SVO sentences.

This highlights the need for further discussion of the following aspects: the contrastive parameters in the fit typology, look back and look ahead processing strategies, and SOV vs. SVO. In the next paragraph, we take a closer look at how these parameters have evolved in the three languages, as well as potential causal links among them. This approach allows us to propose explanations for mechanisms other than word order that may facilitate the processing of semantic looseness in permissive subjects in Dutch. At the same time, it clarifies how these developments relate to the emergence of contrasts in processing strategies, the intermediate position of Dutch, and how languages can be shaped in their structure by these processing mechanisms.

5.2 Causal-diachronic implications

Contrasts in argument structure flexibility among English, Dutch, and German are traditionally attributed to diachronic language developments, referred to as "drift" (e.g., Sapir, 1921). These traditional accounts can be mapped onto the loose vs. tight fit typology: while Old English was comparable in terms of parameters to present-day German, English has evolved into a loose fit language, by, e.g., losing its case system. Furthermore, over time it exchanged SOV word order for SVO and relaxed verb-second (Visser 1963–73; Van Gelderen, 2011; Los and Dreschler, 2012; Komen et al., 2014; Dreschler, 2015; Los, 2015, 2018).[3] The shift is said to have also led to greater flexibility in argument structure, semantic ambiguity and vagueness in English, whereas German has maintained tighter constraints, reflecting its preference for more rigid mappings between meaning and form (Hawkins, 2012, 2014). Historically, Dutch—like Old English—also resembled German and had a fully intact case system, which it lost over time. Unlike English, however, Dutch still retains verb-second and aligns with German in having V_{lex}-final surface order (Burridge, 1984; Van der Horst, 2008).

Hence, Dutch in the fit typology supports the view that loose fit characteristics and SVO order in a language can be considered innovations. With regard to processing strategies, the only plausible diachronic scenario is thus that look ahead is likewise more recent than look back. If we zoom in on other parameters in the fit typology as well as SVO vs. SOV, it becomes apparent that Dutch shows features that pose "problems" for the general typology: the fact that Dutch is V_{lex}-final yet lacks case system seems to conflict with Greenberg (1966) universal no. 41, in which case marking is typically regarded as a structural feature of verb-final languages. These peculiarities led Van Haeringen (1956) to describe Dutch as "artistically unsystematic."

Moreover, the rise of diversity in the semantic roles assigned to the subject position in present-day English can be considered the result of several interdependent "efficient trade-offs," which suggests a causal link among the contrastive parameters in the West Germanic languages (see, e.g., Hawkins, 2014; Sinnemäki, 2014; see Levshina, 2021 for critical considerations on the efficiency behind trade-offs between linguistic variables). Of course, the complexity of this discussion cannot be fully captured here. Nonetheless, it is clear that Dutch also does not fit neatly into the (by, among others, Hawkins, 2014) proposed chain of causality. The scenario in which case syncretism initially led to a rigid SVO word order (e.g., Kellner, 1892; Sapir, 1921; Meillet, 1949; Mossé, 1952; Van Haeringen, 1956; Jakobson, 1971; Hawkins, 2012, 2014)[4] cannot be confirmed for

3 It should be noted here how challenging and complex it is to capture word order through concepts such as SOV and SVO. Taylor and Pintzuk (2012) point out, in Old English there is an interplay of word order, complexity and information structure. This has continued to the present day. Changes in Middle English word order are further complicated by the influence of contact with Scandinavian in the early period and French in the later period. All this shows how abstract SOV and SVO typologies are and therefore how difficult it is to do more than to point to correlations.

4 The two-dimensional trade-off between case and word order has been discussed in numerous previous accounts, yet there is still no consensus on the causal direction of the correlation between the two variables (see Dryer, 2013 for a critical view based on the World Atlas of Language Structures; Jespersen, 1894 for criticism on causal directions; see Levshina, 2021; Shcherbakova et al., 2024; Chen et al., 2024 for statistical testing of correlations between morphology and syntax). In Levshina (2021) the most

Dutch. Thus far, relatively few direct effects of case loss have been observed in Dutch. However, the loosening of argument structure, described as the second step in the causal chain for English—according to Kirkwood (1978) and Hawkins (2012), facilitated by the development of SVO—can, by contrast, be observed in Dutch. Despite the V_{lex}-final surface word order in Dutch, speakers of Dutch have developed look ahead processing routines similar to those of English speakers, allowing them to handle non-agentive structures better than German speakers.

