Empirical issues in syntax and semantics

Selected papers from CSSP 2023

Edited by

Gabriela Bîlbîie

Gerhard Schaden

Empirically Oriented Theoretical Morphology and Syntax 16

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Preface

The present volume in the series *Empirical Issues in Syntax and Semantics* collects a curated selection of papers from the 2023 *Colloque de Syntax et Sémantique à Paris* (CSSP 2023), held on December 7-8, 2023, at the École Normale Supérieure in Paris. The result aims to be a snapshot of contemporary linguistic research in the areas of syntax and semantics.

CSSP has always been committed to fostering research uniting empirical rigor with formal precision, while remaining open to newly emerging methodologies, and multiple theoretical approaches. This volume embodies that spirit, presenting work that collectively demonstrates how contemporary linguistic research can simultaneously respect empirical complexity and seek theoretical generalization.

Gabriela Bîlbîie
Gerhard Schaden
Paris, May 2025

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Finally, our thanks go to Sebastian Nordhoff for his help with LaTeX and typesetting in general.

Chapter 1

A novel representation of focus structure and non-constituent focus

Kata Balogh[a], Laura Kallmeyer[a] & Rainer Osswald[a]
[a]Heinrich-Heine-Universität Düsseldorf

In this paper, we introduce the first proposal within the theory of Role and Reference Grammar towards a formal grammar with a modular architecture and a designated place for information structure. Our emphasis is on a formal representation of the focus structure that can uniformly capture "non-constituent focus" domains. In our account, the primary role of focusing is a pragmatic structuring, and we argue that the related notion of focus structure should be part of the grammatical system. In this proposal, we seek for a formal representation of the focus structure of the sentence without a syntactic F(ocus)-marking and, in general, without a primary determining role of syntax.

1 Introduction

Various focus structures where the elements within the focus domain do not form a syntactic constituent are problematic for traditional compositional approaches that capture the focus structure of the sentence using a syntactic F(ocus)-marking (see Krifka 1992, Büring 2016). Within the context of the preceding *wh*-question, the answer in (1a) has a focus structure where the subject and the verb form the focus domain, while, in the answer in (1b), the focus domain contains the verb and the indirect object. None of these form a constituent within the syntactic structure (in terms of traditional syntax).

(1) a. What happened to the book? *Pete sold* the book.
b. What did Pete do with the book? Pete *gave* the book *to Kate*.

Kata Balogh, Laura Kallmeyer & Rainer Osswald. 2025. A novel representation of focus structure and non-constituent focus. In Gabriela Bîlbîie & Gerhard Schaden (eds.), *Empirical issues in syntax and semantics: Selected papers from CSSP 2023*, 1–26. Berlin: Language Science Press. DOI: 10.5281/zenodo.15450428

It is generally accepted that focusing leads to a division of the sentence, which has a direct effect on the interpretation. Following Chomsky's (1971) focus vs. presupposition distinction, Jackendoff (1972: 240) introduced a focus marker in syntax (i.e., F-marker), which gets interpreted at phonological form (PF) and logical form (LF). Languages reflect F-marking in various ways. In English, prosody (i.e., accent placement) is the main reflection of F-marking. To capture the prosody-information structure interface, take, for example, Selkirk's (1995) "focus projection" rules, that derive the focus domains based on the prosodic pattern and the syntactic structure. In a nutshell, the basic F-marking rule states that an element that bears the nuclear pitch accent is F-marked, and the additional F-projection rules determine in which ways F-marking is licensed on larger units. Using Büring's (2006) terminology, focus projection can be vertical (i.e., when F-marking of the head percolates up to larger constituents), or horizontal (i.e., when F-marking of an internal argument licenses the F-marking of the head). Based on F-marking, the *focus* (FOC) of the sentence is determined as the highest F-marked constituent.

Based on the F-marking in the syntactic structure, formal semantic approaches derive the contribution of focusing, either by introducing alternatives (see Rooth 1992) or by structuring the sentence meaning (see von Stechow 1991, Krifka 2001). The strength of such traditional compositional approaches is that the semantics of the constituents is directly calculated at the given nodes, hence an F-marked constituent has direct access to its corresponding semantic content. Despite the numerous phenomena analyzed and explained, all F-marking analyses have problems with broad focus domains that do not correspond to a constituent in the syntactic structure (1). Nevertheless such constructions occur frequently. The problem is essentially related to the grammar architecture and the determining role of syntax, as focus structure and the corresponding interpretation are read off from the syntactic structure. In the answer in (1a), the focus domain consists of the subject noun phrase plus the predicate, which do not form a constituent in traditional syntax. Similarly, the focus domain of the answer in (1b) is not a constituent, a VP without the object NP. The core problem in both constructions is that there is no node corresponding to these focus domains that could carry (the highest) F-marking, and as a result, the focus interpretation cannot be derived.[1]

In our proposal, we seek for a formal representation of the focus structure of the sentence without any syntactic F-marking. Information structure (IS), and

[1]Note that not all F-marking approaches require that the focus corresponds to a continuous domain. For example, Roothian alternatives can be derived using separate F-markers (on subject and verb, for example); however, this analysis lacks the representation of the focus structure and the distinction between broad focus and multiple focus structures.

hence focus structure, is orthogonal to syntax and semantics, and as Van Valin (2005), Latrouite & Van Valin (2023) and Bentley (2023) argue, it plays an important role in the linking between these levels. We propose a formal grammatical model that has a designated place for IS in its architecture, including a representation of the focus structure, which reflects the notion of *pragmatic focus*, i.e., focus in answers and correction. Building upon the theory of Role and Reference Grammar (RRG; Van Valin & LaPolla 1997, Van Valin 2005, 2023b), and its formal specification in terms of Tree-Wrapping Grammar (TWG; Kallmeyer et al. 2013, Kallmeyer 2016), we propose a modular grammar architecture, where IS is a separate module that must be linked to syntax, semantics and prosody. The way focus structure is represented should be uniform across languages, while the details linking the various grammatical modules capture the language-specific aspects of the expression and interpretation of focus, thus accounting for cross-linguistic variation. In this spirit, the representation of IS should be captured without syntactic F-marking and, in general, without a primary determining role of syntax.

The problems of syntactic F-marking in the interpretation of discontinuous focus are explicitly pointed out by Büring (2016), who also proposes a solution for them. Büring's approach to focusing is essentially Roothian in that it builds upon the fundamental idea that the core semantic contribution of focusing is the introduction of *alternatives*, which play a central role in focus pragmatics (relation to questions, contrast and so on). Büring (2006) already shows that F-marking is, in fact, unnecessary for explaining the relation of accent placement (prosody) and focus structure/semantics, previously captured in terms of focus projection rules (Selkirk 1995). Büring (2006) argues that the restrictions of vertical projection (i.e., F-marking percolating upwards) are empirically inadequate, and that the main effect of horizontal projection (i.e., integration) can be derived by *default prominence*. Therefore, focus projection is not necessary. Instead, he proposes a new theory and replaces the F-interpretation rules by *prominence interpretation* (Büring 2006: 343). This implies that syntactic F-marking is needless. As for deriving the set of alternatives without F-marking in the syntax, he introduces "Unalternative Semantics" (UAS; Büring 2015, 2016, 2019), and proposes a system where alternatives are calculated directly from the prosodic structure. In English, we get the alternatives from the metrical structure of the sentence. This is a crucial improvement. Next to other advantages, this system eliminates the primary source of the problem with discontinuous focus. The core idea behind Büring's approach is that focusing does not evoke, but rather restricts the alternatives at each node by determining the corresponding set of *unalternatives*, i.e., the meanings that are excluded from the set of alternatives. In recent work (Assmann et al. 2023), this approach has been extended to and embedded into

a broader formal theory of focus marking, which is equally applicable to languages with focus marking by accent placement (like English) and to languages with morphosyntactic focus marking like Gúrúntúm, Hausa, Wolof and other African languages. Without going into the details of this approach, it offers an alternative way to capture the relation of focus marking and pragmatic focus, with special attention given to syncretisms of focus structures (i.e., when different pragmatic foci are marked in the same way, for example, Obj/VP/S-focus in English) across languages. As a main difference from earlier focus projection accounts, in their unified focus marking theory, Assmann et al. (2023) allow "Direct FOCAL-marking" of complex constituents (Assmann et al. 2023: 1350), from which the pragmatic focus is restricted by "Blocking" (Assmann et al. 2023: 1379).

Our proposal shares the core insight with Büring's work that syntactic F-marking is insufficient in the analysis of various focus structures, in particular of non-constituent focus domains. Nevertheless, our work considerably differs in its aims and motivations, as a result of our differing perspectives on focusing. While Büring's proposal is essentially Roothian, concentrating on semantic interpretation in terms of alternatives, our approach is based on the view that the primary contribution of focusing is a *pragmatic structuring* (Lambrecht 1994, Van Valin & LaPolla 1997).

Although Büring's UAS approach offers an elegant way to get rid of the problems caused by syntactic F-marking in the calculation of alternatives, it nevertheless raises some issues, in particular while considering the place of IS (including the focus structure) in the grammatical architecture. In UAS, there is no representation of the focus structure (i.e., pragmatic focus) at all. Assmann et al. (2023) explicitly argue that there is no empirical evidence for distinguishing the syncretic focus structures (i.e., different pragmatic foci that are marked in the same way, for example, Obj/VP/S-focus in English) in the grammatical structure. Therefore, they keep the FOCAL-marking in the grammar, which is used to calculate the alternatives in each case. This is not a problem for semantic approaches to focusing where the calculation of alternatives is central. However, as we argued before, the elimination of this representation level from the grammatical model is not preferred. In fact, there are certain grammatical aspects across languages that are sensitive to the focus structure of the sentence (see, e.g., Latrouite & Van Valin 2023, Bentley 2023), as will be illustrated in what follows. Focus structure affects verb selection: certain verb types are only compatible with a sentence focus structure. There are languages where focus structure interacts with case marking. This is the case, for example, in Kaluli (Papua New Guinea), in Korean (see Latrouite & Van Valin 2023, Bentley 2023) and in Kurtöp (Tibeto-Burman;

Hyslop 2010). There are more cases where focus structure interacts with grammatical organization, nonetheless, these examples already provide evidence that the representation of the focus structure (i.e., pragmatic focus) should be part of the grammatical model.

In our proposal, we implement the perspective of RRG on IS and on grammar architecture. The general grammatical model of RRG and the representation of IS is considerably different from traditional accounts based on syntactic F-marking, as well as Büring's proposal. The essence is that focus domains are sets of information units (IUs), that are linked to syntactic domains, but which do not necessarily correspond to nodes within the constituent structure. When the basic IUs are defined, their combination can make up the actual focus domain (i.e., the pragmatic focus). This predicts that non-constituent focus structures are not problematic and can be analyzed uniformly with other focus structures.

The paper is structured as follows. Section 2 briefly introduces the theoretical foundation, and is followed in Section 3 by our proposal of the formal grammatical model: Section 3.1 introduces the grammar formalism, and in Section 3.2, we propose the formalization of the IS-Projection. In Section 4, we apply the formal model to various focus structures, and Section 5 concludes the paper.

2 Information structure in RRG

Our proposal is based on the theoretical framework of Role and Reference Grammar (RRG; Van Valin & LaPolla 1997, Van Valin 2005, 2023b). RRG is a linguistic theory, developed from a strong typological and theoretical perspective, and maintaining a surface-oriented grammatical model. One of the theory's main aims is to capture both the universal characteristics of natural languages and their language-specific features. The general architecture of RRG is modular, with various levels of representation called "Projections" and well-defined linking relations between them, as shown in Figure 1. The syntactic representation (namely, the layered structure of the clause) captures universal notions in terms of predicate-argument relations, as well as language-specific aspects in terms of special syntactic positions. The heart of the semantic representations is a decompositional representation based on the classification made by Vendler (1967) and adapted from the decompositional system of Dowty (1979). The center of the grammatical system of RRG is the bi-directional linking algorithm between the syntactic and the semantic representations capturing both language production and comprehension (Van Valin 2023a).

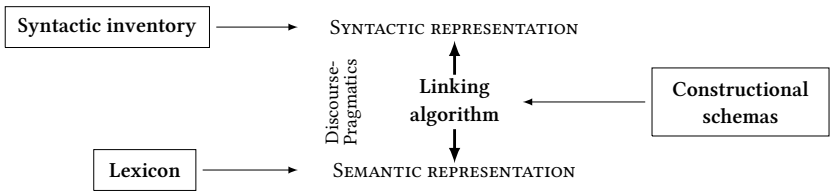


Figure 1: The general grammar architecure in RRG

As Van Valin (2005: 185) argues by characterizing a "cognitive model of context", discourse pragmatics affects all aspects of the grammatical system (for an overview see Bentley 2023, Latrouite & Van Valin 2023). An essential part of discourse pragmatics is captured by the *Focus Structure Projection* and its effects on the bi-directional linking between syntax and semantics. This projection, and the way of looking at IS in RRG, is based on the theory of Lambrecht (1994), where the main contribution of focusing is a *pragmatic structuring* into the pragmatic assertion and the pragmatic presupposition. As Balogh (2021) proposes, the projection should also model the topic-comment structure of the sentence for a comprehensive account of information structure and for an appropriate account of various phenomena where focus-structure and topic-structure interact (e.g., the linearization constraints of the focus-sensitive particle *also*). Following this proposal, we refer to the projection as the *Information Structure (IS-)Projection.*[2]

The basic building blocks of the IS-Projection are the *information units* (IUs) (IUs; see Lambrecht 1994, Van Valin 2005, Bentley 2023), that have a dual nature, linking both to the syntactic structure and to the semantic representation: IUs are linked to minimal phrasal units in the constituent structure and to their respective contents within the semantic representation. RRG distinguishes two syntactic domains, both including one or more IUs: the *potential focus domain* (PFD), where the focus can fall in the sentence, and the *actual focus domain* (AFD), whose content is considered the "focus" in interpretational terms.[3] The notion of PFD is cross-linguistically relevant, and has an important role in the grammar theory. While, in English, the PFD is always the entire clause, this is not generally the case in other languages. For example, in Italian, the PFD excludes any core-internal pre-nuclear elements (Van Valin & LaPolla 1997, Bentley 2008), and in Hungarian, the structural topic position is clause-internal, but external to the PFD. Therefore, the notion of PFD is central to capturing the structural restrictions on the location of focus in various languages. Furthermore, as argued by

[2]The topic-comment structure plays no direct role in the analysis of our target phenomenon; therefore, in this paper, we simplify the IS-Projection and discuss only the focus structure.

[3]Note that the term *focus domain* is understood here within the terminology of RRG.

Van Valin (2005) and Shimojo (2023), the PFD plays a crucial role in the explanation of focus structure in complex sentences, and in the analysis of extraction phenomena. For the purposes of this paper, however, the notion of PFD has no direct relevance, therefore we omit a more detailed discussion of it.

The general grammatical model of RRG and the representation of IS as the IS-Projection is considerably different from traditional accounts based on syntactic F-marking. The essence is that focus domains are sets of IUs, linked to syntactic domains but not determined by (or read off from) the nodes of the constituent structure. Once defined, any combination of basic IUs can make up the AFD/focus. This predicts that non-constituent focus structures are not problematic, and the different focus structures can be captured via a uniform process. Despite the advantages that the RRG approach offers to our target phenomena, the formal implementation of the theoretical grounds asks for a further development. The core issue is the formal modeling of IUs in a way that links them to syntactic domains and pieces of semantic information without a traditional implementation of compositionality. Regarding the aim of a uniform analysis of the possible focus structures, a central question is at which point in the derivation and how the IUs are determined.

3 Formalization of the IS-Projection

In RRG, the composition of the constituent structure (i.e., the layered structure of the clause) in the syntactic representation is the combination of tree templates in the syntactic inventory. However, the way these templates combine is left undefined and informal. Keeping the core of the theoretical base of RRG, the use of a formalism based on Tree-Adjoining Grammar (TAG; Joshi & Schabes 1997, Abeillé & Rambow 2000) is a straightforward choice in the formalization of the syntactic combination. The formal specification of RRG syntax is defined in terms of *Tree-Wrapping Grammar* (TWG; Kallmeyer et al. 2013, Kallmeyer 2016), which is strongly based on TAG. The semantic representations are formalized in terms of decompositional frames (Barsalou 1992, Löbner 2014, 2017, Petersen 2015), formally defined as base-labeled typed feature structures (Kallmeyer & Osswald 2013). The current development of the formalization of RRG provides a specification of the syntax-semantics interface, but lacks a model of IS. We propose the necessary extension of the IS-Projection, towards a uniform formal representation of the various focus structures.

