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Dative alternation and planning scope in spoken language: A corpus study on effects of verb bias in VO and OV clauses of Dutch

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Abstract

The syntactic structure of main and subordinate clauses is determined to a considerable extent by verb biases. For example, some English and Dutch ditransitive verbs have a preference for the prepositional object dative, whereas others are typically used with the double object dative. In this study, we compare the effect of these biases on structure selection in (S)VO and (S)OV dative clauses in the Corpus of Spoken Dutch (CGN). This comparison allowed us to make inferences about the size of the advance planning scope during spontaneous speaking: If the verb is an obligatory component of clause-level advance planning scope, as is claimed by the hypothesis of *hierarchical incrementality*, then biases should exert their influence on structure choices, regardless of early (VO) or late (OV) position of the verb in the clause. Conversely, if planning proceeds in a piecemeal fashion, strictly guided by lexical availability, as claimed by *linear incrementality*, then the verb and its associated biases can only influence structure choices in VO sentences. We tested these predictions by analyzing structure choices in the CGN, using mixed logit models. Our results support a combination of linear and hierarchical incrementality, showing a significant influence of verb bias on structure choices in VO, and a weaker (but still significant) effect in OV clauses.

Keywords: Advance planning scope; Verb bias; Incrementality; Dative alternation; Corpus linguistics; Psycholinguistics

1. Introduction

During grammatical encoding, conceptual messages are transformed into linguistically structured word sequences. Most models of sentence production, starting with Garrett (1975), hold that grammatical encoding consists of two subprocesses: functional and positional encoding. Functional encoding comprises the retrieval of lemmas (i.e., lexical entries specifying the syntactic properties of a word) and the assignment of grammatical roles (e.g., subject, direct object, indirect object, head) to these lemmas. During positional encoding, lemmas are embedded in syntactic constituents and

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receive serial order. There is considerable debate on what factors drive the ordering of constituents in linguistic structures. One group of theories assumes that the mapping from a conceptual to a linguistic structure is lexically mediated. According to these theories, lemma accessibility can directly influence word order such that highly accessible units are prioritized, i.e., receive early placement in the clause. For example, consider a speaker describing a *dog–chases–mailman* event. If, at the outset of sentence formulation, the concept with the patient role (''undergoer'') is more accessible to the speaker than the actor, it will tend to be placed early in the clause, giving rise to a passive structure (e.g., *the mailman is being chased by the dog*) (Bock and Levelt, 1994; Kempen and Hoenkamp, 1987).

Other theories postulate a direct mapping from the conceptual message to a hierarchical sentence structure (Chang, 2002; Chang et al., 2006). Given the conceptual structure of the message, in particular the thematic roles, functional-hierarchical structures are formed with terminal nodes that can be unified with lexical items. Linearization of the hierarchical structure and unification with lexical items take place during the subsequent positional stage. Sentence production can still proceed incrementally but is driven by an overarching structural framework rather than by activation levels of individual lexical items.

In the literature, these two accounts of sentence production have been referred to as (a) *linearly* (or lexically/radically) incremental, and (b) *hierarchically* (or structurally/weakly) incremental (Bock et al., 2003; Lee et al., 2013). The accounts do not only differ in their ideas on how structure choices come about, they also make different assumptions about the scope of pre-planning needed to initiate an utterance. Linear incrementality posits that as little as one lexical item needs to be encoded before the formulation and pronunciation of a sentence can be initiated. In contrast, according to hierarchical incrementality, the retrieval of a sentence-initial increment encompasses the (partial) preparation of later increments and/or of an overarching abstract syntactic framework. More specifically, the number of lemmas retrieved prior to speech onset is constrained by the grammatical structure of the sentence (Lee et al., 2013).

Within the hierarchical structure of *clauses*, the verb is often attributed a central role. In particular, the subcategorization frame of the head verb of the clause is assumed to play an important role in organizing functional role assignment, leading to preparation of clause-size planning units centered around the verb lemma (Bock and Levelt, 1994). The ditransitive verb *give*, for instance, requires three arguments: the subject, and two objects (one direct, one indirect). In versions of Tree Adjoining Grammar (TAG; cf. Ferreira, 2000; Joshi, 1987; Kroch and Joshi, 1985), the lexical entries for verbs have the form of ''elementary trees'' with one distinguished branch whose terminal node is the verb itself (called ''lexical anchor''); all other branches end in phrasal nodes that are to be expanded by constituents specifying arguments and adjuncts of the verb (via a substitution or adjunction operation). In accounts of syntactic production based on a TAG-like formalism, this implies that binding the non-head constituents of a clause needs to wait until after the head verb of the clause has been selected from the lexicon. This holds even if all other constituents precede the verb in the finally uttered clause.

The aim of the present study is to test this claim directly via a corpus-based approach. We do this by examining—in a corpus of spoken Dutch—how strongly the preferred subcategorization frame of the head verb can influence the syntactic shape of the clause depending on its position in the clause: early (VO) or late (OV). Many verbs display a bias for one subcategorization frame over another (i.e., are associated with differing elementary syntactic trees). With respect to the so-called dative alternation, for instance, some verbs prefer the double object dative (DO; e.g., *Anna gives David the apple*) while others prefer the prepositional object dative (PO; e.g., *Anna hands the apple to David*). According to some models of sentence production, verb biases exert their influence via weighted links between verb lemmas and structural representations (Chang, 2002; Chang et al., 2012). Hence, a verb that is typically used with (i.e., has a bias toward) the DO dative—e.g., Dutch *opleveren* 'yield'—will have a more highly weighted connection to the DO than to the PO structure. Several studies have found effects of verb bias on structure choices or word order choices in sentence production (Bernolet and Hartsuiker, 2010; Colleman, 2009; Ferreira, 1994; Stallings et al., 1998) and in sentence comprehension (Gahl and Garnsey, 2004; Garnsey et al., 1997; Wilson and Garnsey, 2009).[1]

Verb preferences thus play a role in syntactic decisions. However, in published empirical production studies (Bernolet and Hartsuiker, 2010; Ferreira, 1994; Stallings et al., 1998), the verb always precedes the object argument(s) (i.e., VO). This raises the question whether verb biases are also able to constrain syntactic choices if, in the resulting clause, they occupy a late position in that clause (i.e., OV). In the current study, we examine the influence of verb bias (measured in a sentence completion task, see section 5.2) on syntactic choices in spoken Dutch VO and OV clauses.

In Dutch subordinate clauses, the verb is placed after the canonical position of direct and indirect objects. In main clauses, the finite verb precedes this position but nonfinite verbs governed by the finite verb follow it. For example, in the embedded DO dative in (1a), the finite verb *aanried* 'recommended' is produced at the end of the relative clause.

[1] Verb bias effects have been found in sentence *comprehension* studies as well. These studies have mainly focused on the parsing of sentences that contain verbs with a bias toward a direct-object NP (e.g., *we confirmed the date of our visit*) as opposed to a sentential complement bias (e.g., *we confirmed the date was correct*).

In main clause (1b), the past participle *aangeraden* is governed by the auxiliary *heeft* 'has' and follows the direct and indirect objects.

(1a) *De verkoper die de klanten deze koelkast aanried, is ontslagen*
The vendor who the customers the fridge recommended was fired
'The vendor who recommended the customers this fridge was fired'

(1b) *De verkoper heeft de klanten deze koelkast aangeraden*
The vendor has the customers this fridge recommended
The vendor has recommended the customers this fridge

Aanraden 'recommend' has a strong bias toward the DO dative. If the verb lemma is retrieved before sentence formulation starts (as is assumed by verb-centered hierarchical models), then the bias of the verb may promote the selection of a DO structure in the subordinate clause. However, if the objects in an OV ditransitive clause are planned before the verb is retrieved (as is assumed by strictly linear incrementality), verb bias cannot exert any influence on structure choices in OV clauses.