A logical explanation would be that the emergence of look ahead processing in Dutch arose in response to the diminishing morphological markings, most likely case markings on NPs.[5] The parser thereby becomes more dependent not only on the verb to determine semantic role assignments for non-marked NPs but, to some degree, also on subsequent syntactic material (such as other NPs; Hawkins, 2014). This assumption is supported by research on cross-linguistic variation in electrophysiological activity during the processing of conflicting form-to-meaning mappings (Bornkessel-Schlesewsky et al., 2011; see Bornkessel-Schlesewsky and Schlesewsky, 2020 for an overview). EEG experiments by Bornkessel-Schlesewsky et al. (2011) reveal fundamental differences in ERPs between German and English; remarkably, the same differences also emerge between German and Dutch. This contrast is likewise interpreted in terms of divergent processing strategies, with Dutch showing greater overlap with English—a finding that fully aligns with the hypothesis that speakers of English and Dutch tend to rely on look ahead, whereas speakers of German apply look back. Moreover, eye-tracking studies by Kamide et al. (2003) demonstrate that case markings in German facilitate the selection of predicate frames during sentence processing, thus providing an alternative to look ahead mechanisms. By contrast, English speakers appear able to predict predicate frames more quickly because fewer morphological markings must be processed on NPs. Taken together, all these findings lead us to suggest a potential causal link between the loss of case and the rise of look ahead strategies. To substantiate this link, however, further research employing the methods of Bornkessel-Schlesewsky (EEG) and Kamide et al. (2003) (eye-tracking) is needed to map look ahead strategies in permissive subjects.

probable causal link between linguistic variables is indeed found between rigid word order and case marking. Additionally, experimental data from Fedzechkina et al. (2016) and Fedzechkina and Jaeger (2020) support the presence of a causal link between case marking and word order, suggesting communicative efficiency through this trade-off. Also in this data, the direction of the influencing variables remains unclear, but Levshina (2021) reports a higher probability of the directional relationship from word order to case marking than the reverse (see also Koplenig et al., 2017).

5 Moreover, richer voice morphology on the verb, which should help to decode the arguments' thematic roles, could play a role in a look back parsing strategy for an SOV language. However, the contrast between German and Dutch in terms of voice morphology is much smaller than that regarding case, thus allowing for fewer situations in which it would yield differing expectations for look ahead vs. look back.

6 Conclusion

To summarize, this study reveals differences in the processing of permissive subjects between speakers of English, Dutch, and German. We argue that speakers of the three languages employ different strategies to process non-agentive subject-verb combinations in permissive subjects. In English, all constructions in our self-paced reading experiment are processed fast, indicating the use of routinized look ahead parsing strategies by speakers of English. German speakers show significant difficulty processing loose semantics in subject-verb combinations, which implies a greater reliance on look back parsing strategies. In Dutch, permissive subjects are processed significantly faster than in German, leading us to infer that Dutch speakers also utilize mechanisms of look ahead strategies for processing permissive subjects. The fact that Dutch speakers apply processing strategies that resemble those of English speakers, suggests a typologically looser fit for Dutch than traditionally expected for SOV languages (see Hawkins, 2012; Levshina, 2020). This finding challenges the claim that different processing strategies are directly derived from contrasts in the position of the lexical verb, i.e., VO vs. OV (as claimed by Hawkins, 2012, 2014; Levshina, 2020; Engelhardt et al., 2024). Taking into account that both German and Dutch have predominantly V_{lex}-final surface word order, we hypothesize that other contrasts in language properties between the West Germanic languages influence how loose semantics in permissive subjects are processed. We posit that the loss of case marking triggers and encourages look ahead to subsequent sentence material, and consequently, this strategy is routinely employed in both English and Dutch. Additional contrastive psycholinguistic research is required to verify the current findings and to further substantiate the proposed causal link by testing to what extent case markings and also other word orders (e.g., S Aux OV) affect the processing of permissive subjects. Methods like eye-tracking and EEG would be particularly sensible and fruitful approaches. The observed gap between linguistic norms and language processing, evident in the processing of extended permissive subjects in both Dutch and English, also underlines the need for further research employing different methods. From the perspective of fit typology, this could imply that, when positioning languages, processing strategies should likewise be taken into account.

Interestingly, our findings also show that not all types of permissive subjects elicit the same contrasts across English, Dutch, and German. How these structures are processed depends on the specific semantics of the non-agentive subject-verb combinations. In terms of processing strategies, it can be concluded that immaterial and pseudo-agentive permissive subjects do not increase integration costs during look back processing in German, while transitivity-altering and material permissive subjects do. Future studies should examine these aspects in greater depth.

With this study, we highlight that classifying the three West Germanic languages in terms of the fit typology based on processing differences not only helps explain how distinct typological features between related languages can lead to varying strategies for processing grammatical structures, but also sheds

light on how language systems may evolve differently over time as influenced by processing contrasts (Hawkins, 1995; Christiansen and Chater, 2008; Sinnemäki, 2014). Our results for English and Dutch suggest that there is potential for an increase in permissive subjects and further development of argument structure flexibility. This corresponds with the increasing number of permissive subjects in English observed in diachronic corpus data (Dreschler, 2020), a tendency that is also observed in corpus studies on permissive subjects in Dutch (e.g., Doms and De Clerck, 2015). This study underscores the need for further investigation into the mechanisms of processing permissive subjects in the three languages, as it can offer contrastive insights in language structures based on psycholinguistic data and a unique opportunity to generate hypotheses regarding the diachronic relevance of contrasts and causal relationships between linguistic variables.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary material.

Ethics statement

The studies involving humans were approved by Ethikkommission FB7 Psychologie und Sportwissenschaft, Universität Münster. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

AR: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. GD: Writing – review & editing, Supervision, Conceptualization. JB: Supervision, Writing – review & editing, Formal analysis.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/flang.2025.1529973/full#supplementary-material and https://osf.io/h83y6/?view_only=5e096b9d0d574823b3cd5450bbf91351

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