3.1 Grammar formalism for RRG: Tree-Wrapping Grammar

The tree templates of RRG are defined as the elementary trees of the TWG, and they are combined by the rewriting operations of standard *substitution* (Figure 2a), where a leaf node is replaced by another tree, and *(sister) adjunction* (Figure 2b), where an internal node is replaced by another tree. For the derivation of certain constructions (e.g., extraction phenomena, control constructions), an additional, more complex substitution operation is proposed: *wrapping substitution* (see Kallmeyer & Osswald 2023: 750), where a tree is split at a special dominance edge and wrapped around the target tree. Given that in our examples this latter operation does not occur, we do not introduce it any further. For the exact definitions of the operations used for syntactic composition in TWG, see Kallmeyer et al. (2013) and Kallmeyer & Osswald (2023).

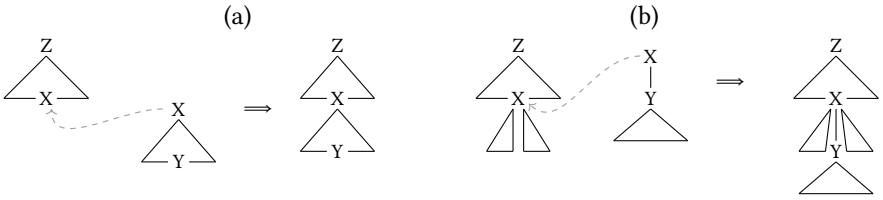


Figure 2: Substitution (a) and sister adjunction (b) in TWG

One of the important characteristics of formalized RRG representations is that the nodes in the tree representation are decorated with feature structures, including *index features* (*I*) which establish the link between syntactic structure and semantic representation, hereby capturing essential aspects of the syntax-semantics interface (see Figure 3). Within RRG, two oppositions are made prominent in the syntactic structure: (i) operators are distinguished from the predicate and its argument, and (ii) arguments are distinguished from adjunct modifiers, where the latter are represented as "periphery" elements. In TWG, we represent these distinctions as follows. The "operator nodes" are marked by OP-, together with the information of the operator type (OP-NEG for negation, OP-TNS for tense, OP-ASP for aspect, OP-DEF for definiteness, and so on). The information that an element is an adjunct modifier is encoded in the PERI+ feature on the respective node. The PRED+ feature marks the respective node as predicative.

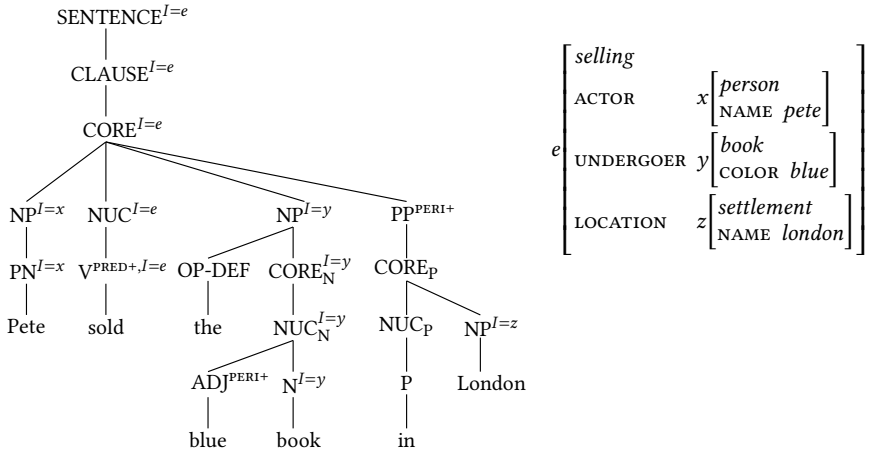


Figure 3: Syntactic and semantic representation in formalized RRG

An important advantage of the formalization of RRG with respect to the core theory of RRG is that syntactic and semantic composition can be carried out on a par. A detailed discussion of the formalized theory goes beyond the scope of this paper, therefore we only provide a basic introduction here. Syntactic templates, i.e., elementary trees, are paired with pieces of semantic representations. We call these pairs *elementary constructions*. The semantic composition is parallel to the syntactic composition, mediated by the index feature (I) on the nodes (Figure 4). The syntactic operations (Kallmeyer et al. 2013) trigger the unification of the semantic representations, thereby deriving the meaning representation of the sentence.

As shown in Figure 4 below, the tree for the predicate is substituted at the NUC node, triggering $\boxed{0} = e$ and providing the type of the eventuality. The NP trees are substituted at the respective NP nodes, triggering $\boxed{1} = x$ and $\boxed{2} = y$. The tree for the definite article is adjoined at the NP node of tree for *book*, triggering $\boxed{3} = y$, and the tree for the adjective *red* is adjoined at its NUC_{N} node, triggering $\boxed{4} = y$. The tree for the preposition *in* is (sister) adjoined at the CORE node of the tree for the predicate, triggering $\boxed{5} = e$, and the tree for *London* is substituted at the NP node within the tree for *in*, triggering $\boxed{6} = z$. In the derived semantic representation, the pieces of the meaning representations within the elementary constructions are unified under these restrictions. The derived construction, the syntactic tree and the corresponding semantic representation as a frame structure, is the one given in Figure 3 above.

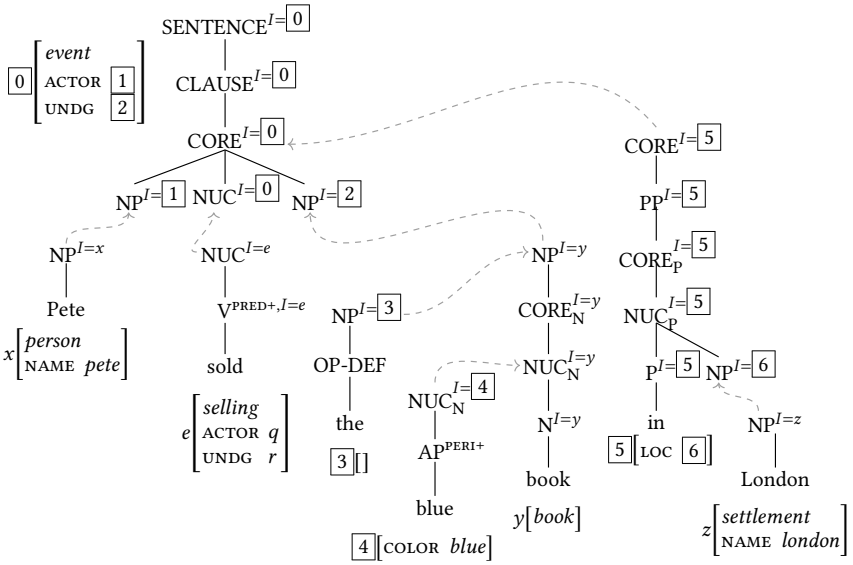


Figure 4: Elementary constructions and their composition

3.2 Formal representation of the information units

While the syntactic and semantic operations are fairly worked out in formalized RRG, the formalization of RRG's IS-Projection, an important mediator between syntax and semantics in the grammar architecture, is still missing.

In the theory of RRG (Van Valin 2005), IS is represented in a separate module, which is linked both to syntax and semantics. The basic components of the IS-Projection are the *information units* (IUs). They correspond to single syntactic constituents (Van Valin 2005, Bentley 2023) and their respective content. Following Lambrecht (1994), the basic IUs correspond to the content of the minimal phrasal categories in the constituent structure (Van Valin 2005: 78), i.e., the sub-trees corresponding to the NUCLEUS, the core arguments (NP and PPs) and the periphery adjuncts (PPs), as indicated by the dashed box in Figure 5. Hence, IUs are linked both to syntactic domains (sub-trees) and their respective semantic representations.

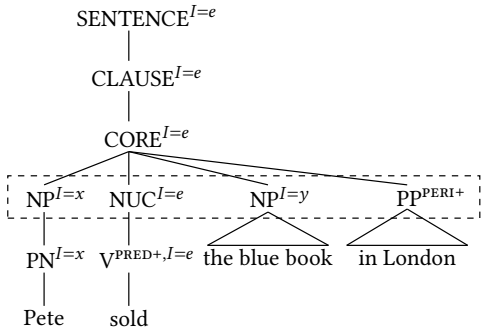


Figure 5: The syntactic domains of basic IUs

The IUs linked to the argument NPs are such that their content can be directly determined on the final semantic representation (see Figure 3) by pointing at the corresponding nodes labeled x and y in the frame. The IUs corresponding to the NUCLEUS and the adjunct PP are different, as their content cannot be addressed via frame nodes. Each clause has a unique NUCLEUS, that expresses the type of the eventuality (2a). The content of the periphery PP in the case at stake includes that the location of some unspecified eventuality is London (2b).

(2) a. IU corresponding to the NUCLEUS:

$$e\begin{bmatrix} selling \\ \text{ACTOR} \;\; q \\ \text{UNDERGOER} \;\; r \end{bmatrix}$$

b. IU corresponding to the PP$^{\text{PERI+}}$:

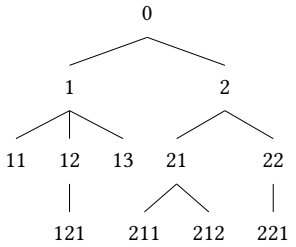
$$\boxed{5}\left[\text{LOCATION} \;\; z\begin{bmatrix} settlement \\ \text{NAME} \;\; london \end{bmatrix}\right]$$

The IUs correspond to the content of certain syntactic domains, i.e., sub-trees in the constituent structure. Despite the clear intuitions regarding what semantic contents are contributed by these sub-trees, the question arises of how to reach or how to derive all basic IUs in a uniform way, in other words, how they are determined in the formal model. We propose that the content of the syntactic domains linked to the basic IUs are determined by the "derivation tree", adapted from the TAG formalisms.

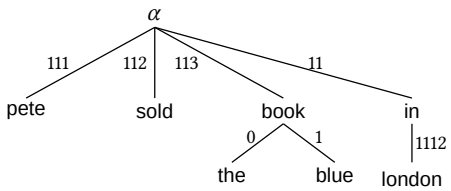
In a TAG derivation, in addition to the final phrase structure tree (called the "derived tree"), a "derivation tree" is given, which uniquely describes the TAG derivation in question, i.e., which trees are combined at which nodes. The derivation tree contains nodes for all elementary trees used in the derivation, edges for all syntactic compositions performed throughout the derivation, and edge labels

indicating the target node of the given syntactic operation. For referring to the nodes in the elementary trees, Gorn addresses (Gorn 1967) are used, where the root node of the tree has address 0, and the i^{th} daughter of the node with address n has address ni. Whenever an elementary tree γ rewrites the node at Gorn address n in the elementary tree γ', there is an edge from γ' to γ labeled with n (see 3a).

(3) a. Gorn addresses:



b. Derivation tree for Figure 4:



inducing the unification of the frames under: $\boxed{1} = e$, $\boxed{1} = x$, $\boxed{2} = \boxed{3} = \boxed{4} = y$, $\boxed{5} = e$, $\boxed{6} = z$

In the derivation of the sentence *Pete sold the blue book in London* (see 3b), the tree for the base structure of a transitive construction (referred to by α here) has three substitution nodes, one labeled NUC and two labeled NP. The tree for *Pete* is substituted at node 111, the tree for *sold* at node 112 and the tree for *book* at node 113. The tree for *in* is adjoined (by sister adjunction) to α at node 11. The trees for *the* and *blue* are (sister) adjoined to the tree for *book* at nodes 0 (root) and 1 respectively, and finally, the tree for *London* is substituted at node 1112 to the tree for *in*. All these operations are registered in the derivation tree (3b), which implicitly includes the respective unifications of the corresponding pieces of semantic content. For example, the node labeled 'book' stands for the elementary construction of the pair of the elementary tree anchored by the noun *book* and its corresponding semantic frame.

We propose that the information units, i.e., the designated syntactic domains and their content, correspond to the non-operator daughter sub-trees of the root node of the derivation tree. Together with the information on the substitution/adjunction sites of each of these parts – what is also described by the derivation tree – we derive the set of IU contents in the given sentence (Figure 6). We refer to this set as IUS.

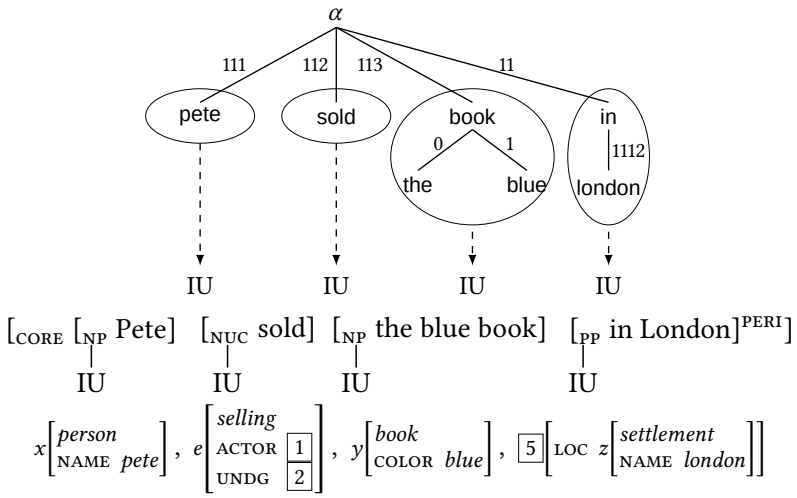


Figure 6: Derivation tree and the set of information units

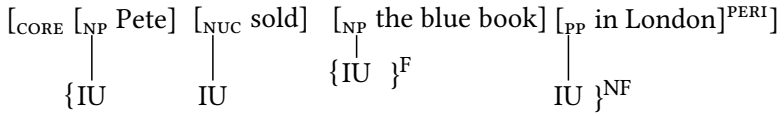
The basic IUs are the minimal elements of the various IS-domains, such as the actual focus domain, the comment and so on. These IS-domains are formally defined as subsets of the IUS. The minimal focus domains correspond to basic IUs, but not vice versa: not every basic IU can be part of a focus domain. Therefore, we can model the potential focus domain (PFD) as the set of all minimal focus domains (MFDs). These minimal focus domains can be marked by the feature MFD+ on given nodes in the constituent tree, which is language-specific.

4 Focus structures

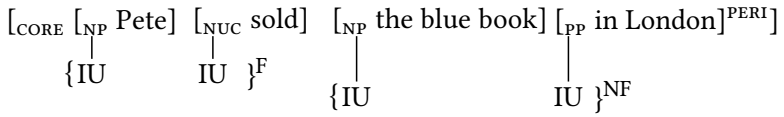
The basic idea of a uniform representation of different focus structures is relatively simple: within the IS-Projection, the IS-domains are formally represented as sets of IUs. This provides the necessary flexibility to deal with non-constituent focus, since focus structure is not directly determined on the syntactic tree. Note that the relation to the syntactic structure is not lost, as determining the basic information units is based on syntactic domains. For the aims of this paper, two IS-domains are directly relevant: the FOCUS (corresponding to RRG's AFD) and the NON-FOCUS. Both are subsets of the set IUS, structurally determined as shown before. The FOCUS (F) is a non-empty subset of the IUS, and the NON-FOCUS (NF) is the (possibly empty) complement set of the FOCUS with respect to the IUS. The partition to these IS-domains is the core of the representation of all focus structures, as illustrated in (4a) for object focus structures or in (4b) for subject-verb focus structures.

(4) Example focus structures

a. object focus:



b. subject + V focus:



How to derive these partitions is a complex matter. It is determined by the interplay of the language-specific focus marking strategies, the discourse context (in terms of questions under discussion) and the given communicative function. The set of IUs is structurally determined, and this set can formally be partitioned in various ways. These partitions are formally possible focus structures, that are constrained by focus marking and the local discourse context (e.g., an explicit question). A detailed discussion of all these aspects and this complex interplay goes beyond the scope of this paper, and need to be discussed in subsequent work.

The partition into the IS-domains essentially represents the focus structure of the given sentence. These IS-domains are based on the IUs in the sentence, and as such they are linked both to syntax and semantics. The relation to the syntactic domains, as well as the content of the IUs are shown above. What remains is the issue of how to capture the content of these IS-domains and their relations, which leads to the analysis of the function of focusing. Considering these issues, two distinctions are relevant: whether the FOCUS contains a single IU or multiple IUs ([±single IU]), and whether the FOCUS contains the IU of the main verb/predicate ([±V]). These aspects guide how to derive the content of the IS-domains, and also how these relate to each other. By these aspects we also distinguish four basic focus structures: complement focus ([-V, +single IU]), multiple focus ([-V, -single IU]), verb focus ([+V, +single IU]) and broad focus ([+V, -single IU]).

The content of the IS-domains FOCUS and NON-FOCUS corresponds to the IS notions of *focus* and *pragmatic presupposition* in terms of Lambrecht's (1994) theory of information structure. We take the core function of focusing in pragmatic terms: resolving the underlying issue or question under discussion (QUD; Roberts 2012). The focus structure of the sentence reflects its inherent issue, which is not necessarily the same as the explicit question (if any).