Before turning to our empirical study, we review the available evidence on how far ahead verbs are planned, i.e., their ''pre-planning scope''.

2. The pre-planning scope for clauses

Early studies have focused on advance planning of simple subject-verb-object clauses. In a study by Lindsley (1975), participants described pictures displaying transitive events (e.g., a girl greeting a boy) with referents and actions that were either ''old'', (i.e. known to the participant before trial onset) or ''new''. Response latencies were measured as the participants orally produced subject-only (*the girl*), subject-verb (*the girl is greeting*), verb-only (*greeting*) and subject-verb-object utterances (*the girl is greeting the boy*). Onset latencies were then compared among these utterance types to test the predictions of three models with diverse assumptions regarding the amount of preparation of the verb at sentence onset. (All models assumed that the subject is retrieved prior to sentence initiation, and that verb selection takes longer than subject selection.) According to the Pre-Predicate model, speakers initiate their utterance immediately after subject selection. Hence, characteristics of the verb do not contribute to onset latency at all. This also implies that verb-only utterances should always take longer to initiate than subject-first sentences. The Post-Predicate model posits that speakers retrieve both the subject and the verb before initiating their utterance. Subject-only utterances should thus be initiated faster than subject-verb utterances. Verb-only utterances should also have shorter onset latencies than subject-verb utterances, except when the subject is known to the speaker, in which case latencies should be similar as they are determined solely by the time it takes to complete verb selection. The third, Semi-Predicate model assumes that speakers initiate their utterance after selecting the subject and some (pre-lexical, i.e., visual and/or conceptual) preparation of the verb. Similarly to the Post-Predicate model, it predicts faster onsets for subject-only than subject-verb utterances, but in contrast to the Post-Predicate model it makes a different prediction for subject-verb utterances with known subjects vs. verb-only utterances. Regarding this contrast, the model predicts longer latencies for verb-only utterances because here the verb needs to be completely prepared, against only partial preparation in a subject-verb utterance.

Lindsley found that subject-only utterances were initiated faster than subject-verb clauses, and that subject-verb clauses with old subjects were initiated faster than verb-only utterances. These results were taken as evidence for the Semi-Predicate model in which the verb is at least partly prepared (i.e., pre-lexically) before sentence onset. Kempen and Huijbers (1983) replicated and extended these findings for Dutch.

Vigliocco and Nicol (1998) found evidence for planning of the verb in a pre-linear stage by examining subject-verb agreement errors in English declarative (SVO) and interrogative (VSO) sentences. In their study, participants had to complete sentence beginnings, such as *The helicopter of the flights*. Since the head noun of the subject NP (*helicopter*) and the local noun (*flights*) differ in number, there is an increased probability of subject-verb agreement errors (specifically, so-called *attraction errors*) in which the verb agrees with the local noun rather than with the head noun of the sentence (leading to the production of: . . . *are safe* instead of the correct . . . *is safe*). However, in questions (e.g., *Is the helicopter for the flights safe?*) there is no linear proximity between the verb and the local noun. Still, participants produced similar amounts of agreement errors during the formulation of interrogative and declarative clauses. The authors interpreted this finding as evidence for computation of agreement during a stage in which syntactic structure is built prior to a linearization (positional) stage.

The above studies suggest that the verb is (at least partly) planned before overt production of a sentence is initiated. However, there is also evidence against pre-planning for the verb. Schriefers et al. (1998) used a semantic interference paradigm to examine whether the verb is an obligatory part of the grammatical advance planning scope. In their study, participants had to describe pictures using either VO or OV clauses. In German, the language targeted here, subordinate

clauses have OV word order, like in Dutch. The to-be-produced word order was induced by lead-in fragments. For instance, the fragment *auf dem nächsten Bild sieht man wie* 'on the next picture one sees how' needs a completion in the form of an OV clause, whereas the fragment *auf dem nächsten Bild* 'on the next picture' elicits a VO completion. The verbs to be used in the picture descriptions included transitive and intransitive verbs. After each lead-in fragment, participants were auditorily and visually presented with a distractor verb. Distractor verbs were either semantically related, semantically unrelated, syntactically deviant (i.e., had a different subcategorization frame), or identical to the target verb. A neutral condition (without distractor) was also included. Results indicated that, for transitive sentences, semantically related and syntactically deviant distractor verbs lead to interference only when the verb occurs in sentence-initial position. For sentences with intransitive verbs, no interference effects were obtained. The authors conclude that the verb lemma and its associated subcategorization frame are not necessarily planned ahead of overt sentence initiation.

3. The present study

In the present study, we investigate whether speakers plan the head verb of a clause before utterance initiation even if the verb is clause-final (OV). To address this question, we compare the effect of verb bias on structure choices in VO and OV dative clauses within *spoken language*. For this comparison, we analyze a syntactically annotated corpus of spoken Dutch (CGN; see section 5.1 for treebank details) and derive verb biases based on VO clauses from a written sentence completion task (see section 5.2).

Our main analysis is based on two important presuppositions. First, we assume, in line with results from priming studies (Cleland and Pickering, 2006; Hartsuiker and Westenberg, 2000), that syntactic representations are shared between the written and spoken modalities. To check this assumption, we compare verb biases in written text (the Lassy Small and CONDIV corpora; section 5.1) with those obtained from a spoken corpus (CGN).

Second, we presuppose that the direction (DO or PO) and the strength (lemma-to-structure weight) of verb biases are represented in the mental lexicon. By implication, verb biases must be invariant with respect to the linear position the verb takes in the clause of which it is the head. In other words, the bias of a verb is based on the same underlying representation, irrespective of whether it ends up in VO or OV position. The most veridical measure of a verb's bias is obtained from *written* text, considering that writing situations, which usually allow extensive editing and revision, are relatively immune to time pressure, distraction, cognitive load and other factors that may obscure the underlying bias (Akinnaso, 1982). Consequently, if during *spoken* language production a verb shows different biases in different positions in the clause, this must be due to such factors. In order to establish the invariance of verb biases with respect to within-clause position, we therefore compare verb biases in VO and OV position in *written* language by means of the Lassy Small corpus (section 5.1).

Stated more generally, we hypothesize that verb biases such the ones we address in this paper, form part of the information associated with verb lemmas, and that this information guides sentence processing whenever a verb lemma is retrieved, irrespective of modality (spoken or written), direction (production or comprehension), inflectional form (finite or nonfinite), and word order (earlier or later position in the cause). The corpus studies reported in sections 6.1 and 6.2 are partial tests of this general assumption.

4. Hypotheses

Theories of linear and hierarchical incrementality yield opposite predictions regarding the effect of verb biases in OV clauses in *spoken language*. *Linear incrementality* assumes piecemeal planning guided by lexical availability. According to this view, conceptual information may cause activation of lemmas that are going to play a functional role in a clause, prior to activation of the head verb of that clause. This gives conceptually easily accessible lemmas the opportunity to be inserted into a generic clausal structure—i.e., a structure not yet shaped by a head verb—before the head verb has been inserted. In datives, the choice between the DO vs. PO alternatives must take place prior to placement of the first object (direct or indirect) noun phrase.[2] Hence, only in VO structures, i.e., prior to placement of the first object, can the verb influence the structure choice. Therefore, if sentences are planned in a linearly incremental fashion, we do not expect to find an influence of verb preferences on structure choices in OV clauses. In other words, there should be an interaction between verb bias and verb position, such that verb bias significantly predicts structure choices in VO clauses, whereas the degree to which verb bias predicts structure choices in OV clauses should not exceed chance level.

[2] In Dutch, the dative alternation cannot be reduced to a word order alternation, because the PO structure accommodates both PP-NP and NP-PP order, e.g., *Anna heeft een appel aan David gegeven* ('Anna has given an apple to David') and *Anna heeft aan David een appel gegeven* ('Anna has given to David an apple'). One of the factors determining the order of direct and indirect object may be related to conceptual and/or lexical accessibility of recipient and theme. On the hypothesis of linear incrementality, if the recipient is accessed earlier than the theme, the speaker has two options to grammatically encode it: as an NP (yielding a DO structure) or a PP headed by the preposition *aan* 'to' (yielding a PO). In an OV structure, the hypothesis predicts that this encoding choice is not affected by, hence may not match, verb bias.

On the other hand, *hierarchical incrementality* predicts that conceptual information is mapped directly onto a clausal structure bound to, and shaped by, the head verb. Thematic roles or event roles (i.e., agent, theme, recipient) are directly assigned a functional role (i.e., subject, direct object, indirect object) and a syntactic shape (NP, PP, AP), controlled by the head verb. Since structure choices are made before the sentence is linearized, the position of the verb in the to-be-produced clause should not be a factor determining whether or not its bias can exert an effect on structure choices. Hence, if sentence planning proceeds in hierarchically incremental fashion, and the verb is a necessary part of the clause-initial planning scope, then the direction and strength of verb preferences should be a strong predictor of structure choices in OV clauses. In statistical terms, on a strictly hierarchically incremental account there should be a main effect of verb bias but no interaction between verb bias and verb position.

Finally, there is the possibility that linear and hierarchical incrementality each account for *part* of the sentences produced by language users. For example, hierarchical incrementality may hold when the head verb of a clause is easily accessible—e.g., due to high frequency of that verb in the language, or to high salience (given the current discourse) of the conceptual content underlying that verb. However, when the head verb is hard to access, more easily accessible nonverbal constituents may already be inserted into the generic clausal structure earlier than the verb. Such a course of events may serve to prevent speech pauses and to promote fluency if verb-final word order is mandatory in the clause under construction. However, it may also give rise to mismatches between the linear order of direct and indirect objects on the one hand, and the DO/PO bias of the finally selected head verb on the other. A combination of hierarchical and linear incrementality predicts that verb biases are capable of exerting their influence on structure choices in OV clauses, but do so to a lesser extent than in VO clauses. This may result in an interaction between verb bias and verb position, such that verb bias is a strong predictor of structure choices in VO clauses and a weaker predictor in OV clauses.

5. Materials and methodology

To assess verb bias effects on structure choices in VO and OV ditransitive clauses, we use corpus data and data obtained from a written sentence completion task (see section 5.2). We introduced this test to obtain more reliable estimates of DO/PO verb biases in VO clauses—more reliable than the estimates obtained from the relatively small proportion of VO clauses in the CGN corpus (where spoken VO clauses comprise only 32% of the spoken clauses) and in the written Lassy Small Corpus (with 39% of all written clauses featuring VO order). Ford and Bresnan (2013, 2015) have shown that results from a sentence completion task eliciting ditransitives can be a good proxy for corpus data. We judged a written (instead of a less convenient spoken) task would be adequate, given that a recent study (Van Bergen et al., 2013) yielded written VO biases that were generalizable to biases in spontaneous speech.

In the present section, we first describe how data were extracted from the corpora we investigated (section 5.1). This is followed by a description of how the sentence completion task was set up and analyzed (section 5.2). Finally, we explain how we applied distinctive collexeme analysis in order to compute verb biases from the corpus and sentence completion data (section 5.3).

5.1. Treebanks

The present study is based on two ''treebanks'' (syntactically annotated text corpora) for spoken and written Dutch, respectively. For our main analysis of verb bias effects in spoken language, we used the syntactically annotated part of the Corpus of Spoken Dutch (CGN 2.0; 130,595 corpus graphs and about 1.1 million words; Van Eerten, 2007). In order to verify the preliminary assumptions mentioned in section 3, we made use of the written Lassy Small corpus (henceforth referred to as Lassy). Lassy includes the STEVIN D-COI and DPC corpora as well as some excerpts from the Dutch Wikipedia, and contains about 65,000 corpus graphs and 1 million words (Oostdijk et al., 2013; Van Noord et al., 2013). In both corpora, the sentences are annotated with dependency graphs—annotations that are relatively theory-neutral (Hoekstra et al., 2001; Van der Beek et al., 2002). Dependency graphs specify functional-dependency relations between constituents and subconstituents. Additionally, the graphs contain specifications of lexical entry, string position, and syntactic category of every (sub)constituent. With these data at hand, we collected occurrences of the Dutch ditransitive construction using a list of ditransitive verbs compiled by Colleman (2009), and searching additional ditransitive verb forms.[3] Fig. 1 shows an example of a ditransitive construction taken from the CGN treebank.

[3] CGN was searched with TIGERSearch (König and Lezius, 2003), applying special measures to recognize compound verbs with separable verb prefixes. Lassy was searched with a JAVA program of our own making, also able to retrieve separable verbs. Notice that, in Dutch, the separable part of a verb (the 'particle') usually follows the direct and indirect object NPs—even in main clauses, where the finite form of the verb occupies ''verb-second'' position (SVO), e.g., *De vader geeft het kind de peer mee* 'The father gives the child the pear along' In PO structures, the indirect object (like any other type of PP) may follow the particle, e.g., *De vader geeft de peer mee aan het kind* 'The father gives the pear along to the child'.

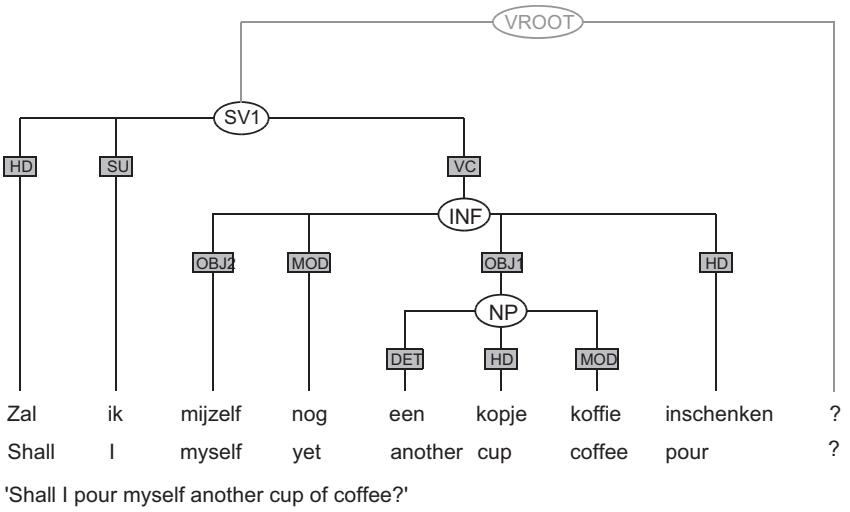

Fig. 1. Example taken from the CGN treebank illustrating the encoding of a nonfinite verbal complement (edge label VC). Nodes are labeled with grammatical categories, edges with grammatical functions. SV1: interrogative clause; INF: infinitival clause; NP: Noun Phrase; SU: subject; HD: head; OBJ1: direct object; OBJ2: indirect object; MOD: modifier; DET: determiner.

The queries yielded 1042 and 1625 dative clauses for CGN and Lassy, respectively. These results were manually filtered and analyzed. From both data sets, we removed passive clauses, which do not contain a direct object. We also excluded idiomatic expressions where the verb in isolation is not ditransitive but only takes a dative in combination with another PP or NP (e.g., *de hand schudden* 'shake hands', *het leven redden* 'save the life'), and cases that did not include the combination of a direct and an indirect object, or had been misclassified as ditransitive. These criteria led to the exclusion of 16 (2%) and 366 (23%) sentences from the CGN and Lassy output, respectively. The higher exclusion rate for the Lassy corpus was mainly caused by the higher passivization tendency in written language use (e.g., O'Donnel, 1974).