Similarly to Lambrecht (1994), we take the *pragmatic assertion* to be a special relation between the pragmatic presupposition and the focus. We propose that the content of the IS-domain NF is the inherent issue of the sentence, which is resolved by the content of the FOCUS. The matter of IS at the sentence level, i.e., the F-NF division, is anchored to an eventuality, given the basic assumption that declarative sentences describe eventualities.[4] An issue queries some part(s) of the described eventuality, or, intuitively speaking, it represents the "missing/requested" information within that particular eventuality under discussion. Considering what the inherent issue targets, there are two basic options: (i) the type of the eventuality is given and the query targets some particular participant(s) (see Section 4.1), and (ii) some participants are relationally given and the query targets the type of the eventuality that relates them (see Section 4.2). This opposition is reflected in the [±V] aspect distinguishing the basic focus structures.

4.1 Complement focus and multiple focus

In case the FOCUS contains a single IU different from the IU of the main verb (or main predicate), the content of the NON-FOCUS has an attribute with an unspecified value. This reflects the underlying issue that queries one of the participants of the described eventuality. Focusing indicates that the value of the given attribute is the content of the single IU within the FOCUS, which models a narrow focus structure, like the narrow object focus in (5a) and narrow adjunct focus in (5b). This is considered the pragmatic assertion of the sentence.

(5) a. narrow object focus:

$$[_{\text{CORE}}\ [_{\text{NP}}\ \text{Pete}]\ [_{\text{NUC}}\ \text{sold}]\ [_{\text{NP}}\ \text{the blue book}]\ [_{\text{PP}}\ \text{in London}]^{\text{PERI}}]$$

$$\{\text{IU} \qquad \text{IU} \qquad \{\ \text{IU}\ \}^{\text{F}} \qquad \text{IU}\ \}^{\text{NF}}$$

content of NON-FOCUS:[5]

$$e\begin{bmatrix} \textit{selling} \\ \text{ACTOR} & x[\textit{pete}] \\ \text{UNDG} & \boxed{2} \\ \text{LOC} & z[\textit{london}] \end{bmatrix}$$

content of FOCUS:

$$y\begin{bmatrix} \textit{book} \\ \text{COLOR} & \textit{blue} \end{bmatrix}$$

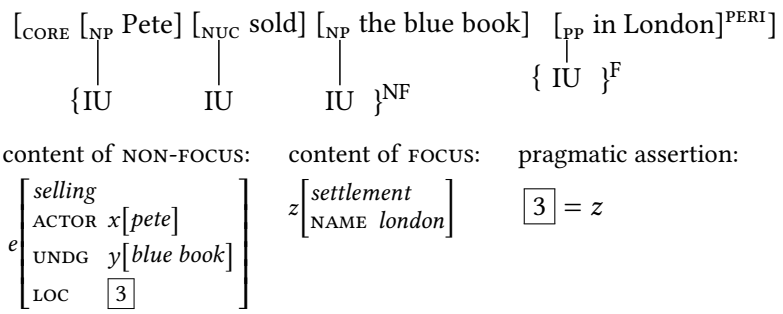
pragmatic assertion:

$$\boxed{2} = y$$

[4] In this paper, we only deal with declaratives, but, according to the theory of RRG, the analysis of IS equally applies to other sentence types. The extension of our formal model to interrogatives and imperatives is left for further work.

[5] For a simplification in the representations, at some places we use the following abbreviations: $x\begin{bmatrix} \textit{person} \\ \text{NAME} & \textit{pete} \end{bmatrix} \rightarrow x[\textit{pete}]$, $y\begin{bmatrix} \textit{book} \\ \text{COLOR} & \textit{blue} \end{bmatrix} \rightarrow y[\textit{blue book}]$, $z\begin{bmatrix} \textit{settlement} \\ \text{NAME} & \textit{london} \end{bmatrix} \rightarrow z[\textit{london}]$

b. narrow adjunct focus:



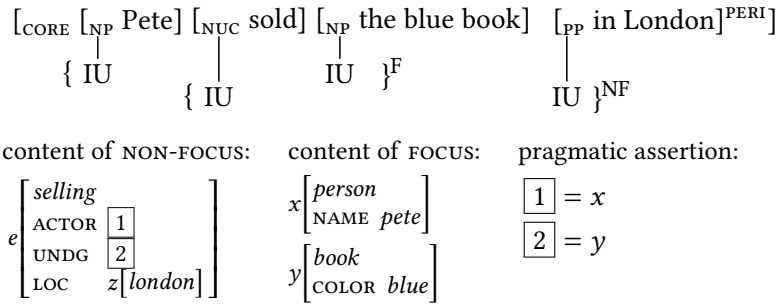
In complement focus structures, the calculation of the content of the FOCUS is straightforward: it equals the single IU it contains. The content of the NON-FOCUS is calculated by a composition of its IUs, restricted by the syntactic composition, which is registered in the derivation tree. In other words, the unification of the IUs in the NON-FOCUS is constrained by the syntactic operations and the corresponding unifications of the values of the respective index features.

The constructions where two (or more) complements are part of the FOCUS are subsumed under the focus structure type of *multiple focus*, illustrated in (7). Note that in case the IU of the verb and the IU of a complement (or the IUs of more complements) are within the FOCUS, they do not form a multiple focus, but are understood as a broad focus structure. See, for example, the English example in (6): a focal accent on the verb and on the indirect object can only be interpreted with a (non-constituent) broad focus structure.

(6) Pete GAVE the blue book to SAM.
QUD: *What did Pete do with the blue book?*

This suggests that we can only request the specification of the value of an argument/adjunct if the type of the event is known/given. In multiple focus structures, the values of two (or possibly more) attributes need to be specified, which is provided by the IUs within the FOCUS. This process, and thus the pragmatic assertion, is parallel to the cases in complement focus structures.

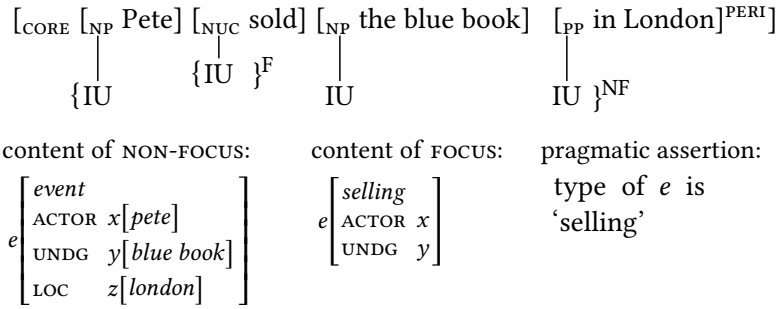
(7) multiple focus structure:



4.2 Verb focus and broad focus

The focus structures in the previous section all reflected the resolving of an underlying issue where one (or more) of the complements are queried, i.e., the type of the eventuality is known/given (part of the NON-FOCUS), while the value of one (or more) of the attributes in the event description must be specified. Cases of verb focus and broad focus structures differ as here the type of the eventuality needs to be specified by the focal part, while some of the attributes can be (and often are) given. Therefore, the pragmatic assertion is the type specification of the described eventuality, which can be simple as 'type: selling' or complex as 'type: selling the blue book'. To formally capture such complex types, the content of the FOCUS can be seen as a *frame type* (introduced by Balogh & Osswald 2021). The exact formal specification of such frame types and their relation to the content of the FOCUS needs a more thorough investigation, which we leave for further work. Nevertheless, the example in (8) reflects this idea, although presenting the pragmatic assertion still in an informal way.

(8) verb focus:



As illustrated in (8), in verb focus structure, the FOCUS contains the single IU by the verb/main predicate. The NON-FOCUS contains the information that the given participants are functionally related under an eventuality of an unknown type.[6] This information is jointly derived on the basis of the derivation tree and the set of IUs. The IUs are all connected under the node α, representing a yet unspecified eventuality. The FOCUS provides the type specification: *e* is of type 'selling'. The ACTOR and UNDERGOER attributes represent the obligatory attributes and thus a restriction as a consequence of having the event type 'selling'.

When the FOCUS contains the IUs of the verb and one (or more) of its arguments/adjuncts, we talk about a broad focus structure. Although these cases can be divided into further subtypes, their pragmatic assertion is uniformly captured as providing a possibly complex event type (in terms of frame types). The special subtypes that can be distinguished are: (i) cases where the NON-FOCUS is a singleton set (9), this type including the traditional "predicate focus" structure; (ii) cases where both the NON-FOCUS and the FOCUS are non-empty, non-singleton sets (10), these cases being often referred to as "non-constituent" focus in other approaches, and (iii) cases where the NON-FOCUS is an empty set, which is referred to as "sentence focus". In the latter focus structure, all IUs within the sentence are in the FOCUS, while the NON-FOCUS is empty. In such cases, the content of the whole sentence is considered new information. Nevertheless, an empty NON-FOCUS does not mean that such sentences are unrelated to the local discourse context (see, for example, the notion of "stage topic" by Erteschik-Shir 2007).

(9) a. (traditional) predicate focus:

$$[_{\text{CORE}}\ \underset{\{\text{IU}\}^{\text{NF}}}{[_{\text{NP}}\ \text{Pete}]}\ \underset{\{\text{IU}}{[_{\text{NUC}}\ \text{sold}]}\ \underset{\text{IU}}{[_{\text{NP}}\ \text{the blue book}]}\ \underset{\text{IU}\ \}^{\text{F}}}{[_{\text{PP}}\ \text{in London}]^{\text{PERI}}}]$$

content of NON-FOCUS:	content of FOCUS:	pragmatic assertion:
$e\begin{bmatrix} \textit{event} \\ \text{ACTOR}\ x[\textit{pete}] \end{bmatrix}$	$e\begin{bmatrix} \textit{selling} \\ \text{ACTOR}\ x \\ \text{UNDG}\ y[\textit{blue book}] \\ \text{LOC}\ z[\textit{london}] \end{bmatrix}$	type of *e* is 'selling the blue book in London'

[6] The type specification 'event' in the frame is highly underspecified.

b. relationally given UNDERGOER:

$$[_{\text{CORE}}\ [_{\text{NP}}\ \text{Pete}]\ [_{\text{NUC}}\ \text{sold}]\ [_{\text{NP}}\ \text{the blue book}]\ [_{\text{PP}}\ \text{in London}]^{\text{PERI}}]$$
$$\{\text{IU} \qquad \text{IU} \qquad \{\ \text{IU}\ \}^{\text{NF}} \qquad \text{IU}\ \}^{\text{F}}$$

content of NON-FOCUS:	content of FOCUS:	pragmatic assertion:
$e\begin{bmatrix} \textit{event} \\ \text{UNDG}\ \ y[\textit{blue book}] \end{bmatrix}$	$e\begin{bmatrix} \textit{selling} \\ \text{ACTOR}\ \ x[\textit{pete}] \\ \text{UNDG}\ \ y \\ \text{LOC}\ \ z[\textit{london}] \end{bmatrix}$	type of e is 'selling by Pete in London'

In both examples in (9), the NON-FOCUS expresses a yet unspecified eventuality, of which one of the participants is specified. These structures correspond to the topic-comment division, however, we claim that the topic-comment structure represents a different aspect of IS, that needs to be represented separately. It also requires a representation of the referential structure of the sentence in context, that is not yet included in our model.

The examples in (10) illustrate different cases where the verb together with an argument or adjunct form the FOCUS. In our approach, these cases are captured parallel to the ones in (8) and (9): the uniform core function of focusing is the specification of the (possibly complex) type of the eventuality under discussion.

(10) a. focal subject + V:

$$[_{\text{CORE}}\ [_{\text{NP}}\ \text{Pete}]\ [_{\text{NUC}}\ \text{sold}]\ [_{\text{NP}}\ \text{the blue book}]\ [_{\text{PP}}\ \text{in London}]^{\text{PERI}}]$$
$$\{\text{IU} \qquad \text{IU}\ \}^{\text{F}} \qquad \{\ \text{IU} \qquad \text{IU}\ \}^{\text{NF}}$$

content of NON-FOCUS:	content of FOCUS:	pragmatic assertion:
$e\begin{bmatrix} \textit{event} \\ \text{UNDG}\ \ y[\textit{blue book}] \\ \text{LOC}\ \ z[\textit{london}] \end{bmatrix}$	$e\begin{bmatrix} \textit{selling} \\ \text{ACTOR}\ \ x[\textit{pete}] \\ \text{UNDG}\ \ y \end{bmatrix}$	type of e is 'selling by Pete'

b. focal V + adjunct:

$$[_{\text{CORE}}\ [_{\text{NP}}\ \text{Pete}]\ [_{\text{NUC}}\ \text{sold}]\ [_{\text{NP}}\ \text{the blue book}]\ [_{\text{PP}}\ \text{in London}]^{\text{PERI}}]$$
$$\{\text{IU} \qquad \{\text{IU} \qquad \text{IU}\ \}^{\text{NF}} \qquad \text{IU}\ \}^{\text{F}}$$

content of NON-FOCUS:	content of FOCUS:	pragmatic assertion:
$e\begin{bmatrix} \textit{event} \\ \text{ACTOR}\ \ x[\textit{pete}] \\ \text{UNDG}\ \ y[\textit{blue book}] \end{bmatrix}$	$e\begin{bmatrix} \textit{selling} \\ \text{ACTOR}\ \ x \\ \text{UNDG}\ \ y \\ \text{LOC}\ \ z[\textit{london}] \end{bmatrix}$	type of e is 'selling in London'

5 Conclusion and further issues

5.1 Concluding remarks

In this paper, we introduced a first proposal towards a grammar formalism that offers a novel approach to the representation and analysis of information structure, in particular the focus structure of the sentence. Our proposal is based on the theoretical grounds of Role and Reference Grammar (Van Valin & LaPolla 1997, Van Valin 2005) and Lambrecht's (1994) theory of information structure, formally implemented using Tree-Wrapping Grammar (Kallmeyer et al. 2013, Kallmeyer & Osswald 2023) and decompositional frame semantics (Kallmeyer & Osswald 2013, Löbner 2014, Petersen 2015).

The core motivating phenomenon in this paper is "non-constituent focus", that is problematic for traditional compositional analyses capturing focus structure with the use of syntactic F-marking. The particular problems with this special information structure are addressed by Büring (2016), who offers a solution without F-marking, using Unalternative Semantics (Büring 2006, 2015). Büring's approach offers a highly appropriate and elegant solution for semantic theories where focus is defined as the source of alternatives. However, this approach not only eliminates the syntactic F-marking, but also the representation of the focus structure. We argue that from a linguistic and grammatical perspective this can be disadvantageous, since focus structure plays an essential role in the different stages at the linking between syntax and semantics (Bentley 2023, Latrouite & Van Valin 2023, Van Valin 2005).

In our approach, we aim to uniformly capture the various focus structures, in a way that straightforwardly extends to cases previously referred to as "non-constituent focus". The core of our proposal is that focus structure is not directly determined on the nodes of the constituent structure. Instead, information structure (containing focus structure) is represented in a separate module, which is linked both to syntax and to semantics. Consequently, the structures found at the level of IS do not need to be parallel to the structures found at the level of syntax, which is essentially correct, and naturally prevents the issues raised by "non-constituent" focus in traditional compositional accounts. The general architecture of RRG and our representation of IS are considerably different. In our approach, information units (IUs) play an essential role in determining the focus structure. Crucially, the IUs are linked to syntactic domains, but the focus structure is not read off the syntactic structure. Therefore, when the basic IUs are defined, any combination of them can make up the content of the FOCUS. The IUs are determined structurally together with the corresponding pieces of

semantic representations. Focus structure is essentially represented as a partition of the set of IUs into two IS-domains: the NON-FOCUS and the FOCUS. The core function of focusing is a pragmatic structuring, represented by the content of the NON-FOCUS and the FOCUS (which correspond to the underlying issue and the focus respectively), and the pragmatic assertion, which is seen as a special relation between the issue and the content of FOCUS. The formal derivation of the focus structure and the content of the IS-domains is uniform across all cases. A difference in pragmatic assertion is proposed based on whether the verb/main predicate is part of the FOCUS.

5.2 Further issues

As any new proposal, our approach has several loose ends, that ask for further investigation in terms of formalization and empirical coverage. For the formalization, we have two main tasks directly ahead of us: (i) the formal derivation/ calculation of the content of the NON-FOCUS and the FOCUS needs to be worked out in more detail, and (ii) the representation of their relation, i.e., the pragmatic assertion, needs to be formally characterized. As for the first issue, we proposed in this paper that this calculation is determined by the IUs and the derivation tree. Currently, we have two basic processes: in argument focus structures, the sub-tree corresponding to the IU within the FOCUS is cut-off the derivation tree, while the remaining tree determines the content of the NON-FOCUS; in broad focus structures, the derivation tree is divided into two sub-trees, both including a copy of the root node (which reflects that the content of the two domains describes information on the same eventuality). This needs to be refined in a more uniform way that applies to further problematic cases as well. We are currently exploring the idea of defining a more flexible composition, where we model the background-focus distinction within a construction, such that certain pragmatic factors are reflected in syntactic composition. This revision would also be seen as part of the formal characterization of the linking between syntax and pragmatics, which is core to our modular grammar architecture. Working out the second issue, our initial proposal is to include complex frame types. The formal definitions of this idea are currently being developed.