For each of the clauses in the final data set (i.e., 1026 and 1259 clauses in CGN and Lassy, respectively), we determined the citation form (infinitive) of their head verb, the type of construction they embody (DO or PO), and their verb position (VO or OV). Table 1 displays for both corpora the number and percentage of sentences in each configuration.

The classification of verb infinitives yielded a total of 162 and 157 different ditransitive verbs in CGN and Lassy, respectively. Clauses were classified as PO datives if they consisted of a noun phrase (NP) expressing the theme/patient/undergoer and a prepositional phrase (PP, with *aan* 'to' or *voor* 'for' as head) expressing the recipient. Clauses were classified as DO datives when both their objects were NPs. Both CGN and Lassy contain more DO than PO datives: In the final data set, 77% (789 CGN clauses) and 56% (709 Lassy clauses) featured a DO dative. The higher proportion of DO clauses in spoken language may be due to a higher pronoun density in spoken vs. written language (Louwerse et al., 2004). Since language users prefer to formulate pronominal indirect objects as NPs and not as PPs, high pronoun density leads to the production of more DO datives (Colleman and Bernolet, 2012).

In addition, we classified the position of the verb as preceding or following the canonical position of the (in)direct objects (i.e., VO vs. OV). In Dutch, finite verbs are placed in ''verb-second'' position, that is, immediately following the first constituent in a main clause without subject-verb inversion (i.e. before any objects; we also counted imperatives and clauses with subject-verb inversion as verb-second, hence as VO). In most other cases, verbs are placed verb-finally, that

Table 1
Number and percentage of sentences with each of the four possible configurations (DO vs. PO dative, and VO vs. OV order) in Lassy and CGN.

Structure	Lassy		CGN	
	VO order	OV order	VO order	OV order
DO dative	292 (41%)	417 (59%)	257 (33%)	532 (67%)
PO dative	198 (36%)	352 (64%)	67 (28%)	170 (72%)

is, after the (in)direct object NPs (Haeseryn et al., 1997; Koster, 1975; Zwart, 1993). Hence, all nonfinite (infinitival, participial) clauses and all subordinate clauses were classified as verb-final.[4]

In both corpora, OV order occurs more frequently than VO order, with 68% (CGN) and 61% (Lassy) of the total number of sentences displaying OV order (see Table 1).

In PO ditransitive clauses with OV order, the verb can also be placed immediately after the direct object, preceding the prepositional phrase (*aan/voor* + the indirect object). For example, in the CGN clause *dat u kredieten moet geven aan de glastelers* 'that you must give loans to the greenhouse-horticulturists', the verb *geven* is placed before the PP *aan de glastelers*. When comparing verb bias effects in VO and OV position, we excluded these cases ($n = 80$ in CGN and $n = 197$ in Lassy) as they may be argued to be only ''halfway'' OV.[5]

Finally, OV-clauses with extraposed constituents (i.e., heavy constituents moved to the right of their canonical position) were still considered verb-final even if part of the object (indirect in PO and direct in DO datives) appeared after the verb, as in: *Ze moeten ons de motivatie geven om te werken aan de mindere punten die in het onderzoek naar voren kwamen* 'They have to give us the motivation to work on the bad points that emerged in the investigation' where *motivatie* and *om te werken aan de mindere punten die in het onderzoek naar voren kwamen* are separated by the verb *geven*.

5.2. The sentence completion task

5.2.1. Participants

Forty adult native speakers of Dutch (ages 18–30 years) from Radboud University Nijmegen participated in the study. They received payment for their participation. All participants had normal or corrected-to-normal vision. Permission to conduct the study had been obtained from the Ethics Board of the Social Sciences Faculty of the Radboud University Nijmegen.

5.2.2. Materials (see Appendix A)

We selected 16 verb pairs from the CGN corpus. Each verb pair consisted of a DO- (e.g., *uitleggen* 'explain') and a PO-biased (e.g., *opleggen* 'impose') verb, as determined on the basis of the distinctive collexeme analysis we had applied to all ditransitive verbs in CGN. The selected verbs occurred in a ditransitive construction within the corpus at least twice. For each verb pair, one main clause (as in (2a/b)) was constructed which could accept both verbs and which was based on materials used in earlier studies (Van de Velde and Meyer, 2014; Van Bergen et al., 2013). These sentences were broken down into a preamble *Het schoolhoofd* . . ., and three sentence fragments: recipient, theme and verb (infinitive). Each verb pair was presented with two fragment orders: recipient-verb-theme (RT order) and theme-verb-recipient (TR order), e.g., [*leerlingen uitleggen regels*] and [*regels uitleggen leerlingen*], respectively.

(2a)	Het	schoolhoofd	legt	de	leerlingen	de	regels	uit
DO bias	The	headmaster	explains	the	students	the	rules	
	'The headmaster explains the rules to the students'							
(2b)	Het	schoolhoofd	legt	de	leerlingen	de	regels	op
PO bias	The	headmaster	imposes	the	students	the	rules	
	'The headmaster imposes the rules on the students'							

Four lists of stimuli were created to counterbalance verb bias and fragment order, so that each item appeared in a different condition (PO vs. DO bias, and recipient-verb-theme vs. theme-verb-recipient order) in each list. In order to prevent priming of structure choices, target sentences were each separated by two structurally unrelated filler sentences (34 fillers in total). The fillers were monoclausal sentences, usually including intransitive verbs (e.g., *The elderly man slept through the ceremony*). They were presented in a manner similar to the presentation of the target items, e.g., *The elderly man* . . . [*ceremony sleep through*]. The verb was always presented as the second fragment, whereas the order of the

[4] We use the term ''clause'' as synonymous with Verb Phrase, denoting a constituent headed by a single verb (of any type). Therefore, if a verb takes a nonfinite verbal complement (as in *Ze heeft hem dit boek aangeraden* 'She has recommended him this book'; literally: She has him this book recommended), we treat it not as one clause but as a hierarchy of two clauses. In Fig. 1, the two clauses are labeled SV1 and INF.

[5] In PO main clauses with separable verbs, speakers can place the prepositional phrase before the verb particle (e.g., *De aanpak van geweld op school laat Minister Van der Hoeven nu voornamelijk aan de opleidingen zelf over* 'The policy w.r.t. violence at school leaves Minister Van der Hoeven mainly to the education programs themselves'. Here, *over* is the particle of the separable verb *overlaten* 'leave something to'.) These cases—few in number—are normal VO clauses.

remaining fragments was randomized, with approximately 50% displaying an order congruent with the original sentence order (e.g., [*through sleep ceremony*] with *through* preceding *ceremony*), the other half incongruent (i.e. [*ceremony sleep through*] with *ceremony* preceding *through*). This was done to discourage the development of general-purpose completion strategies, e.g., always inserting the fragments in the order of mention.

Within each list, the order of the target items was pseudo-randomized such that (a) no two consecutive target items involved a verb with the same preference direction (PO or DO), and (b) no more than two target items with similar fragment orders were shown consecutively. All sentences were printed in a pen-and-paper questionnaire.

5.2.3. Procedure

Participants were randomly assigned to one of the four item lists and tested in small groups. They received a sheet with written instructions, and two sheets containing the sentence fragments, after giving informed consent. Instructions emphasized that sentence fragments had to be completed to grammatically correct sentences and that present tense had to be used whenever possible. Furthermore, the participants were instructed to work quickly, not to use many extra words, and to write the first thing that came to mind. The task consisted of 16 experimental and 34 filler items. At the end of the session, participants were debriefed about the goal of the task. It took participants about 20 minutes to complete the task.

5.2.4. Scoring and analysis

Sentences were scored as embodying either double object (DO) or prepositional object (PO) syntax. Sentences with intransitive syntax or other constructions were discarded, as were sentences with the direct or indirect object omitted, with verb substitutions, or with noun substitutions (except for minor substitutions, e.g., *oma* 'grandma' instead of *opa* 'grandpa', or the use of plural instead of singular nouns). The final dataset consisted of 569 responses (253 PO sentences, 316 DO sentences), equivalent to fourteen scorable responses per participant.

To evaluate the sentence completion task, we tested whether verb bias (i.e., collostructional strength as estimated on the basis of the CGN data) was a significant predictor of structure choices in the completion task, independent of the order in which theme and recipient were presented. To this end we performed a mixed logit model predicting the logit-transformed likelihood of a PO-response (Jaeger, 2008). The model included Verb bias as a continuous and Fragment order as a categorical fixed factor, after they had been centered. We used a backwards elimination procedure, starting from an initial model containing all experimental factors and their interactions, as well as a maximum random structure, to arrive at the model that best fits the data (Baayen, 2008a; Baayen et al., 2008; Jaeger, 2008).

5.2.5. Results

Fig. 2 shows the mean proportion of PO responses per condition. For reasons of clarity, Verb bias is displayed as a categorical variable. On average, PO datives were produced in 44% of the trials, which is more often than in the CGN speech corpus (23%). Previous studies have also found that PO datives occur more frequently in experimental studies (e.g., Bernolet and Hartsuiker, 2010) than in natural corpus data (e.g., Colleman, 2009). This difference has been attributed to the lack of pronominal arguments in experimental studies. Pronominal indirect objects tend to be

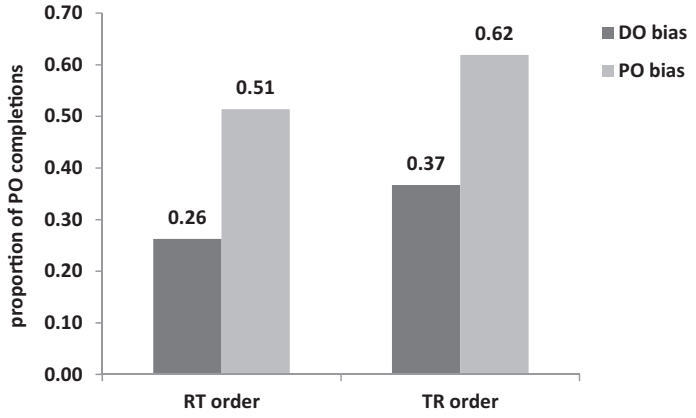

Fig. 2. Proportion of PO completions per condition. ''RT'' and ''TR'' denote order of presentation of theme and recipient fragments in the experimental items.

Table 2
Summary of the fixed effects in the mixed logit model (n = 569; loglikelihood = −328).

Predictor	Coefficient	*SE*	Wald *Z*	*p*
Intercept	−0.26	0.52	−0.51	0.61
Fragment order	0.73	0.31	2.38	<0.05
Verb bias	−0.54	0.11	−4.87	<0.001

formulated as NPs, thereby boosting the production of DO datives in natural corpus data (Colleman and Bernolet, 2012).

To test for effects of Fragment order and Verb bias, we ran a mixed logit model. The final model yielded significant main effects of Verb bias and Fragment order (with by-subject and by-item random intercepts, and a by-subject random slope for Fragment order).[6] The interaction between Verb bias and Fragment order was not significant and was thus excluded from the model. The results of the analysis are summarized in Table 2. The significant main effect of Verb bias confirms findings from earlier studies that verb preferences are similar across corpora and controlled experiments (Colleman and Bernolet, 2012; Van Bergen et al., 2013). Moreover, not only the direction of verb preferences derived from the CGN data, but also the relative strength of preferences was a significant predictor of sentence structure in the completion task above and beyond the effect of Fragment order.

5.3. Distinctive collexeme analysis

The data from the sentence completion task (all VO) as well as the finally selected CGN and Lassy sentences (classified as VO or OV) were subjected to *distinctive collexeme analysis* to determine their DO or PO verb biases (Gries, 2006, 2007; Gries and Stefanowitsch, 2004; Stefanowitsch and Gries, 2003, 2005). This technique allows us to establish the degree of preference of lexical items (here: ditransitive verbs) for one syntactic construction over another one (here: DO vs. PO dative). It does so by comparing the observed frequency of a given ditransitive verb occurring in one of the alternative syntactic constructions with the expected frequency of occurrence based on the overall distribution of the two alternative constructions in the set of ditransitive verbs.

The statistical test used for this purpose is the Fisher-Yates Exact Test (FET). This statistic does not involve distributional assumptions (e.g., normality), nor does it overestimate verb bias for rare verb–structure pairings (Stefanowitsch and Gries, 2003). The result is a *p*-value, indicating the preference of the verb for one of the two constructions. Verb bias is usually expressed as $-\log_{10}(p_{FET})$, with higher values indicating a stronger preference for one construction over the other. Table 3a and b shows the resulting distinctive collostructional strengths of the ten verbs with the highest preferences for a DO and a PO structure in the CGN and Lassy corpora. While PO-preferring verbs display stronger biases than DO-preferring verbs in CGN (M = 0.93, SD = 1.62, *range* = 0.18–11.47 vs. M = 0.32, SD = 0.61, *range* = 0.12–5.06), in Lassy DO-preferring verbs exhibit a wider range of biases (M = 1.15, SD = 1.57, *range* = 0.17–9.50 vs. M = 0.82, SD = 1.97, *range* = 0.20–17.60).

Since p_{FET}-values are dependent on sample size, this measure does not lend itself to direct comparisons of degrees of association derived from samples of different sizes (Gries, 2006; Wiechmann, 2008). Therefore, in the correlation analyses to be reported below, we used $\log_{10}$ odd ratios as a measure of association strength to enable direct comparisons across corpora (CGN and Lassy) and data sets (VO and OV). The $\log_{10}$ odd ratio of a verb was defined as ($\log_{10}$[(#DO + 1)/(#PO + 1)]). We added 1 to the obtained frequency counts (e.g., #DO + 1) in order to deal with zero frequencies (cf. Bernolet and Hartsuiker, 2010).

5.4. Data analysis

All data were analyzed using R (R Development Core Team, 2013), and the R packages *lme4* (Bates et al., 2009) and *languageR* (Baayen, 2008b). Analyses on structure choice in VO and OV dative clauses were carried out with mixed logit models (coefficients are given in log-odd ratios). Model factors include Verb bias as a continuous factor and Verb position (VO vs. OV) as a categorical factor (after they have been centered), and a random by-item (verb) intercept (Baayen, 2008a; Baayen et al., 2008; Jaeger, 2008). All models use a maximum random structure as justified by the model's design, with a by-item random slope for Verb position (Barr et al., 2013). The model with an interaction between Verb bias and

[6] Including more by-item or by-subject random slopes (for a maximum random structure) led to non-convergence of the model.

Table 3
Collexemes with the strongest overall bias (i.e., collapsing across verb position) for the DO and the PO dative in (a) CGN (spoken corpus) and (b) Lassy (written corpus).