In this paper, we discussed rather basic constructions, that best served as a starting point of our formal grammatical model, and best facilitate the aim of introducing our approach and the basic processes globally. Needless to say, for a comprehensive model, we need to verify that our approach is applicable to more phenomena and complex constructions cross-linguistically. Currently, we

are investigating different types of adjunct modifiers that do not necessarily introduce an attribute in the event description (e.g., *almost*, *completely*, *intentionally*), clausal adjuncts and complex noun phrases. The core issues are what exactly counts as a basic IU and how to capture IUs and IS-domains in embedded constructions. Furthermore, we need to extend our proposal to further languages beyond English. Currently, we are looking at different case studies in Hungarian, Japanese and Lakota.

5.3 A brief note on related formalisms

While our approach is based on the theoretical grounds of RRG, the core proposal of the formal representation of the focus structure does not strictly require RRG-like syntactic structures. From the theoretical point of view, the important aspect of the grammatical model is its modular architecture without the primacy of syntax, and the linking between the different representation levels. The linguistic theory of RRG is developed proposing such an architecure, therefore it provides an excellent ground for our formal implementation. Nevertheless, the core proposal in this paper can be worked out with a standard Lexicalized Tree-Adjoining Grammar (LTAG) with frame-based semantics, and possibly also within a construction-based Lexical Functional Grammar (LFG) model (e.g., Findlay 2023). The theories of RRG and LFG both argue for a modular grammar architecture, which raises the issue whether the two offer similar or comparable approaches to information structure. The possibilities of the above mentioned alternative formal models, as well as a thorough comparison of the approaches to information structure within RRG (see, e.g., Van Valin & LaPolla 1997, Van Valin 2005, Bentley 2023) and within LFG (see, e.g., Butt & King 1996, Dalrymple & Nikolaeva 2011, Dalrymple et al. 2019, Zaenen 2023) are left for further work.

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Chapter 2

Primary vs. secondary meaning facets of polysemous nouns

Long Chen[a], Laura Kallmeyer[a] & Rainer Osswald[a]
[a]Heinrich Heine University Düsseldorf

Inherently polysemous nouns, or dot-type nouns, have two or more meaning facets that are systematically related to each other and can be addressed simultaneously in copredication constructions. In this paper, we investigate the internal semantic structure of inherently polysemous nouns and argue for a distinction between primary and secondary meaning facets. Evidence is provided by showing that copredication constructions behave asymmetrically for certain polysemous nouns in English and Chinese. We develop two proposals for modelling restrictions on copredication: First, an approach that distinguishes between (i) predicates that pick a specific facet, thereby blocking other facets for subsequent predications, and (ii) predicates that address a specific facet without blocking other facets. Second, as an alternative, we propose to model the distinction between primary and secondary facets within the representations of dot-type nouns via default constraints, where secondary facets are defeasible and can be blocked in certain predication constructions while primary facets cannot be blocked.

1 Introduction

Inherently polysemous nouns, or dot-type nouns, have different meaning facets that can be targeted by different predications over the same occurrence of the noun in a sentence or phrase. This phenomenon is known as *copredication*. While there is already a large body of work on the types of meaning facets and their semantic relationships, the internal semantic structure of polysemous nouns and how they license copredication is still a topic of ongoing research. For example, Pustejovsky (1995) and Asher (2011) model the meaning facets of complex type

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nouns as facets of equal status; Chen et al. (2022) assume that all the facets are on the same level and related to each other by attributes in the frames of the nouns; Babonnaud et al. (2016) suggest that one of the facets stands for the noun and the other facet is its attribute; Retoré (2014) proposes "flexible" and "rigid" as a feature of the facet to represent the compatibility of a semantic type with other types, which implies that different meaning facets might not be equally prominent; Ortega-Andrés & Vicente (2019) introduce the concept of "activation package" to indicate the close semantic relationship between the facets that can be jointly addressed by copredication; Murphy (2021) suggests a "complexity hierarchy" of the semantic types which leads to a copredication hierarchy.

Following Chen et al. (2022), we assume that predication over a noun involves either targeting one or several meaning facets of the noun or performing coercion. For example, *book* has an object facet and an information facet. In *read the thick book*, *read* targets both facets while *thick* targets the object facet. On the other hand, since *book* cannot be predicated by typical event-targeting verbs such as *perform* or *conduct*, it does not have an event facet. Consequently, *enjoy the book* is a case of coercion, because *enjoy* targets an event.

The meaning facets of an inherently polysemous noun may differ with respect to accessibility and persistence. This is reflected, among others, by asymmetries in copredication constructions. Such asymmetries have been noticed in previous research, especially in cases where a noun has multiple meaning facets. Asher (2011: 63) observed that the felicity of copredication related to the polysemous noun *city* in (1a) is higher than in (1b).

(1) a. The city has 500,000 inhabitants and outlawed smoking in bars last year.
    b. ? The city outlawed smoking in bars last year and has 500,000 inhabitants.

Similarly, Retoré (2014) noticed that for the polysemous noun *Liverpool*, the senses of *people* and *place* can be subject to copredication, but the sense of *football team* cannot be elicited together with any of the others. Jezek & Melloni (2011) conducted case studies on deverbal nouns and determined constraints on the copredication with action nominals. Chatzikyriakidis & Luo (2015) investigated the case of *newspaper* and discovered that the *organization* reading can occur with the *physical object* or *information* readings in copredications only under certain conditions. Ortega-Andrés & Vicente (2019) investigated the copredication of *school* and proposed two "activation packages" of *school*, one corresponding to the *institution* sense and the other corresponding to *object-information* sense,

and only meaning facets in the same activation package can occur together in copredications. Sutton (2022) observed that for the noun *statement*, the *physical entity* sense and the *eventuality* sense are incompatible for copredication, but that both can occur in copredications with the *informational content* sense. Murphy (2021) investigated the order of copredication more systematically and claimed that complexity and coherence are the decisive factors for the order of copredication. Michel & Löhr (2024) further suggest that context is a more fundamental factor than complexity, and explain the order of copredication with the notion of "expectation".

The above studies have shown that for nouns with multiple meaning facets, some facets are easier to occur in a copredication construction than the others, and it is more natural to predicate over some facets than the others in a copredication construction. However, many of them do not distinguish copredication from coercion, which are different in the mechanisms of composition. For example, it is debatable whether the reading of *managing entity* of *city* or *school* is an inherent meaning or a coerced meaning. We will therefore focus on more unquestionable cases where the nouns have two distinct meaning facets. According to our observation, these asymmetries of copredication also occur with nouns with only two meaning facets, and the choice of the predicate also affects the felicity of copredication. For example, in (2), it is easier to target the object facet of *lunch* first and target the event facet later (as in 2a) than the opposite order (as in 2c), and if the event facet is targeted by *quick* rather than *slow*, copredication can still happen.[1]

(2) a. Kerry Weins and Joanne Weins organized a delicious lunch at Bette Axani's home in Union Bay.

b. In one instance I am obsessing over how to improve my blog and in the next I am ordering a quick lunch using Foodpanda!

c. # In one instance I am obsessing over how to improve my blog and in the next I am ordering a slow lunch using Foodpanda!

In this paper we focus on polysemous nouns with only two meaning facets and examine whether the two meaning facets are equally prominent or not. As observed in the previous works (e.g. in Chatzikyriakidis & Luo 2015 and Jezek & Melloni 2011), the syntactic construction may also affect copredication acceptability, so we only consider the following two copredication patterns: V+Mod+N

[1] If not mentioned otherwise, the English examples in this paper are from the English Web 2021 corpus (enTenTen21; see Jakubíček et al. 2013) provided by SketchEngine (www.sketchengine.eu).

and Mod1+Mod2+N.[2] Based on data from English and Mandarin Chinese, we argue that polysemous nouns have primary facets and secondary facets. Primary facets are more prominent and stable in the noun's meaning, which is to say, they cannot be blocked by a predication over another facet. In particular, they can be targeted in any type of copredication pattern. Secondary facets, by contrast, might be unavailable in certain predication patterns, such as the object facet of *lunch* (see above). Concretely, a predication over a different facet might exclude a subsequent predication over a secondary facet.

We base our analyses on observed possibilities and restrictions for copredication constructions. Concretely, we examine three common dot-types, discuss restrictions on copredications for these types, in particular in relation to the different facets, and sketch possible ways to model dot-type nouns and predications over them. We will present one analysis that distinguishes between predicates that pick only one of the facets, thereby excluding further predications over the other facets, and predicates that address one of the facets while keeping the other facets for further predication. We call the first type of predication *facet-picking* and the second type of predication *facet-addressing*. As an alternative, we sketch a second approach that explicitly encodes primary and secondary facets in the representations of dot types and that models composition during predication in such a way that certain predications exclude further predications over different facets. This second approach assumes that primary facets can never be blocked for further predication. As a formalization for our semantic representations, we choose semantic frames. In the first proposal, facet-picking predications roughly move the access point of the noun's frame to the picked facet. In the second proposal, we use default logic and model secondary facets as default attributes that can be removed due to conflicting frame constraints.

2 Primary facets, secondary facets and restrictions on copredication

Three common facets of dot-type nouns in English and Chinese (as well as other languages) are *event*, *info(rmation)*and *obj(ect)*. In this section, we investigate the dot-types *event•food*, *obj•info* and *event•info* regarding the restrictions on copredication. We provide empirical evidence for facet-picking and facet-addressing

[2]Constructions of the form Mod1+and+Mod2+N (*delicious and romantic dinner*) or Mod1+, +Mod2+N (*delicious, romantic dinner*) are not exactly the same as the construction we consider, since the two modifiers in these constructions are coordinated and the acceptability of copredication is higher in this case.

predications over the dot-type nouns, which yields hypotheses for the respective patterns of primary and secondary facets.

2.1 *Event • food*

Nouns for meals in English and Chinese, such as 午饭 (wǔcān) 'lunch', 自助餐 (zìzhùcān) 'buffet', 晚饭 (wǎncān) 'dinner', and 大餐 (dàcān) 'feast' have an event and an object facet. In the copredication pattern V+Mod+N, the Mod(ifier) can target the object facet and the V(erb) the event facet as in (3a) and (3b), but the other direction of copredication is only possible for some modifiers: in (3c), 'lively' seems to exclude further predication over the object facet, while in (3d) 'early' is facet-addressing.

(3) a. On Saturday night, the INTA had organized a delicious dinner in the CityNorth Hotel.
b. how to organize a vegan dinner[3]
c. # order the lively dinner
d. benefits of eating an early dinner[4]

The Chinese examples in (4) reveal a similar asymmetry in copredication possibilities.[5]

(4) a. 组织 美味/丰盛 的 晚餐
zǔzhī měiwèi/fēngshèng de wǎncān
organize delicious/abundant MODM[6] dinner
'organize a delicious/abundant dinner'
b. # 带走 热闹/两个小时 的 晚餐
dàizǒu rènào/liǎnggèxiǎoshí de wǎncān
take.away lively/two.hours MODM dinner
'take away the lively/two-hour dinner'

The copredication pattern Mod1+Mod2+N in (5) also shows the asymmetry of the availability of copredicating the two facets. There is a rich literature on the preferred order of noun-modifying adjectives and the underlying semantic

[3]https://otttimes.ca/life/food/how-to-organize-a-vegan-dinner/, retrieved 31 May 2024.
[4]https:// pharmeasy.in/ blog/ eat-light-and-feel-light-benefits-of-eating-an-early-dinner/, retrieved 31 May 2024.
[5]The Chinese examples in this paper are all from the CCL corpus (corpus of the Center for Chinese Linguistics of PKU, see Zhan et al. 2019).
[6]'MODM' stands for modifier markers.

factors.[7] For example, type-modifying adjectives tend to be closer to nouns than token-modifying adjectives (McNally & Boleda 2004); individual-level adjectives tend to be closer to nouns than stage-level adjectives (Larson 1998); subsective adjectives tend to be closer to intersective adjectives (Morzycki 2016). However, the following data imply that these theories are not always able to explain the adjective orders in the case of copredication.

(5) a. Whether using the tool to whip up her own [...] veggie-heavy vegan chili recipe, or an impromptu healthy dinner for her family, McDonald knows that slow cookers are a no-fuss way to prepare meals even when there's no meat in your recipe.

b. ? Whether using the tool to whip up her own her veggie-heavy vegan chili recipe, or a healthy impromptu dinner for her family, McDonald knows that slow cookers are a no-fuss way to prepare meals even when there's no meat in your recipe.

c. I made this shrimp and pasta salad a couple of weeks ago as a *planned cold* lunch.

d. # I made this shrimp and pasta salad a couple of weeks ago as a *cold planned* lunch.

e. Labrosse, our landlord, had a late hot dinner waiting for us in the smaller room off the large dining-room.

f. # Labrosse, our landlord, had a hot late dinner waiting for us in the smaller room off the large dining-room.

In the examples in (5), *healthy*, *cold* and *hot* targets the object facet and *impromptu*, *planned* and *late* targets the event facet. The object facets are always targeted first in these examples.[8] The aforementioned theories might not be able to explain this preferred order. For example, *healthy* is an intersective adjective but it is closer to the noun; *hot* and *cold* are stage-level adjectives and are more likely to be modifying the token based on the context, but they are also closer to the noun. Therefore, we propose that the primary and secondary facet is also an important factor in deciding the adjective orders.

[7] See Scontras (2023) for a more comprehensive discussion of this topic.

[8] In this paper the order of targeting is based on syntactic structure rather than linear sequence. Therefore although linearly *impromptu* comes before *healthy*, structurally *impromptu* is modifying *healthy dinner*, so *dinner* is targeted by *healthy* first, and then by *impromptu*.

The asymmetry also exists in coercion. Usually, in Chinese the classifier 顿 (dùn) is used for events and 份 (fèn) is used for objects.[9] However, as shown in (6), 顿 (dùn) can sometimes also be used for food nouns like 饺子(jiǎozi) 'dumpling' while 份 (fèn) can never be used for event nouns like 晚宴 (wǎnyàn) 'banquet'. This also indicates that in the context with the event and the food, usually the event is more prominent.

(6) a. 一 顿 饺子/晚宴
yī dùn jiǎozi/wǎnyàn
one CLF$_e$ dumpling/banquet
'a meal of dumplings/a banquet'

b. 一 份 饺子/#晚宴
yī fèn jiǎozi/#wǎnyàn
one CLF$_o$ dumpling/#banquet
'a portion of dumplings/a banquet'

One reason for this asymmetry is related to the semantic relation between the meaning facets. In the 'dinner' concept, there is an event during which food is consumed. An interpretation in the other direction is less natural, i.e., 'dinner' is food which is consumed in an eating event. So conceptually it is more reasonable that the food is embedded under the event, which means the event is more prominent and is the primary facet.

Another possible explanation for the asymmetry is that when the food within a meal is being referred to specifically, it is more accurate and informative to mention the name of the food directly, like answering the question *What did you eat last evening*, *I ate a pizza* would be better than *I ate a dinner*. However, the event facet of a meal seldom has its own name. Therefore, when referring to the event, the dot-type noun, such as *I will attend the dinner* is used. Otherwise less efficient phrasings like *I will attend the eating activity in the evening* is required to convey the same idea.

As already observed (see 3d), despite being a secondary facet, the object facet is not always unavailable when the event facet is targeted first. Further examples are given in (7) where both *quick* and *slow* target the event facet of *lunch*. In (7a), (7c) and (7e) *quick lunch* has the object facet and can still be predicated by *cook*, *pack* or *serve*, but *slow lunch* does not have the object facet and cannot replace *quick lunch* in those sentences.

[9] In Chinese, different classifiers apply to different types of nouns, in general. For example, 顿 (dùn), 次 (cì), 场 (chǎng) can only modify event nouns but not physical object nouns, while 份(fèn), 只 (zhī) can only modify physical object nouns but not event nouns. Here, classifiers that modify events are glossed by CLF$_e$, and classifiers that modify objects by CLF$_o$.

(7) a. We prepared the poultice and cooked a quick lunch, waiting for the minnow trap to work for fishing bait.
b. # We prepared the poultice and cooked a slow lunch, waiting for the minnow trap to work for fishing bait.
c. So, we packed a quick lunch and headed out to find...
d. # So, we packed a slow lunch and headed out to find...
e. Since 2006, Ronnie's Cafe has been serving hot breakfast and quick lunches to ASU West students and Glendale residents alike.
f. # Since 2006, Ronnie's Cafe has been serving hot breakfast and slow lunches to ASU West students and Glendale residents alike.

Based on the difference in (7), we can categorize adjectival modifiers into facet-addressing modifiers and facet-picking modifiers. Facet-addressing modifiers such as *quick* or *early* tend to keep the secondary facets in the phrase after modifying the primary facet, while facet-picking modifiers such as *slow* and *lively* tend to pick out only the primary facet.