(a) CGN DO preference		(b) Lassy DO preference	
Dutch (English)	coll. strength	Dutch (English)	coll. strength
zeggen (say)	5.06	wensen (wish)	17.60
vertellen (tell)	3.83	bezorgen (deliver)	5.23
maken (make)	1.16	opleveren (yield)	4.53
bieden (offer)	1.00	geven (give)	3.25
gunnen (award)	0.93	leren (teach)	1.50
kwalijk_nemen (resent)	0.93	ontnemen (deprive)	1.35
beloven (promise)	0.81	bewijzen (prove)	1.25
voorhouden (hold_up)	0.81	aandoen (affect)	1.25
wensen (wish)	0.81	toeroepen (call out)	1.25
kosten (cost)	0.72	verwijten (blame)	1.25
(a) CGN PO preference		**(b) Lassy PO preference**	
Dutch (English)	coll. strength	Dutch (English)	coll. strength
vragen (ask)	11.47	overdragen (transfer)	9.50
verkopen (sell)	3.77	brengen (bring)	7.55
schrijven (write)	2.48	leveren (deliver)	5.34
hebben (have)	2.17	doorgeven (pass on)	3.98
afstaan (cede)	1.26	verlenen (grant)	2.81
laten (let)	1.26	voorleggen (propose)	2.53
verlenen (grant)	1.26	toekennen (grant)	2.37
zoeken (search)	1.26	doorspelen (pass on)	2.16
teruggeven (return)	0.86	schrijven (write)	1.55
aanbieden (offer)	0.78	verkopen (sell)	1.55

Verb position is compared against the model containing only main effects for Verb bias and Verb position, using likelihood ratio tests.

6. Results: checking two presuppositions and answering the key question

In separate subsections (section 6.1 through section 6.3), we report results from three sets of analyses. First, to check the assumption that overall verb biases are similar between spoken and written language, we correlate verb biases obtained from corpora of written vs. spoken language (in $\log_{10}$-odd ratios), after excluding outliers based on extreme Cook's distances (Stevens, 1984). Besides comparing biases obtained from CGN and Lassy, we add verb biases from another corpus of written language: the newspaper component of the CONDIV corpus. The CONDIV corpus (which does not contain syntactic annotations) consists of articles from three Dutch and three Belgian newspapers (Colleman, 2009). In addition, in order to evaluate cross-corpus similarity of bias *direction*, we compute generalized Kappa for the three corpora while correcting for chance (Fleiss, 1971; King, 2004). This statistic can be interpreted as a chance-corrected measure of agreement among three or more independently rated categories (here: verb biases derived from three independent corpora).

Second, in order to check the assumption that verb biases in VO and OV position in *written language* are identical, we carry out a mixed logit model (Jaeger, 2008) predicting structure choices in the Lassy corpus from the factors Verb bias (in $-\log_{10}(p_{FET})$) and Verb position (OV vs. VO). If VO- and OV-based verb biases are similar in written language, then we expect to find a main effect of Verb bias on structure choices. If there is a difference in the extent to which verb biases can exert their effect on structure choices in VO vs. OV clauses, then we expect to find an interaction between the factors Verb bias and Verb position (see section 6.2).

The third and final analysis step focuses on our key question: Do verb bias effects on structure choices *in spoken language* vary depending on the VO vs. OV position of the verb in the clause? To examine this question, we used a mixed logit model predicting dative structure choices in the CGN corpus with VO-specific Verb bias obtained from the sentence completion task (in $-\log_{10}(p_{FET})$) and Verb position as fixed factors. If preparation of the verb precedes the choice of a

Table 4
Correlations among verb biases (expressed as $\log_{10}$ odd ratios) obtained from the Lassy and CGN corpus in the present study, and from the CONDIV corpus in Colleman (2009). Between parentheses are the number of different ditransitive verbs and the *total number of verb form occurrences* per analysis separated by a dash. For the correlation between Lassy and CONDIV, four verbs (*ontfutselen* 'pilfer', *wensen* 'wish', *overlaten* 'leave to' and *afstaan* 'cede') were excluded based on extreme Cook's distances. In the comparison between CGN and CONDIV, two verbs (*verzoeken* 'request' and *opgeven* 'give up') were excluded for the same reason. All three correlations are significant at the .01 level (two-tailed).

	Lassy	CGN	CONDIV
Lassy			
CGN	.56 (71–*1911*)		
CONDIV	.82 (113–*15070*)	.60 (98–*14811*)	

syntactic alternative in dative OV clauses, in line with verb-centered hierarchical incrementality, then we expect to find a main effect of Verb bias, independent of Verb position. If the verb is not prepared in dative OV clauses, in line with linear incrementality, then we expect to find an interaction between Verb bias and Verb position, with Verb bias exerting a significant influence on structure choices in VO clauses and a non-significant influence on structure choices in OV clauses.

6.1. Cross-corpus agreement of DO/PO biases

First we examine the overall similarity of the verb biases in the three target corpora. Table 4 shows the correlations among verb biases measured in Log_{10} odd ratios.

Correlations between verb biases in the different corpora, taking direction of preference into account, were strong. The highest correlation was obtained between verbs in the two written corpora (CONDIV and Lassy).[7] The fact that verb biases obtained from the CGN corpus correlate strongly with verb biases in CONDIV and Lassy, implies that verb biases affect structure choices to a similar degree in spoken and written modalities.

To assess the similarity in the *direction* of verb preferences between corpora we compute generalized Kappa (Fleiss' Kappa). Generalized Kappa can be used to measure the degree of cross-corpus agreement with respect to the direction of verb bias, over and above the agreement that would be expected on the basis of chance alone (Fleiss, 1971). According to this statistic, agreement differs significantly from chance ($z = 6.65$, $SE_{Fleiss} = .08$, $p < .001$). The obtained value of Kappa = .50 is characterized as moderate (Landis and Koch, 1977).

6.2. DO/PO biases in written VO and OV clauses

In order to establish that, in *written* language, verb biases do not differ when used in different clause positions, we run a mixed logit model on the Lassy data, with Verb bias and Verb position as fixed factors, predicting the logit-transformed likelihood of a PO-response. Since in Lassy the distribution of VO and OV clauses is reasonably balanced (39% VO order, 45% OV order and 16% ''halfway'' OV), we used overall verb biases. We computed DO-directed verb biases such that not only preference strength but also preference direction was taken into account (e.g., – 5.34 refers to a strong bias for the PO structure). In the mixed logit analysis, only clauses with VO and OV order were included ($n = 1058$ verb tokens and 152 verb types). Table 5 shows a summary of the best model fit.

Table 5
Summary of the fixed effects in the mixed logit model predicting PO choice in the Lassy corpus ($n = 1058$, log likelihood = −556). The model also includes a random by-item intercept. A random slope for Verb position is not included, as it leads to non-convergence.

Predictor	Coefficient	*SE*	Wald *Z*	*p*
Intercept	−1.67	0.30	−5.49	<0.001
Verb bias	−0.51	0.10	−4.90	<0.001
Verb position	0.93	0.16	5.68	<0.001

[7] This is remarkable because, whereas CONDIV exclusively consists of newspaper texts, Lassy contains texts from various different printed genres (for details, see Oostdijk et al., 2013).

The absence of an interaction between Verb bias and Verb position ($z = -0.48$) indicates that, within written language, VO biases are highly similar to OV biases. Furthermore, as expected, Verb bias was a significant predictor of structure choices (DO vs. PO) in Lassy: the stronger the DO bias, the lower the proportion of PO datives.

The effect of Verb position, indicating that clauses with VO order are more likely to be structured as a PO dative than OV clauses, can be attributed to the scoring criteria applied in this analysis. Specifically, a rather large number of PO clauses with OV order was excluded because, in these clauses, the verb preceded the indirect object (i.e., they were only ''halfway'' OV). Therefore, VO clauses exhibited a PO structure more often than OV clauses.

6.3. DO/PO bias in spoken VO and OV clauses as indicator of planning scope

So far, we have found that overall verb biases are similar across written and spoken modalities and that within *written* language VO and OV-related biases are virtually the same. Addressing now our main question as to whether the verb is planned in advance in OV clauses, we turn to a comparison of verb bias effects in VO vs. OV clauses within *spoken* language. To this end we first calculate, through distinctive collexeme analysis, the VO-based DO/PO biases in the sentence completion task. Table 6 summarizes the outcome.

Table 6
Mean strength of the DO and PO biases (in $-\log_{10}(p_{FET})$) computed from the sentence completion task.

Verb bias	Verb preference	
	DO	PO
Average	2.10	1.81
Stdev	1.41	1.77
Range	0.33–5.23	0.25–7.23

The thus obtained verb biases (computed as DO-directed) together with Verb position are used as fixed factors in a mixed logit model predicting the logit-transformed likelihood of a PO-response in the CGN corpus. The dataset for this analysis consists of 666 CGN clauses that contain one of the verbs of the sentence completion task (i.e., 32 different verbs). See Table 7 for a summary of the results.

Table 7
Summary of the fixed effects in the mixed logit model predicting PO choice in the CGN corpus ($n = 666$, log likelihood = −282). The model also includes a random by-item intercept. A random slope for Verb position is not included, as it leads to non-convergence.

Predictor	Coefficient	*SE*	Wald *Z*	*p*
Intercept	−1.96	0.31	−6.42	<.001
Verb bias	−0.47	0.14	−3.29	<.001
Verb position	−0.17	0.24	−0.71	0.48
Verb bias × Verb position	0.67	0.27	2.47	0.01

In the final model (Table 7), Verb bias is a significant predictor of syntactic structure of OV and VO clauses in CGN. In addition, the model yields a significant interaction between Verb bias and Verb position. A comparison—using a likelihood ratio test—of this model with a model that only contains main effects reveals that the inclusion of the interaction between Verb bias and Verb position is justified ($X^2(1, N = 666) = 7.96$, $p < 0.01$). Hence, the effect of Verb bias on structure choices is significantly different for verbs in different clausal positions.[8]

To examine the interaction more closely, we split the data into VO ($n = 198$) and OV ($n = 468$) clauses and examined the degree to which Verb bias predicts syntactic structure for each verb position separately. As expected, Verb bias is a strongly significant predictor of structure choices in VO clauses, ($\beta = -0.77$, $SE = 0.28$, $z = -2.72$). In OV clauses, Verb

[8] The outcome of this analysis remains essentially the same if we include the 80 OV clauses in CGN where the indirect object PP follows the ditransitive verb (see last paragraph of section 5.1).

bias is also a significant predictor of structure choices ($\beta = -0.25$, $SE = 0.11$, $z = -1.93$), but the effect is weaker than in VO clauses.[9]

7. Discussion

We compared the effect of verb biases on structure choices in VO and OV dative clauses in the Corpus of Spoken Dutch (CGN), using the results as a kind of litmus test enabling inferences about the size and structure of the advance planning scope during spontaneous speaking. We contrasted two views of clausal pre-planning that entail differential predictions regarding the effect of verb bias in VO vs. OV clauses. According to the hypothesis of *hierarchical incrementality*, the verb is an obligatory component of clausal planning scope. Therefore, verb biases should exert an influence on structure choices regardless of the early (VO) or late (OV) position of the verb in the clause.

Conversely, according to the framework of *linear incrementality*, planning proceeds in a piecemeal fashion strictly guided by lexical availability. Consequently, the verb and its associated bias can only influence structure choices in VO clauses. We tested these predictions by analyzing structure choices in CGN, using mixed logit models.

Results are in line with a combination of linear and hierarchical incrementality, showing a significant effect of verb bias on structure choices in OV clauses, but an even stronger effect of verb bias in VO clauses. The significant main effect of verb bias in OV clauses shows that during spontaneous speaking verb biases of verbs in clause-final position can drive syntactic choices, in line with the hypothesis of verb-centered hierarchical incrementality.

The significant interaction between verb bias and verb position indicates that verb bias exerts a significantly stronger influence on structure choices in VO than in OV clauses. This finding is in line with a combination of hierarchical and linear planning strategies, suggesting that speakers engage in hierarchically incremental planning most of the time, but sometimes resort to a more linearly incremental planning strategy. For, if sentences were planned in a strictly hierarchically incremental fashion, we would expect structure choices in VO and OV clauses to be determined by verb bias equally strongly. (As reported in section 6.2, the latter holds for written language, which allows revisions of suboptimal passages.)

One possibility raised earlier, is that the degree to which the head verb of a clause is prepared prior to the choice of a syntactic structure, is driven by the *accessibility of the conceptual content* it expresses: hierarchical incrementality may hold when the head verb of a clause is easily accessible; but when the head verb is hard to access, speakers may resort to more linearly incremental planning, and first insert more easily accessible nonverbal constituents into the generic clausal structure.

Another explanation for the finding that verb biases exert a weaker influence on structure choices in OV than VO clauses is that the head verb in an OV clause is only prepared up to a pre-lexical level, in line with Lindsley's (1975) Semi-Predicate model. Consider the scenario in which a speaker has decided to extend an NP with a relative clause, and selects OV word order. Then, given the event s/he is about to describe, s/he activates the general concept of *transfer-of-possession*. Since this concept does not uniquely select one particular verb, the PO and DO options for the dative structure are both open at this point, e.g., PO with *verkopen* 'sell'; DO with *bieden* 'offer' (see Table 2). Now, suppose the speaker encodes the constituents referring to the agent and the recipient of the transfer-of-possession event *prior to having decided on the verb*. At this pre-lexical stage of verb planning, the speaker could select the DO option, based on the fact that DO structures occur more frequently in Dutch than PO structures, and thus serve as the default option. The two dependent constituents can now be inserted into a generic clausal structure—the indirect object preceding the direct object NP—, followed by the clause-final verb.

This version of the Semi-Predicate hypothesis can be put to test by comparing the predictive power of a model for PO/DO choices in OV clauses containing verb-specific biases as a predictor against a model with only an intercept—the latter representing the default bias in favor of DO. If pre-lexical selection of a DO vs. PO dative is indeed a viable scenario, then adding verb-specific biases to a model predicting PO/DO choices will not explain significantly more variance than the intercept-only model. Comparing the intercept-only model with a model that included an intercept and the factor Verb bias, we found that the latter factor yields a (marginally) significant increase of predictive power ($X^2(1, N = 468) = 3.67$,

[9] We also calculated the correlation between verb biases as obtained from the sentence completion task (VO position) and verb biases obtained from CGN (OV position), after removing outliers ($n = 3$; *brengen* 'bring', *doorgeven* 'pass on' and *schrijven* 'write', due to extreme Cook's distances). Although this analysis does not take overall distributional differences into account (as verb biases were expressed in $\log_{10}$-odd ratios to enable comparisons between corpora of different sizes), the result confirms the findings from the mixed logit model: VO biases obtained from the sentence completion task correlate significantly with OV biases obtained from CGN ($r = .37$, $p = .05$, $n = 29$). We also computed the correlation between verb biases based on VO clauses in CGN and VO biases based on the sentence completion task, after removing outliers ($n = 1$, *garanderen* 'guarantee' due to an extreme Cook's distance). In line with the outcome of the mixed logit model, VO-related biases in CGN are more strongly correlated with biases computed from the completion task ($r = .78$, $p < .001$, $n = 21$) than OV-based biases are ($r = .37$).

$p = 0.055$). This result supports our assumption that the data pattern we obtained above is based on lexical rather than pre-lexical pre-planning of verbs in OV position.

However, the study by Schriefers et al. (1998), which we briefly discussed in section 2, seems to contradict this conclusion. Schriefers et al. employed a picture-word interference paradigm to examine whether semantic distractors caused interference to action naming in SOV or VSO order (induced by lead-in fragments). They found a semantic interference effect in VSO sentences only and interpreted this result as showing that verbs in clause-final position are not automatically part of the grammatical advance planning scope. This conclusion clearly disagrees with findings from the current study. What could be the reason for this discrepancy? The fact that Schriefers et al. studied a different language (German instead of Dutch) and different sentence types (intransitive and monotransitive instead of ditransitive clauses), may provide a sufficient explanation. We suggest, however, that the experimental paradigm they deployed has induced a more linearly incremental planning strategy. Previous research has shown that speakers tend to plan more linearly incrementally (a) when experiencing cognitive load, (b) under time pressure, and/or (c) when their average production speed is high (Ferreira and Swets, 2002; Wagner et al., 2010).