The reasons why some adjectives are facet-addressing or facet-picking are related to the conceptual relationships between the meanings of the adjective and the dot object. For example, in a *lively dinner*, the liveliness is usually not only about eating the food, but also about the eaters talking and other activities not involving food, thus the food is more neglected in a *lively dinner*, making the object facet unavailable; on the other hand, an *early dinner* means a dinner where the food is eaten earlier than usual, so the food is still an essential part of the meaning of the phrase, thus the object facet is preserved. However this may not be able to explain all the facet-addressing/picking adjectives, especially for the case of *quick dinner* and *slow dinner*, where the two adjectives are very close in meaning. The exact reasons why certain adjectives tend to be facet-addressing while others are facet-picking require further research.

2.2 *Object • info*

The two facets in *object • info* are usually of equal status and both are primary facets since the copredication of V+Mod+N is always available. (8) and (9) are copredication examples of English *book* and Chinese 书 (shū) 'book'.

(8) a. Others may regard reading thick books as a dull way to learn.
b. Individuals cannot carry their religious books [...] with them.

Table 1: Facet availability after modification for 书 (shū) 'book'

	targeted facet	modified 书 'book'
两千字 (liǎngqiān zì) '2000 characters'	info	object, info
两百页 (liǎngbǎi yè) '200 pages'	object	object, info
幽默 (yōumò) 'humorous'	info	object, info
厚 (hòu) 'thick'	object	object, info

(9) a. 我 读 了 一 本 很 厚 的 书 。
wǒ dú le yī běn hěn hòu de shū .
1SG read ASP one CLF_o very thick MODM book
'I read a very thick book.'

b. 翻开 那些 难懂 的 书
fānkāi nàxiē nándǒng de shū
open those difficult MODM book
'Open those difficult books.'

Table 1 presents some common modifiers of 书 (shū) 'book' and the facets the phrases have after application of these modifiers. The second column indicates the target facet of the modification, and the third column the facets accessible for further predication after modification. After the modification, the phrases can still be the argument of 带走 (dàizǒu) 'take away' (which targets the object facet) or 阅读 (yuèdú) 'read' (which targets the info facet).

2.3 *Event • info*

Speech and *lecture* are typical *event • info* nouns in English. Neither the event facet nor the info facet is particularly prominent. Copredications of the pattern V+Mod+N or Mod+Mod+N where the leftmost predicate addresses the event facet and the second the info facet are possible (see 10a–10c) but it seems that they are not always felicitous, as can be seen in (10d) and (10e). In general, we can conclude from (10) that facet-addressing predications over the info facet are possible. Whether the event facet is primary is less clear. Facet-addressing predications over the event facet seem less acceptable (see 10f) but in order to exclude them, we still need to look at more data. For the moment, we assume that both facets are secondary, which means that predicating over them can be excluded due to a predication over the respective other facet.

(10) a. I recently attended a most informative lecture delivered by two of Ireland's most prominent obstetricians.

b. Pendleton denounced them as unconstitutional, and concluded an elaborate speech against them in these words.

c. [...]after a short instructive lecture on [...][10]

d. ? Yesterday there was a speech, and the speaker elaborated the details on frame semantics. I attended the detailed speech.

e. ? Yesterday there was a lecture, and the speaker elaborated the details on frame semantics. I missed it because the organizers rescheduled the detailed lecture from Friday to Monday and I wasn't informed.

f. # Yesterday the famous scientist made a speech. There was a large audience and I liked the content very much. So today I am going to recite that crowded speech.

In Chinese, however, we can find *event • info* nouns with primary facets. There are two nouns for *speech* in Chinese, namely 讲话 (jiǎnghuà) and 演讲 (yǎnjiǎng).[11] The former is usually used for speeches given in more serious situations or by important people, while the latter is a more general word for *speech*. Both are of type *event • info*, but they behave differently in copredication.

(11) a. 背诵/进行 一 篇 演讲
bèisòng/jìnxíng yī piān yǎnjiǎng
recite/perform one CLF$_i$ speech
'recite/perform a speech'

b. 背诵/#进行 一 篇 讲话
bèisòng/#jìnxíng yī piān jiǎnghuà
recite/#perform one CLF$_i$ speech
'recite/perform a speech'

c. 背诵/进行 详细 的 演讲/讲话
bèisòng/jìnxíng xiángxì de yǎnjiǎng/jiǎnghuà
recite/perform detailed MODM speech
'recite/perform a detailed speech'

[10] *The Musical Magazine* Vol. 2, 1840, p. 210.

[11] The two morphemes in 讲话 (jiǎnghuà) mean 'speak' and 'words', and the two morphemes in 演讲 (yǎnjiǎng) mean 'act/perform' and 'speak'.

Table 2: Facet availability after modification for 讲话 (jiǎnghuà) ‘speech’ and 演讲 (yǎnjiǎng) ‘speech’

	targeted facet	讲话 (jiǎnghuà)	演讲 (yǎnjiǎng)
两千字 (liǎngqiānzì) ‘2000 characters’	info	info	info, event
两个小时 (liǎnggèxiǎoshí) ‘2 hours’	event	event	event
详细 (xiángxì) ‘detailed’	info	both	both
盛大 (shèngdà) ‘grand’	event	event	event
沉闷 (chénmèn) ‘dull’	event	event	event

d. #背诵/进行 两个小时 的 演讲/讲话
bèisòng/jìnxíng liǎnggèxiǎoshí de yǎnjiǎng/jiǎnghuà
recite/perform two.hours MODM speech
‘recite/perform a two-hour speech’

The Chinese classifier 篇 (piān) in (11a)–(11b) combines only with nouns that have an info facet. When it combines with 演讲 (yǎnjiǎng), the result 一篇演讲 (yì piān yǎnjiǎng) ‘a speech’ still has the event facet and can be predicated by 进行(jìnxíng) ‘perform’; but when it combines with 讲话 (jiǎnghuà), the event facet is blocked for subsequent predication. If 讲话 (jiǎnghuà) and 演讲 (yǎnjiǎng) are modified by facet-addressing modifiers such as 详细 (xiángxì) ‘detailed’ in (11c), the resulting phrase will still be a dot object. If they are modified by facet-picking modifiers like 两个小时 (liǎng ge xiǎoshí) ‘2 hours’ in (11d), the phrases only have the event facet and cannot be predicated by 背诵 (bèisòng) ‘recite’.

Table 2 lists the accessible facets of both nouns after modification by some adjectival or nominal modifiers. The event facet of 演讲 (yǎnjiǎng) is always preserved, but when 讲话 (jiǎnghuà) is modified by 两千字 (liǎngqiānzì) ‘2000 characters’, only the info facet remains accessible. Therefore, it can be concluded that in 讲话 (jiǎnghuà), both facets are secondary facets, whereas in 演讲 (yǎnjiǎng), the event facet is the primary facet.

The reason why 演讲 (yǎnjiǎng) has a primary facet while 讲话 (jiǎnghuà) does not is probably related to the Chinese lexical system. The info and event facets of 讲话 (jiǎnghuà) can also be referred to as 讲话稿 (jiǎnghuàgǎo) ‘speech draft’ and 讲话会 (jiǎnghuàhuì) ‘speech meeting’, respectively. Neither is a frequent word. On the other hand, although the info facet and the event facet of 演讲 (yǎnjiǎng) can also be referred to as 演讲稿 (yǎnjiǎnggǎo) ‘speech draft’ and 演

讲会 (yǎnjiǎnghuì) 'speech meeting', 演讲稿 (yǎnjiǎnggǎo) 'speech draft' is much more commonly-used when the info facet is targeted, while 演讲会 (yǎnjiǎnghuì) 'speech meeting' is not frequently used.

3 Modelling composition with polysemous nouns

3.1 Background: Syntax-driven composition of semantic frames

For modelling composition at the syntax-semantics interface, we build on the framework of Kallmeyer & Osswald (2013), which involves tree rewriting on the syntactic side and frame unification on the semantic side. The basic representational components of the approach are *elementary constructions*, which are pairs of constituent trees and semantic frames, together with a partial map from constituent nodes to nodes of the associated frame.

Frames are here understood as *generalized feature structures*.[12] While conventional feature structures require that each node of the frame is accessible from a distinguished root node via a finite attribute sequence, frames relax this condition in that each node is required to be accessible from at least one of a non-empty set of *labeled nodes*. A corresponding generalization applies to the unification of frames: Instead of identifying the designated root nodes of feature structures, *frame unification* relies on the identification of all nodes that carry the same labels. Similarly, *subsumption* naturally extends from ordinary feature structures to frames. As in the single-rooted case, the unification of two frames is their least upper bound with respect to subsumption, if existent.

In order to characterize the properties of frames and frame nodes, we make use of *attribute-value formulas* and *descriptions*, which gives us a logical language tailored for the description of frames and for drawing inferences about them. The vocabulary of this language consists of type symbols (e.g. *apple*, *sweet*, *eating*), attribute symbols (e.g. TASTE, ACTOR, EATER), relation symbols, node variables (e.g. *a*, *b*, *c*, ...), and node names. Examples of (primitive) attribute-value descriptions are *apple*, TASTE : *sweet*, and ACTOR $\doteq$ EATER. They can be seen as one-place predicates which might be satisfied at a node of a frame (under a given interpretation of the vocabulary). For instance, TASTE : *sweet* is satisfied at a node v if v has an attribute denoted by TASTE whose value node is an instance of type *sweet*. The description ACTOR $\doteq$ EATER is satisfied at v if v has attributes denoted by ACTOR and EATER whose value nodes are identical. In contrast to

[12] For a formal account of frames and the logic of attribute-value descriptions and formulas see Kallmeyer & Osswald (2013: Sect. 3) or the more recent version in Chen et al. (2022: Appendix).

descriptions, attribute-value *formulas* are not satisfied at nodes but by frames. Formulas include "grounded" attribute-value descriptions such as $x \cdot \textit{apple}$ and $x{\cdot}\textsc{taste} : \textit{sweet}$, which are satisfied by a frame F if F has a node labeled x at which the respective descriptions are satisfied. Formulas include also expressions such as $x \cdot \textsc{actor} \doteq y$, which is satisfied by F if F has nodes labeled x and y such that the latter node is the value of the attribute denoted by ACTOR of the former node. Attribute-value formulas and, likewise, descriptions, can be combined by Boolean connectives.

Crucially, frames can be seen as *minimal models* of conjunctive attribute-value formulas. Conjunctions of attribute-value descriptions or formulas will be often presented in the well-known format of *attribute-value matrices* (AVMs). In addition to descriptions and formulas, we also make use of (universal) *attribute-value constraints*, which are basically universally quantified descriptions. If ϕ is an attribute-value description then the constraint $\forall\phi$ is satisfied if ϕ is satisfied at every node. We write $\phi \Rrightarrow \psi$ instead of $\forall(\phi \rightarrow \psi)$. Typical use cases are subtyping (e.g. $\textit{apple} \Rrightarrow \textit{fruit}$), incompatibilities (e.g. $\textit{fruit} \wedge \textit{meat} \Rrightarrow \bot$), and attribute requirements (e.g. $\textit{eating} \Rrightarrow \textsc{eater} : \top$).[13] Given a finite set of constraints $\phi \Rrightarrow \psi$ with non-disjunctive ψ and a frame F, there exists a unique minimal frame F' subsumed by F that satisfies all constraints (if no inconsistencies occur and F' keeps being finite).

The tree rewriting formalism used in this paper is Tree Adjoining Grammars (TAG; Joshi & Schabes 1997, Abeillé & Rambow 2000).[14] A TAG is a finite set of elementary trees that can be combined into larger trees via the tree composition operations *substitution* (replacing a leaf with a new tree) and *adjunction* (replacing an internal node with a new tree). The trees that can be added by adjunction are special in that they have a leaf node that is marked as *foot node* and that has the same non-terminal label as the root. These trees are called *auxiliary trees*. The effect of an adjunction is that the root of the adjoined auxiliary tree replaces the target node of the adjunction and the tree below the target node ends up below the foot node.

As mentioned at the beginning of this section, elementary and derived constructions are understood as pairs of constituent trees and semantic frames together with a partial map that takes constituent nodes to frame nodes. This mapping is encoded by the feature I(NDEX) carried by the constituent nodes. Due to this linking and the resulting identification of the I values, syntactic operations,

[13] $\bot$ is satisfied by nothing, $\top$ is satisfied by everything.

[14] Formalisms with different tree operations are also possible; e.g., the Tree Wrapping Grammar formalism described in Kallmeyer & Osswald (2023).

here substitution and adjunction, can give rise to the unification of the associated frames. Consider Figure 2 below for an example. The substitution of the tree of 'the book' into the object NP node of 'took away' leads to a unification of the respective frames under the identification of the node labels p and u. The resulting frame is represented at the bottom of the figure.

The example also illustrates the specific grammatical theory, Role and Reference Grammar (RRG; Van Valin 2005, Bentley et al. 2023), that we use for our syntactic representations. RRG provides an elaborate theory of clause linkage, which is helpful for the analysis of copredication constructions. Moreover, RRG assumes a layered structure consisting of *nucleus* (NUC), *core* (CORE) and *clause* (CL). The nucleus contains the main predicate, the core contains the nucleus and the (non-extracted) syntactic arguments, and the clause includes the core and extracted arguments. Adjuncts can attach to each layer, and the assumption of a layered structure holds across categories. Notice that the specific choice of the syntactic inventory does not play an important role for the purposes of the present paper. A more common X-bar schema would also do for the compositional mechanisms proposed in the following.

3.2 The representation of meaning facets and dot type nouns

Following Chen et al. (2022), we assume that frame-semantic representations of polysemous nouns come with facet attributes whose values characterize the individual meaning facets of the nouns. Predicates and modifiers then access meaning facets of the semantic frames contributed by their arguments. Non-polysemous nouns can be integrated into this picture by assuming that they provide a single meaning facet that points to the denoted entity itself. For example, suppose that our semantic model provides a type *apple*, whose instances are denoted by the English word *apple*, and that *apple* is a subtype of *food*, and *food* is a subtype of *physical-object* (*phys-obj*). Moreover, let us assume that each instance of type *phys-obj* has an attribute OBJECT-FACET (OBJ-FCT) whose value is the instance itself. A formal presentation of these constraints is given in (12), where SELF stands for the identity function.

(12) a. $\mathit{apple} \Rrightarrow \mathit{food}, \quad \mathit{food} \Rrightarrow \mathit{phys\text{-}obj}$
b. $\mathit{phys\text{-}obj} \Rrightarrow^{15} \text{OBJ-FCT} \doteq \text{SELF}$

It follows that each instance x of type *apple* is of type *phys-obj* and has an attribute OBJ-FCT whose value is x, in symbols, $x \cdot \text{OBJ-FCT} \doteq x$.

[15] '$\Rrightarrow$' is always the last operator to be combined.

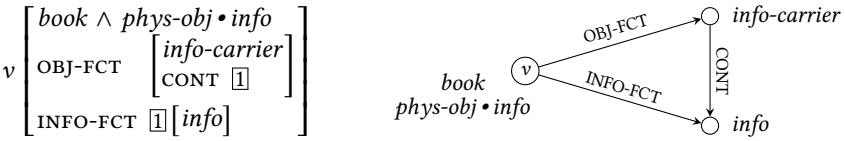


Figure 1: AVM and minimal frame model for the *book* frame

Polysemous nouns are assumed to denote instances of a dot type, whose associated facet attributes have values that differ from the dot-type instance, in general. This is illustrated by the attribute-value constraint in (13b): Instances of type *phys-obj • info* have two attributes OBJ-FCT and INFO-FCT, whose values are related by the attribute CONT(ENT) and are of type *info-carrier* and *info*, respectively.

(13) a. *book* ⟹ *phys-obj • info*
b. *phys-obj • info* ⟹ OBJ-FCT : *info-carrier* ∧ INFO-FCT ≐ OBJ-FCT · CONT
c. *info-carrier* ⟹ *phys-obj* ∧ CONT : *info*

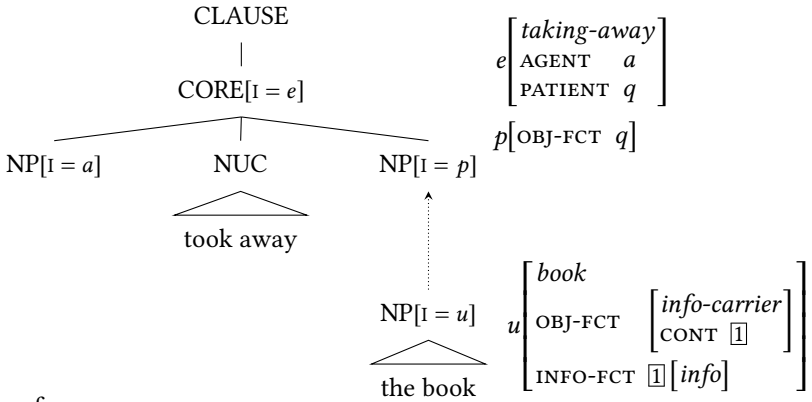
The type *info-carrier* is specified in (13c) as a subtype of *phys-obj* whose instances have a CONT attribute of type *info*. In (13a), *book* is specified as a subtype of *phys-obj • info*. Figure 1 shows the minimal frame model for an instance *v* of *book*, subject to the constraints in (13), together with the corresponding AVM. Figure 2 illustrates how syntactic argument substitution in the derivation of *took away the book* can give rise to a unification of the 'book' frame and the 'take away' frame.

The complex types *event • food* and *event • info*, together with their respective subtypes *dinner* and *speech*, can be specified in a similar vein. In (14b), instances of type *event • food* are characterized as having the facet attributes EV-FCT and OBJ-FCT, where the value of EV-FCT is of type *eating* and the value of OBJ-FCT is the THEME of the *eating* instance, which (14c) requires to be of type *food*.[16]

(14) a. *dinner* ⟹ *event • food*
b. *event • food* ⟹ EV-FCT : *eating* ∧ OBJ-FCT ≐ EV-FCT · THEME
c. *eating* ⟹ *event* ∧ THEME : *food*

According to (15b), an instance of type *event • info* has a facet attribute EV-FCT of type *info-event*, which in turn has an attribute CONT of type *info* (15c), whose value is identical to the value of the INFO-FCT attribute of the dot-type instance.

[16] We omit the fact that *dinner* restricts the event time to the evening since it does not play a role for possible predications over facets.



Resulting frame:

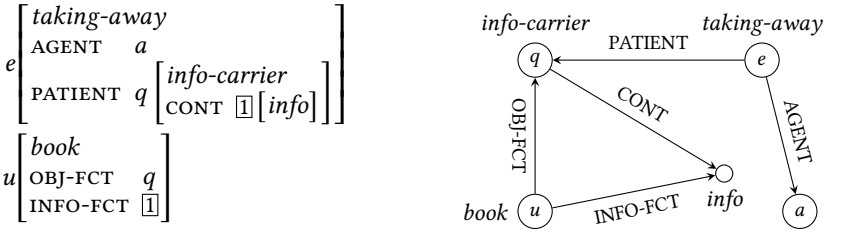


Figure 2: Derivation for *took away the book* with resulting frame

(15) a. $speech \Rrightarrow event \bullet info$

b. $event \bullet info \Rrightarrow \text{EV-FCT} : info\text{-}event \wedge \text{INFO-FCT} \doteq \text{EV-FCT} \cdot \text{CONT}$

c. $info\text{-}event \Rrightarrow event \wedge \text{CONT} : info$

The following more general constraints encode various type restrictions and incompatibilities for the basic types *event*, *info* and *phys-obj* and the facet attributes EV-FCT, INFO-FCT and OBJ-FCT:

(16) a. $event \wedge info \Rrightarrow \bot$, $event \wedge phys\text{-}obj \Rrightarrow \bot$, $phys\text{-}obj \wedge info \Rrightarrow \bot$

b. $\text{EV-FCT} : \top \Rrightarrow \text{EV-FCT} : event$, $\text{INFO-FCT} : \top \Rrightarrow \text{INFO-FCT} : info$, $\text{OBJ-FCT} : \top \Rrightarrow \text{OBJ-FCT} : phys\text{-}obj$

c. $event \wedge (\text{INFO-FCT} : \top \vee \text{OBJ-FCT} : \top) \Rrightarrow \bot$,
$info\text{-}obj \wedge (\text{EV-FCT} : \top \vee \text{OBJ-FCT} : \top) \Rrightarrow \bot$,
$phys\text{-}obj \wedge (\text{EV-FCT} : \top \vee \text{INFO-FCT} : \top) \Rrightarrow \bot$

In addition to (16c), there are constraints on *event* and *info* that resemble the constraint in (12b) on *phys-info*, with OBJ-FCT replaced by EV-FCT and INFO-FCT,

respectively. They ensure that the basic types license exactly one facet attribute, which encodes self-reference.

3.3 Using top and bottom features for facet-picking modifiers

Our first approach to modelling copredication restrictions uses feature-structure based TAG (FTAG, Vijay-Shanker & Joshi 1988). In an FTAG, each node has a top and a bottom feature structure, except for substutition nodes, which only have a top structure. Nodes in the same elementary tree can share feature values. When adjoining an auxiliary tree β to a node v, the top of the root of β unifies with the top of v while the bottom of the foot of β unifies with the bottom of v. In the final derived tree, top and bottom feature structures must unify for all nodes.

We use the capability of FTAG auxiliary trees to separate the top and bottom feature structures of the target adjunction site. This allows adjoining constructions, roughly, to embed the frame of a dot type noun while passing upwards only the frame of the facet that they pick. As an example, consider the composition of *lively* and *dinner* in Figure 3. The NUC_N node of *dinner* has a bottom feature structure with an I feature whose value is the label u of the dot type frame. The I value in the top feature structure of that node is shared with the bottom of the CORE_N node. If nothing adjoins, all I features in the *dinner* tree will be set to u due to the final top-bottom unification. In Figure 3, an adjunction takes place at that node. The adjoining tree of *lively* retrieves the *dinner* frame via the top I feature (value t) of its foot node and via final top-bottom unification (which unifies t with u), and passes the event facet (EV-FCT, label z) of this frame upwards via the bottom feature structure of its root node. Figure 4 shows the result of the adjunction after the final top-bottom unification. Due to the adjunction, the I feature has changed from u (= dot type) on the lower NUC_N node to z (= event) on the higher NUC_N node.

In contrast to a facet-picking modifier such as *lively*, a facet-addressing modifier such as *vegan* in *vegan dinner* just adds information to one facet (here the object facet, OBJ-FCT) but does not change the I feature. Figure 5 shows the corresponding elementary construction for *vegan*. After adjoining it to *dinner* and performing a final top bottom unification, we obtain a tree where all nodes on the path from *dinner* to the root have the same I feature value, namely the label of the dot type frame (the unification of u and v).

Now we consider combinations of two modifiers. Figure 6 shows the adjunction of the elementary tree of *lively* to the tree of *vegan dinner* (the latter before final top-bottom unification). Throughout the paper, we follow standard practices in TAG by assuming that nothing can be adjoined at foot nodes, therefore 'lively'

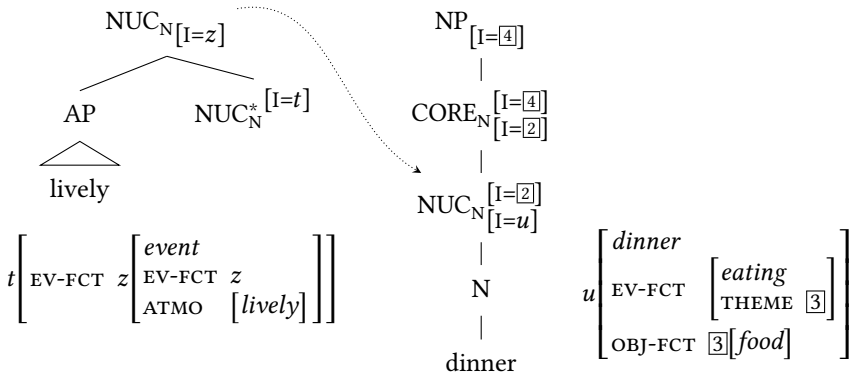


Figure 3: Using top and bottom features for facet picking: The syntactic and semantic composition of *lively dinner*

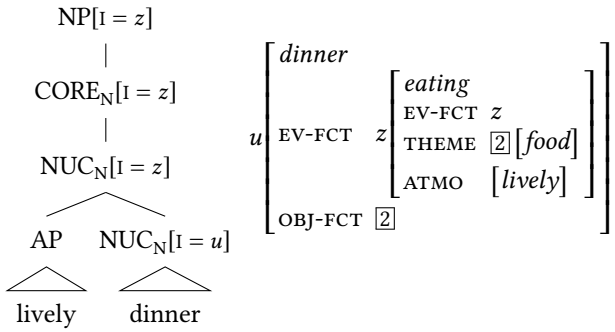


Figure 4: Derived construction for *lively dinner* after final top-bottom unification

can only be adjoined to the higher NUC_N node in the 'vegan dinner' tree.[17] Figure 7 shows the resulting derived construction, both before and after top-bottom unification.

When adjoining the two modifiers in the reverse order, i.e., adjoining *vegan* higher than *lively*, we obtain the derived tree in Figure 8 (before final top-bottom unification). On the NUC_N node in the middle in the derived tree (shaded in gray), the top feature structure has an I feature with value v and the bottom feature structure has an I feature with value z. In the final top-bottom unification, when v and z unify, the type *event* of z is incompatible with the attribute OBJ-FCT of

[17]Note that this *null adjunction* at foot nodes is only imposed to avoid spurious ambiguities. Different adjunction orders for the same surface order would lead to the same tree.

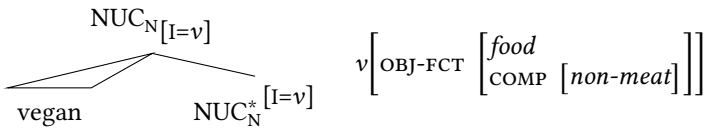


Figure 5: Elementary construction for *vegan*

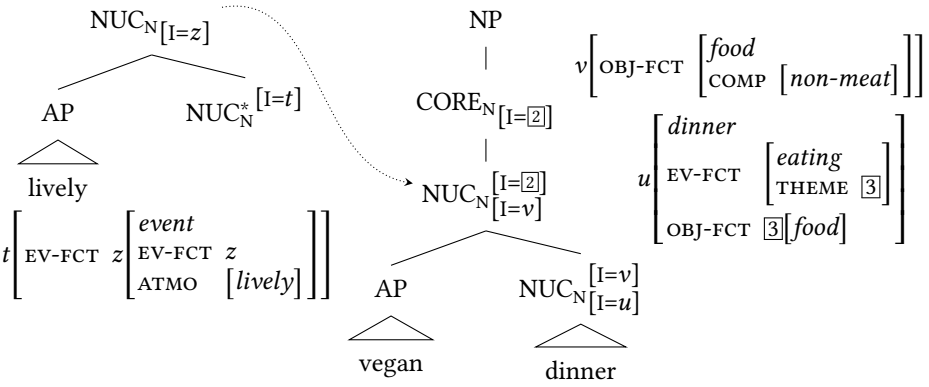


Figure 6: Adjunction of *lively* to *vegan dinner*

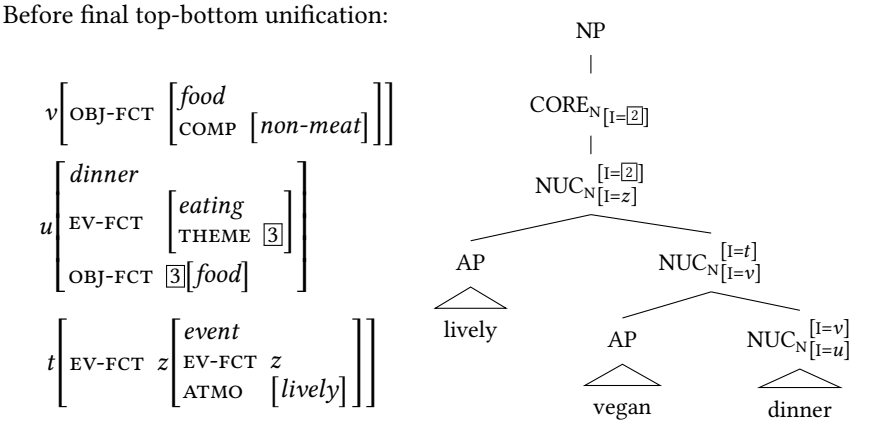
v, resulting in a unification failure. Thus, the infelicitous phrase #*vegan lively dinner* is excluded.

This model also excludes infelicitous verbal predications such as #*take away the lively dinner*. As shown in Figure 4, the value of the I feature of the NP of *lively dinner* is the frame node *z*, which is of type *event*. If this NP is substituted at the object NP node on the elementary tree of *take away*, the frame *z* will unify with a frame with OBJ-FCT (see Figure 2), which results in a unification failure.

3.4 Using default constraints for secondary facets

A shortcoming of the preceding approach is that the frame of the dot type noun does not distinguish between primary and secondary facets. In the following, we aim at modelling this distinction in such a way that the semantic representation of the noun restricts possible facet selection patterns. To this end, we propose to model secondary facets as *default attributes* that will only be present if there is no conflict with other constraints. For example, *dinner* is of type *event* • *food* and usually has an EV-FCT and an OBJ-FCT. However, as discussed above, when *dinner* is modified by an event modifier such as 'lively', its OBJ-FCT is no longer

a) Before final top-bottom unification:



b) After final top-bottom unification:

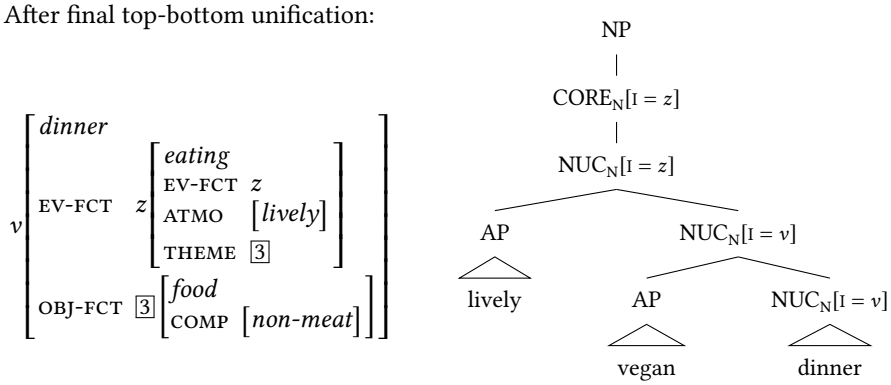


Figure 7: Derived construction for *lively vegan dinner* a) before and b) after final top-bottom unification

available in the resulting frame. In the following, we model this by analyzing the OBJ-FCT of *event* • *food* nodes as a defeasible attribute.

To this end, we introduce *default constraints* (indicated by $\Rightarrow_D$) into our logical system. Given a default constraint $\alpha \Rightarrow_D \beta$ and a frame F that satisfies α, we may assume that F also satisfies β if β is compatible with the properties of F.[18] The assertion that F satisfies β is defeasible and needs to be retracted if more information about F is known that is not compatible with β.

The facet constraints for *event* • *food* in (14b) are now replaced by the following set of constraints, where the OBJ-FCT attribute, representing a secondary facet, is introduced by the default constraint (17b).

[18] A default constraint $\alpha \Rightarrow_D \beta$ is basically the same as a normal default rule $\frac{\alpha : \beta}{\beta}$ in the sense of Reiter (1980); see also Osswald (2005).

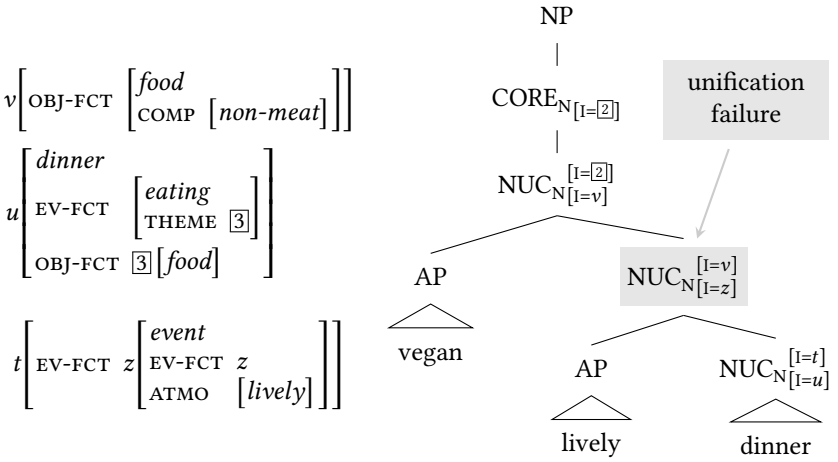


Figure 8: Derived construction for #"vegan lively dinner" before top-bottom unification

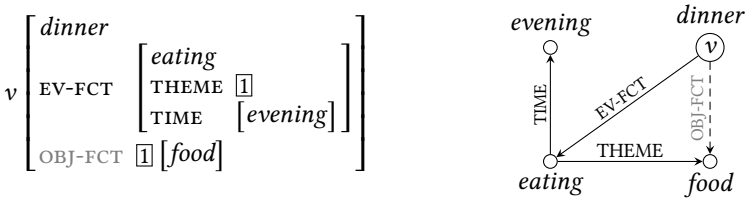


Figure 9: The AVM and graph representations of the frame of *dinner* (default constraints are depicted in gray in AVMs and as dashed edges in graph representations)

(17) a. $event \bullet food \Rrightarrow \text{EV-FCT} : eating$

b. $event \bullet food \Rrightarrow_D \text{OBJ-FCT} : \top$

c. $event \bullet food \wedge \text{OBJ-FCT} : \top \Rrightarrow \text{OBJ-FCT} \doteq \text{EV-FCT} \cdot \text{THEME}$

The minimal frame for an instance of type *dinner* under the constraints in (17) is given in Figure 9. The attribute depicted in gray in the AVM and as a dashed edge in the graph (OBJ-FCT) is a default attribute.