In Schriefers et al.'s picture-word interference paradigm, cognitive load might have been induced by the simultaneous presentation of auditory or visual distractors (the latter flanking the to-be-described picture). The fact that pictures without distractors were described faster than pictures flanked by verbs identical to the to-be-produced verb, suggests that speakers were indeed distracted by the presentation of any material flanking the picture. In addition, the repetition of each picture with different distractors and lead-in fragments (each picture was seen ten times: with two different lead-in fragments in five distractor conditions) might have yielded high processing difficulty. Still, speakers initiated their sentences rather fast: 880 ms was the average onset latency for SOV sentences with unrelated distractors. Therefore, it is conceivable that, in the paradigm of Schriefers et al., speakers relied on linearly incremental planning to a large extent. Since our study used corpus data from spontaneous speech, we have no control over factors that influence planning strategies. Our results suggest, however, that in everyday spontaneous conversation speakers often plan hierarchically incrementally.

Besides lacking control over speakers' planning strategies, our corpus-based approach also did not allow controlling other factors influencing the choice of a dative alternative, such as definiteness and number of the recipient and theme NPs (Bresnan et al., 2007). In fact, argument properties and verb biases may interact in determining structure choice: certain verbs may co-occur with specific argument types (e.g., *take* is over seven times more likely to have a non-given (non-topical) recipient than *bring*; Bresnan et al., 2007), thereby indirectly determining structure choices. However, even though we have not examined properties of recipients and themes separately, several other studies suggest that verb biases exert an independent effect on structure choices.

First, results from controlled sentence production tasks indicate that verb biases do affect structure choices in datives independently of argument properties, in particular properties that that may influence the accessibility of the two objects in the to-be-produced utterance (e.g., presentation order, syllable count, frequency). Both in the computerized sentence completion task explored by Van Bergen et al. (2013) and in the written paper-and-pencil questionnaire of the present study, corpus-based verb biases generalized well to a controlled experimental setup, and vice versa.

Second, the high cross-corpus agreement with respect to verb biases (in strength and direction) indicates that verb biases are robust, relatively immune to extra-grammatical factors that differ between spoken and written language such as memory limitations, processing load, and the speaker-hearer context (Bresnan et al., 2007). This is in line with earlier studies confirming the robustness of effects of probabilistic information on language production (Bresnan et al., 2007; Kuperman and Bresnan, 2012; Tily et al., 2009).

Taken together, the overall pattern of results is in line with a hierarchically incremental planning mechanism underlying clausal pre-planning in many language production situations. According to hierarchical planning, lexical units are integrated into hierarchically organized syntactic constituents prior to being linearized and phonologically encoded. Crucially, according to this view of sentence planning, the selection of a syntactic option from a set of alternatives takes place during the mapping from conceptual to functional-grammatical roles. Verb bias, as one of the factors driving syntactic choices, operates on this pre-linearized level as well. This allows ditransitive verbs to exert their DO or PO preference even if they do not precede the direct and indirect objects in a ditransitive clause: The syntactic choice is made in a pre-linear stage. In some OV clauses, however, verb bias may not be the eventual predictor of structure choice. For instance, when the head verb is hard to access, more easily accessible nonverbal constituents may already be inserted into the developing clausal frame prior to the verb, serving to promote production fluency. This may give rise to mismatches between linearization driven by lexical accessibility and linearization driven by verb preferences. In some OV clauses, therefore, the balance may tip toward a choice that is not in line with the verb's preference. Moreover, besides linguistic factors contributing to the weighting of syntactic choices, extra-linguistic factors may promote a more linearly incremental planning strategy. For instance under conditions of high cognitive load or time pressure, the speaker may prefer a linearly incremental planning strategy with limited look-ahead. The present study, however, excludes strictly linearly incremental planning as the default planning strategy in spontaneous speech.

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Appendix A

Target sentences used for constructing sentence fragments in the sentence completion task.

Pair nr	Verb	Bias	Target sentence in Dutch	Target sentence in English
1	beloven	DO	De organisator belooft de winnaar de prijs.	The organizer promises the winner the prize.
	teruggeven	PO	De organisator geeft de winaar de prijs terug.	The organizer gives the winner the prize back.
2	geven	DO	De militair geeft de vluchteling het voedselpakket.	The soldier gives the refugee the food package.
	brengen	PO	De militair brengt de vluchteling het voedselpakket.	The soldier brings the refugee the food package.
3	vertellen	DO	De directeur vertelt de medewerker de maatregel.	The director tells the employee about the measure.
	voorleggen	PO	De directeur legt de medewerker de maatregel voor.	The director presents the employee the measure.
4	uitleggen	DO	Het schoolhoofd legt de leerlingen de regels uit.	The headmaster explains the students the rules.
	opleggen	PO	Het schoolhoofd legt de leerlingen de regels op.	The headmaster imposes the students the rules.
5	verwijten	DO	De bedrijfsleider verwijt de kassière de fout.	The manager blames the cashier the error.
	duidelijk maken	PO	De bedrijfleider maakt de kassière de fout duidelijk.	The manager makes the cashier the error clear.
6	meegeven	DO	De voorzitter geeft de secretaris het geld mee.	The Chairman gives (along) the secretary the money.
	doorgeven	PO	De voorzitter geeft de secretaris het geld door.	The Chairman passes (through) the secretary the money.
7	garanderen	DO	De coach garandeert de aanvoerder de trofee.	The coach ensures the captain the trophy.
	toevertrouwen	PO	De coach vertrouwt de aanvoerder de trofee toe.	The coach entrusts the captain the trophy.
8	bieden	DO	De consultant biedt de ondernemer de bedrijfsstrategie.	The consultant provides the entrepreneur the business strategy.
	verkopen	PO	De consultant verkoopt de ondernemer de bedrijfsstrategie.	The consultant sells the entrepreneur the business strategy.
9	leren	DO	De professor leert de promovendus de theorie.	The professor teaches the PhD candidate the theory.
	voorstellen	PO	De professor stelt de promovendus de theorie voor.	The professor proposes the PhD candidate the theory.
10	zeggen	DO	De journalist zegt de redacteur het nieuws.	The journalist tells the editor the news.
	schrijven	PO	De journalist schrijft de redacteur het nieuws.	The journalist writes the editor the news.
11	noemen	DO	De ondernemer noemt de financier het bedrag	The entrepreneur mentions the financer the amount.
	aanbieden	PO	De ondernemer biedt de financier het bedrag aan	The entrepreneur offers the financer the amount.
12	mailen	DO	De cliënt mailt de advocaat een vraag.	The client mails the lawyer a question.
	stellen	PO	De cliënt stelt de advocaat een vraag.	The client asks the lawyer a question.
13	betalen	DO	De bewoner betaalt de verhuurder de schade.	The tenant pays the landlord the damage.
	mededelen	PO	De bewoner deelt de verhuurder de schade mee.	The tenant informs the landlord of the damage.
14	vergeven	DO	De staatssecretaris vergeeft de minister de leugen.	The Secretary forgives the Minister the lie.
	melden	PO	De staatssecretaris meldt de minister de leugen.	The Secretary reports the Minister the lie.
15	bewijzen	DO	Het bedrijf bewijst de klant een dienst	The company renders the customer a service
	leveren	PO	Het bedrijf levert de klant een dienst	The company provides the customer a service
16	wijzen	DO	De automobilist wijst de fietser de weg	The driver points the cyclist the way.
	vragen	PO	De automobilist vraagt de fietser de weg	The driver asks the cyclist the way.

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