In addition, we make use of a type *event-active* for marking frames of facet-picking modifiers such as *lively*, which target event facets. In particular, *event-active* holds at nodes whose event facet has been targeted by a facet-picking modifier at some point of the composition. The constraint in (18) ensures the "picking" behavior of the modifier in that an instance of both *event-active* and *event • food* cannot have the attribute OBJ-FCT.

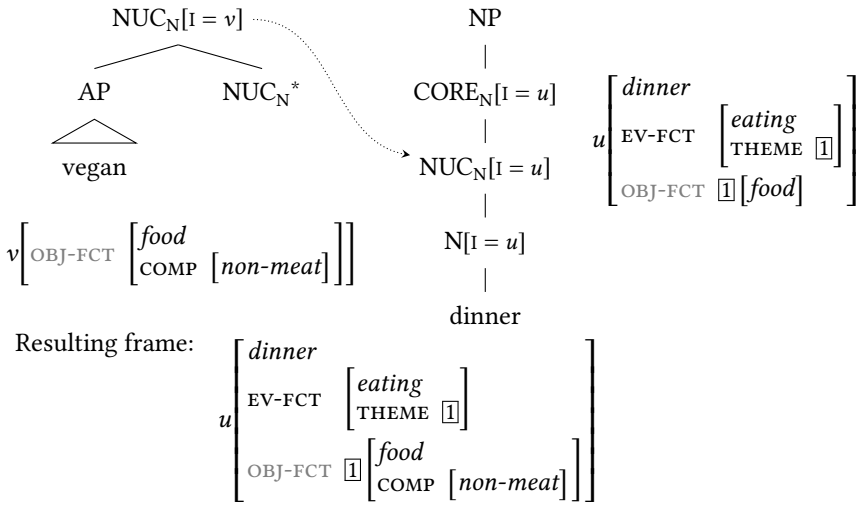


Figure 10: Derivation for *vegan dinner*

(18) *event-active* ∧ *event* • *food* ∧ OBJ-FCT : ⊤ ⇛ ⊥

Likewise, we assume that the presence of *event-active* in a lexical entry excludes the presence of INFO-FCT when combined with nouns of type *event* • *info* (19a). There are also types that encode the picking of other facets than *event-active*. For instance, the type *info-active* excludes the attribute EV-FCT when combined with nouns of type *event* • *info* (19b).

(19) a. *event-active* ∧ *event* • *info* ∧ INFO-FCT : ⊤ ⇛ ⊥
b. *info-active* ∧ *event* • *info* ∧ EV-FCT : ⊤ ⇛ ⊥

Facet-addressing modifiers do not require specific restrictions of this kind. For instance, modifiers such as *vegan* target the object facet of *event* • *food* nouns without affecting the event facet. Figure 10 and Figure 11 illustrate the representations of *vegan* and *lively*, respectively. Note that their facets are modelled as default attributes. In this way, they can target a primary facet, in which case the default attribute in the modifier construction turns into a non-default attribute, but also a secondary default facet, in which case the facet remains a default attribute. Furthermore, they can only combine with frames whose type is compatible with the default facet they address.

Figure 10 shows the derivation of *vegan dinner*. The frames are unified under the identification of u and v, and the OBJ-FCT remains a default attribute. The resulting frame has the same facets as the *dinner* frame before modification. The

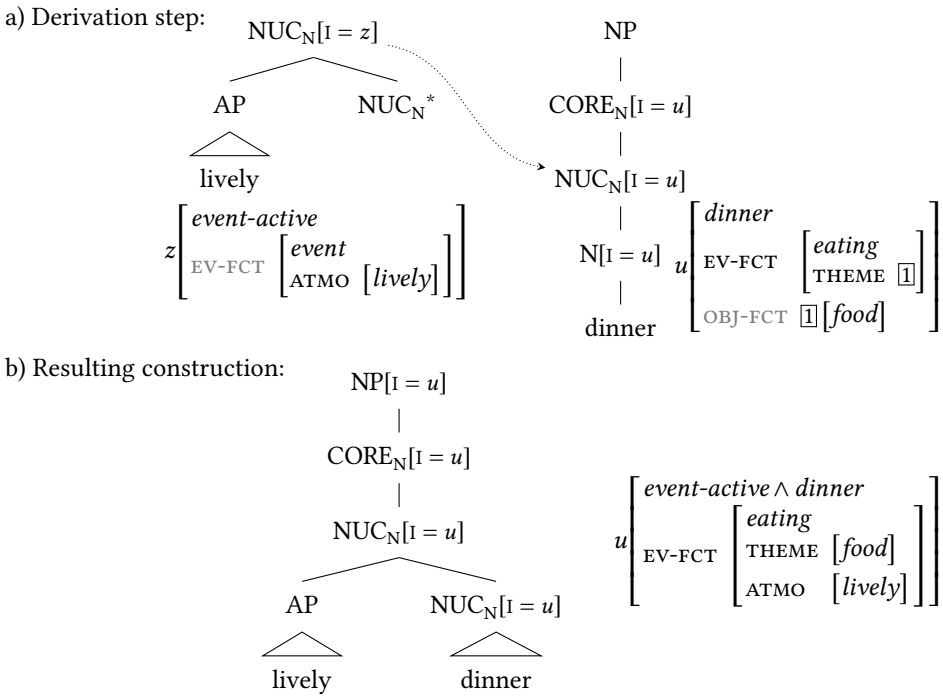


Figure 11: Derivation of the construction for *lively dinner*

frames of 'lively' and 'dinner' specified in the upper part of Figure 11 are not unifiable because of the constraint in (18). The presence of default constraints, however, allows us to retract defeasible information if necessary. In the case at hand, the default constraint in (17b) can be taken out of the game, thereby leading to a 'dinner' frame without the OBJ-FCT attribute, which then unifies with the 'lively' frame without problems, as shown in the lower part of Figure 11.

In general, the decision which defaults to retract is non-deterministic since unification clashes may be resolvable in different ways. In particular, we can consider both of the frames to be unified as candidates for a retraction of defeasible information, or we may take only one of them into account. For the present purposes, the latter option turns out to be more appropriate. The two frames to be unified in a derivation step can be distinguished according to the role their syntactic components play in the derivation. In our model, only the frame of the element which is "predicated over" can be subject to a retraction of defeasible information. In an adjunction, this is the frame of the target tree, in a substitution,

it is the frame of the substitution tree.[19]

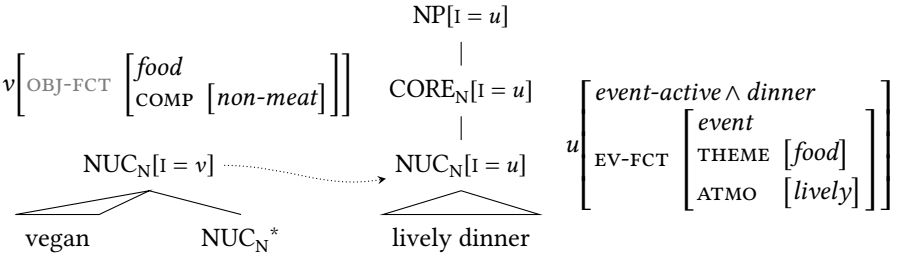
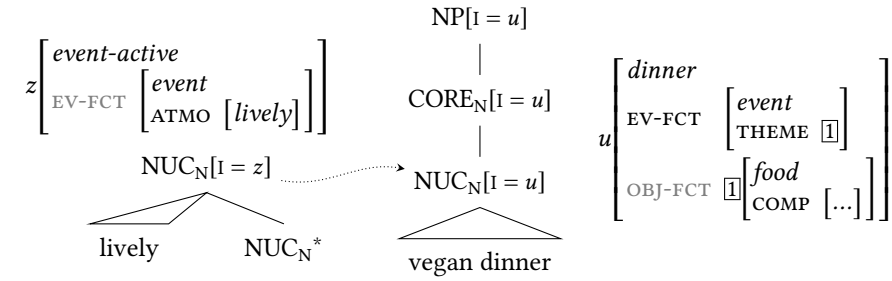


Figure 12: Derivation for #*vegan lively dinner*: the unification failure is due to the incompatibility of *event-active* ∧ *dinner* and OBJ-FCT : ⊤.

Figure 12 illustrates the unification failure that underlies the infelicitous phrase #*vegan lively dinner*. Although the OBJ-FCT attribute in the frame for *vegan* goes back to a default constraint, it cannot be retracted because the frame belongs to the adjoining tree and not to the target tree. Therefore, the incompatibility of the attribute OBJ-FCT and *event-active* ∧ *dinner* given by (18) leads to a unification failure.



Resulting frame:

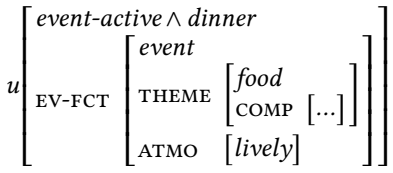


Figure 13: The derivation of *lively vegan dinner*

[19]This "asymmetric" approach to unification under default constraints is somewhat related to the "credulous default unification" proposed in Carpenter (1994). Carpenter assumes for the default unification of F and G that the information in F is strict and all of G is defeasible.

The successful derivation of the construction for *lively vegan dinner* is shown in Figure 13. Here, the frames of *vegan* and *dinner* unify first, and then the frame of *lively* unifies with the resulting frame. Note that the use of binarized trees and null adjunction constraints on foot nodes is crucial for controlling the unification of frames under default constraints: Lower modifiers must be adjoined before higher ones in order to have the frame of the higher modifier unified with the unification of the frames of the lower modifier and the noun. In cases where different modifiers adjoin at different sides of a noun (e.g., #'the lively dinner on the table'), additional features might be necessary in order to enforce the correct adjunction order.

The described approach can handle V+Mod+N copredication constructions as well. For example, the combination #*take away the lively dinner* is excluded since the object NP argument of *take away* is required to have an OBJ-FCT attribute in its frame (see Figure 2) while the type of the frame of *lively dinner* is *event-active* $\wedge$ *dinner*, which is incompatible with OBJ-FCT. It follows that substituting *the lively dinner* at the object NP argument position of *take away* would lead to a frame unification failure.

Let us finally turn to nouns of type *event* • *info*. According to the working hypothesis proposed in Section 2.3, both facets of *event* • *info* nouns are secondary, as long as there are no lexical specifications to the contrary. This can be formalized by replacing the strict constraint (15b) by the constraints in (20). The existence of both facets relies on the default constraints (20a) and (20b), and a further constraint (20c) ensures the presence of at least one of them.

(20) a. *event* • *info* $\Rrightarrow_D$ EV-FCT : $\top$

b. *event* • *info* $\Rrightarrow_D$ INFO-FCT : $\top$

c. *event* • *info* $\Rrightarrow$ EV-FCT : $\top$ $\vee$ INFO-FCT : $\top$

d. *event* • *info* $\wedge$ EV-FCT : $\top$ $\Rrightarrow$ EV-FCT : *info-event*

e. *event* • *info* $\wedge$ EV-FCT : $\top$ $\wedge$ INFO-FCT : $\top$ $\Rrightarrow$ INFO-FCT $\doteq$ EV-FCT $\cdot$ CONT

The values of the two facets, if existent, are related to each other by the CONT attribute (20e), as before.

Concerning the two Chinese nouns for 'speech' discussed in Section 2.3, it was observed that 演讲 (yǎnjiǎng) has a lexically specified primary event facet. One option to implement this is by introducing a specific subtype of *event* • *info* that (strictly) implies EV-FCT : $\top$. Alternatively, we could anchor the constraint $\top \Rrightarrow$ EV-FCT : $\top$ locally to the dot-type node of the lexical frame. Instantiation of the lexical item then leads the non-defeasible presence of EV-FCT. The noun 讲话 (jiǎnghuà), by contrast, follows the general pattern of *event* • *info* nouns described in (20), according to which both of its facets are defeasible.

4 Discussion and conclusion

We presented two approaches to modelling facet-picking and facet-addressing predications over polysemous nouns: One based on top and bottom feature structures on nodes and the possibility to separate these via adjunction, and a second approach based on a default logic that allows the removal of defeasible facets.

The first approach builds on an established framework of the syntax-semantics interface (Kallmeyer & Osswald 2013, Chen et al. 2022). Top and bottom feature structures have long been used in the context of TAG (see the analyses in the XTAG grammar, XTAG Research Group 2001) and have been shown to be useful for a wide range of phenomena. The way frame constraints are unified in this approach is order-independent and monotonic. This facilitates the understanding of the semantic contribution of elementary trees.

This approach can capture in an elegant way the fact that in some predications over dot-type nouns, one facet is picked while the other facets, even though still present in the semantic representation, are no longer accessible for further predications. A potential disadvantage of this approach is that the choice of facet-picking versus facet-addressing depends entirely on the predicate (in our examples on the modifier). The data considered above have however shown that the dot-type nouns clearly influence the result of such a composition in terms of available facets as well. A large part of the data suggests that there are dot-type nouns that distinguish between primary and secondary facets among their meaning components and that allow facet picking combined with the unavailability of other facets only when the other facets are secondary (see for instance the Chinese data concerning the two words for 'speech'.) For these cases, the analysis we have so far might require more than one predication tree for the same lexical item depending on the facet properties of the target noun (which can be encoded via the target type). This would mean a multiplication of predication trees. Note, however, that this might be less problematic than it sounds since these trees would be described in a factorized way within a metagrammar, i.e., a principled description of the possible elementary constructions (Crabbé et al. 2013, Kallmeyer & Osswald 2013, Lichte & Petitjean 2015).

The default approach presented here provides a way to model the distinction between primary and secondary facets in dot-type nouns. Secondary facets are modelled as default attributes that can be retracted in case of conflicting frame constraints. For this analysis we extended the frame logic of Kallmeyer & Osswald (2013; cf. also Chen et al. 2022) by default constraints and made use of a non-commutative and non-associative notion of default unification.

An advantage of the default approach is that it requires only a single feature structure per syntactic node, and not top and bottom feature structures. (Note, however, that we might need top and bottom feature structures in order to express other constraints.) On the other hand, a disadvantage of the default approach is that the non-commutativity and non-associativity of unification make meaning contributions less transparent and impose more constraints on the possible syntactic constructions, compared to the top-bottom approach.

In conclusion, this paper develops two promising options for modelling constraints on copredications over dot-type nouns. However, in order to decide which of the two approaches is preferable, further empirical and theoretical investigations are needed. In future work, we will examine more data, taking lexical properties beyond the picking/addressing of facets into account, in particular with respect to the internal structure of the dot-type frames, and we will also investigate and model further kinds of syntactic copredication constructions.

Acknowledgments

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Chapter 3

Unifying modifiers, classifiers and demonstratives

Chenyuan Deng[a], Antonio Machicao y Priemer[a] & Giuseppe Varaschin[a]

[a]Humboldt-Universität zu Berlin

We argue that the distributional properties of modifiers, classifiers and demonstratives with respect to nouns in Mandarin Chinese motivate a head-functor approach (Van Eynde 2006), where numeral-classifier-noun sequences are analyzed as left branching structures with the noun as the head. This approach explains the distributional similarities between all prenominal categories by unifying their combinatorial properties under a single phrasal schema while also accounting for their differences by means of selectional constraints and a hierarchy of MARKING values. We also analyze classifiers themselves as special kinds of noun. All in all, our analysis entails that nominal complexes in Mandarin Chinese are fundamentally different from those found in languages with dedicated specifiers (e.g. determiners in a language like English), suggesting a two-way typology that is parallel to the NP/DP parameter proposed in the minimalist tradition (Bošković 2007, i.a.).

1 Introduction

The structure of Mandarin Chinese nominal complexes (CNCs) is subject to extensive research, mostly centering on their implications for the NP/DP debate and right and left-branching analyses (Cheng & Sybesma 1999, Bošković et al. 2013, Her & Tsai 2020, Jiang et al. 2022).[1] However, there has been little work on CNCs in the tradition of HPSG (Pollard & Sag 1994). In this paper, we attempt to

[1]We employ the term *nominal complex* in order to not beg the question of the categorial status of these structures.

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bridge this gap by focusing on the combination of prenominal elements (demonstratives, modifiifiers, and classifiers) with the head N. (1) illustrates the kind of structure we will deal with.

(1) na da de san ben guanyu yuyanxue de shu
DEM big DE three CLF about linguistics DE book
'those three big books about linguistics'

As we will see when we examine other examples, the combinatorial properties of prenominal elements in CNCs pose several puzzles for both traditional NP accounts as well as for DP-based theories of nominal complexes.

We argue that the distributional properties of modifiers (MODs) and demonstratives (DEMs) motivate a head-functor approach (HFA; Van Eynde 2006) with respect to Ns and classifiers (CLFs), where NUM-CLF-N sequences are analyzed as left-branching NPs, and where the sequence NUM-CLF forms a CLFP that acts as a functor over the noun. The notion of functor replaces the more specific grammatical relations of specifier and modifier, which are prevalent in NP approaches to the nominal domain. It also stands in contrast to DP analyses, which treat prenominal elements as heads of extended nominal projections.[2] The HFA allows us to unify the combinatorial properties of CLFs, MODs and DEMs, thus explaining their similarities in Mandarin Chinese, while also accounting for their differences by means of selectional constraints and a hierarchy of MARKING values. Our treatment also entails that CNCs are fundamentally different from nominal structures in languages with dedicated specifiers, suggesting a two-way typology of languages (head-specifier or head-functor) that is parallel to the NP/DP parameter proposed in the minimalist tradition (Bošković 2007, Bošković & Gajewski 2011, Despić 2011, Phan & Lander 2015, i.a.).

In Section 2, we briefly review two standard theories of nominal complexes: the head-specifier NP approach and the head-complement DP approach. In Section 3, we discuss the puzzles CNCs pose for both of these approaches. In Section 4, we summarize the HFA alternative and propose an analysis of the CNC data. Lastly, Section 5 summarizes our approach and situates it in the context of a broader typological hypothesis about nominal complexes across languages.

[2]The term *functor* comes from categorial grammar, where it refers to any selecting category, i.e. heads, modifiers and specifiers (Bouma 1988: 23). We use the term here in the more restricted way to refer only to non-head daughters that impose selectional requirements on their sisters.

2 Standard views about nominal complexes

In this section, we summarize two main approaches to the combinatorics of nominal complexes (NCs): a standard NP approach, which posits that NCs are headed by nouns that take determiners and other functional prenominal elements as their specifiers; and a DP approach, which assumes that NCs are headed by determiners that take nouns as their complement. For the sake of commensurability with our own theory, we focus on simple HPSG variants of these approaches, but most of what we say here is independent of choice of formalism.

Let us start with the standard NP approach, which is rooted in classic X′ theory (Chomsky 1970, Jackendoff 1977) and found its way to HPSG through works like Pollard & Sag (1987: 139–143), Ginzburg & Sag (2000: 34), Sag et al. (2003: 102) and Levine (2017: 84). Its defining assumption is the idea that NCs are formed by first combining a nominal head with all of its complements/modifiers and subsequently by adding a specifier that closes off the nominal projection to further combinations and allows it to serve as an argument to other heads. Specifiers of N typically belong to the functional category D, which encompasses definite articles (*the*), demonstratives (*this*), genitives (*the queen's*), quantifiers (*some*, *each*), and measure phrases (*a lot of*). Some examples are given in (2).[3]

(2) a. { The / These / The queen's / Some / A lot of } books are bad.

b. { The / This / The queen's / Some / Each } book is bad.

In HPSG, combinations of these functional prenominal elements with N are licensed by the schema in (3) as structures of the type *head-specifier phrase*.

(3) *head-specifier-phrase* ⇒

$$\begin{bmatrix} \textit{headed-phrase} \\ \textsc{synsem|loc|cat|spr}\ \langle\rangle \\ \\ \textsc{head-dtr|synsem|loc|cat}\ \begin{bmatrix} \textsc{spr}\ \langle \boxed{1} \rangle \\ \textsc{comps}\ \langle\rangle \end{bmatrix} \\ \\ \textsc{non-head-dtrs}\ \left\langle \left[\textsc{synsem}\ \boxed{1} \right] \right\rangle \end{bmatrix}$$

[3] Semantically, it is generally assumed that specifiers are functions that map the property meaning of N (of type $\langle e, t \rangle$) into a semantic type that can be combined with the property expressed by the VP (Kratzer & Heim 1998). This can be either an entity or a generalized quantifier (of type $\langle \langle e, t \rangle, t \rangle$). In this paper, we focus mostly the syntactic combinatorics of CNCs, leaving an account of their semantic composition for future work (see Krifka 1995 for a proposal).

The schema requires the head daughter to have the *synsem* of the non-head daughter in its SPR list and the mother to have an empty SPR, blocking the combination with further specifiers. The head daughter is also constrained to have an empty COMPS list, to ensure that a noun can only combine with its specifier after its complements. Furthermore, heads that select NCs require their N arguments to have empty SPR lists, so a specifier will always be necessary to integrate Ns in a larger phrasal structure. This ensures, for instance, that a verb selecting a noun can only combine with the noun after it has already been saturated by a specifier.[4] Since head-specifier structures are required to be of type *headed-phrase*, they also have to abide by the Head-Feature Principle, given in (4) (Pollard & Sag 1994: 34). A schematic depiction of the effects of (3)–(4) is shown in Figure 1.

(4) *headed-phrase* ⇒
$$\begin{bmatrix} \textit{headed-phrase} \\ \textsc{synsem|loc|cat|head}\ \boxed{1} \\ \textsc{head-dtr|synsem|loc|cat|head}\ \boxed{1} \end{bmatrix}$$

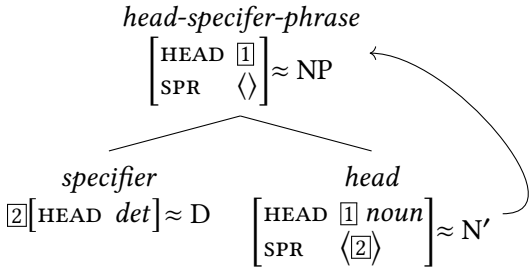

Figure 1: NP analysis (*head-specifer-phrase*)

Crucially, modifiers of N are introduced by the separate combinatorial schema in (5), which defines a distinct phrasal type *head-adjunct-phrase* (Pollard & Sag 1994: 56). According to this schema, modifiers select their heads by means of their MOD feature, which is structure-shared with the head's *synsem*. The combination with a modifier has no effect over the categorial properties of the phrasal head. A simplified example of a structure satisfying these schemas is given in Figure 2.

[4] So structures like **Amy read book* are predicted to be ungrammatical. For bare plurals and mass nouns (which can combine with other heads without an overt determiner) it is necessary to assume either an empty determiner that only combines with Ns of the appropriate type or a unary rule that identifies this exact class of Ns and removes the determiner from their SPR list. Similar provisions are necessary under DP analyses, which make exactly the same predictions.

(5) *head-adjunct-phrase* ⇒
$$\begin{bmatrix} \textit{headed-phrase} \\ \textsc{head-dtr}|\textsc{synsem}\ \boxed{1} \\ \textsc{non-head-dtrs}\ \left\langle \left[\textsc{synsem}|\textsc{loc}|\textsc{cat}\ \left[\textsc{head}|\textsc{mod}\ \boxed{1} \right] \right] \right\rangle \end{bmatrix}$$

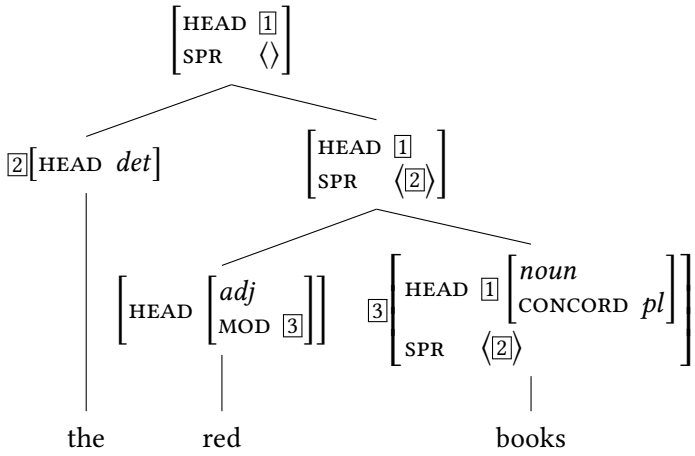

Figure 2: Modified NP

On this analysis the NC is headed by the noun, which, therefore, determines both the internal combinatorics of the phrase (e.g. which kinds of arguments can be introduced in the NC) as well as its distribution when combining with other heads. This seems to be intuitively correct if we look back at (2), where we see that, for at least some of the specifiers (e.g. *the*, *some*), the inflection on V seems to depend only on the number value of N. Strikingly, in (2a), the measure phrase specifier *a lot of* is singular, but V must be plural, in conformity with the number value of *books*. This makes sense under an NP approach, where many of the categorial properties of NCs (all of the HEAD features, including the agreement values under HEAD|CONCORD) are inherited from N due to (4).

The opposite holds on the DP approach, proposed in HPSG by Netter (1994) on the basis of GB work by Abney (1987). Under this analysis, the combination of prenominal elements like D with nominal projections is viewed as a *head-complement-phrase*. The principle constraining structures of this sort is (6).

(6) *head-complement-phrase* ⇒
$$\begin{bmatrix} \textit{headed-phrase} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{comps}\ \boxed{1} \\ \textsc{head-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cat}|\textsc{comps}\ \left\langle \boxed{2} \right\rangle \oplus \boxed{1} \\ \textsc{non-head-dtrs}\ \left\langle \left[\textsc{synsem}\ \boxed{2} \right] \right\rangle \end{bmatrix}$$

According to (6), the prenominal element selects a nominal projection via its valence feature COMPS. After both combine, the resulting phrase no longer has an NP in its COMPS list. Non D-heads always select Ds with empty COMPS lists (i.e. DPs), ensuring that D is obligatory to integrate NCs in larger structures, which rules out bare N arguments **boy sings*. The requirement that D be fully saturated for it to be selected by other heads rules out structures like **a sings*, where a verb combines directly with a N-less determiner. A NC licensed by (4) and (6) is shown in Figure 3. Modifiers of N are assumed to be introduced by (5), as in the NP analysis.

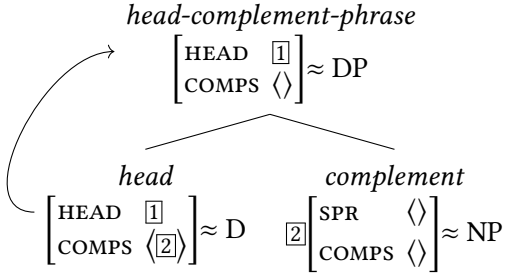

Figure 3: DP analysis (*head-complement-phrase*)

On this approach, D determines the internal structure and the distributional properties of the NC as a whole. As we saw, this seems counterintuitive in light of some of the English data in (2), where the agreement information seems to flow from N alone. However, it is a natural assumption if one considers constructions like (7) in German, where the inflection on V appears to to be coming from D alone, given that the person values on D and N do not coincide (Netter 1994: 301).

(7) Du Idiot {hast / *hat} das Brot vergessen.
you.2SG idiot.3SG have.2SG have.3SG the bread forgotten
'You idiot forgot the bread.'

Both (7) and (2) can be accommodated to NP and DP approaches by appealing to underspecification. For instance, in the case of (7), a proponent of the standard NP treatment could say that German Ns are underspecified for a PERSON value and simply inherit it from the PERSON value of the D in their SPR list.[5]

[5]Pollard & Sag (1994: 47–51) propose a modified NP approach that combines aspects of the NP and DP analyses by incorporating a mechanism of mutual selection between the specifier

Overall, the main difference between the NP and DP theories concerns locality of selection (Sag 2010). Assuming a head can only select the properties of its sister, each approach makes different predictions about what features should be accessible for selection after an N is combined with a prenominal element. Treating NCs as instances of *head-specifier-phrase* implies that the properties of the prenominal element (e.g. D) are not accessible after it is removed from SPR. Treating NCs as objects of the sort *head-complement phrase* implies, in turn, that the properties of N are not accessible after NP is removed from COMPS.

In spite of these differences, the standard NP and DP analyses outlined above share many assumptions about the structure of NCs. Both approaches assume that there is a unique element – typically, a determiner – that has to be combined in the right order to complete NCs, turning them into suitable arguments for other selecting categories. Once this special element is combined, the NC is closed off to further prenominal elements and its combinatorial history is no longer accessible to other selectors. Consider the examples in (8)–(11).

(8) Amy bought [this (big) bed].

(9) * Amy bought [(big) bed].

(10) * Amy bought [this my big bed].

(11) * Amy bought [big this bed].

The standard NP and DP analyses outlined above are all unanimous in licensing (8) and ruling out (9)–(11). However, as we will see in Section 3, analogues of these structures are all acceptable in Mandarin Chinese.

3 Puzzles

In Section 2, we provided a review of the standard theories about NCs (as proposed within HPSG). When taking Mandarin Chinese into account, the empirical data appears to not perfectly align with either of the proposals. In this section, we summarize the puzzles that arise when applying these theories to CNCs.

and N. On their theory, N selects its specifier via SPR and the specifier also selects its N head through a dedicated SPEC feature. Pollard & Sag (1994: 371–373) motivate this NP analysis on the basis of facts about declension classes and adjectival inflection in German (see also Machicao y Priemer & Müller 2021). Since nothing here hinges on the difference between this and the more standard NP approach outlined above, we assume the latter for ease of exposition.

3.1 Challenges for the standard DP approach

As it is well known (see Chierchia 1998, a.o.), Mandarin Chinese lacks articles and NCs can appear in argument positions with or without DEM or CLF(P).[6] That is, bare Ns, CLFP-N, DEM-N and DEM-CLFP-N are all grammatical combinations, cf. (12). In other words, DEM and CLF, traditionally analyzed as D-heads in DP analyses, are not obligatory in CNCs. The optionality of D is a problem for the DP approach, which requires D to project a DP.[7] This leads to the first puzzle: an adequate analysis of CNCs needs to make both, bare and complex NCs, selectable by a verb.

(12) a. wo mai-le *shu.* (bare NP)
1.SG buy-PFV book
'I bought {a book / the book / ∅ books / the books}.'

b. wo mai-le *san ben shu.* (CLFP-N)
1.SG buy-PFV three CLF book
'I bought three books.'

c. wo mai-le *na shu.* (DEM-N)
1.SG buy-PFV DEM book
'I bought that book.'

d. wo mai-le *na san ben shu.* (DEM-CLFP-N)
1.SG buy-PFV DEM three CLF book
'I bought those three books.'

Furthermore, the various possible positions for MODs[8] within CNCs represent a further challenge for the DP analysis, cf. (13). For instance (13a) and (13b) show

[6] At this point of our argument, we are using CLFP as a mere descriptive convenience to refer to NUM-CLF sequences. We will see in Figure 4 and Section 4.2, there is good evidence for a left-branching structure where CLF and NUM build a constituent headed by CLF – i.e. a CLFP (Bale et al. 2019, Her & Tsai 2020, Wągiel & Caha 2020, 2021).

[7] Optionality is even more problematic in theories like Cheng & Sybesma (1999) and Cinque (2005, 2023), which decompose D into multiple heads (NUM^0, DEM^0, CLF^0). Either all of them would have to have phonetically empty variants (which arguably generates unwanted readings for cases like 12a), or the COMPS lists of each of them would have to be disjunctively specified: e.g. DEM^0 can select a ModP, or a CLFP, or an NP, etc.

[8] In this paper, we limit ourselves to phrasal *de*-marked MODs like *bai de* 'white *de*' in *bai de zhi* 'white paper' (cf. Paul 2005, Sun 2015, Xu 2018, i.a.). In the interest of simplifying the exposition, we mostly refer to adjectives in this paper, but the *de*-marker can attach to different types of nominal modifiers, such as relative clauses, possessives, PPs, etc. Furthermore, we assume that non-*de*-marked MODs, e.g. *bai* in *bai-zhi* 'white paper' or 'blank paper' , are introduced morphologically through a compounding rule that forms a new lexeme out of two, being, therefore, outside the scope of our investigation.

that the order of CLFPs and MODs can be reversed without affecting the meaning of the NC. This suggests that the syntactic relation of the CLFP with respect to N is similar to MODs, i.e. more like an adjunct than a D head. Even more challenging is the possibility to realize MODs preceding a DEM, cf. (13c). In a standard DP approach, N is not accessible after NP is removed from the COMPS list of D; but to enable *da de* 'big' to modify the N *shu* 'book' locally in (13c) the information of N needs to be projected above DEM. This leads us to the second puzzle: an adequate analysis of CNCs needs to account for the different attested positions of MODs.

(13) a. na san ben *da de* shu
DEM three CLF big DE book
'those three big books'

b. na *da de* san ben shu
DEM big DE three CLF book
'those three big books'

c. *da de* na san ben shu
big DE DEM three CLF book
'those three big books'

Cases like (13c) also seem to be at odds with Greenberg's (1963) Universal 20, which says that, in pre-N position, DEM has to precede ADJ. DP theories like Cinque's (2005), which hardwire Universal 20 in the form of a rigid sequence of functional heads, have to say that MOD can only appear before DEM if it undergoes movement. However, we will see that this generates unwanted readings.

A further challenge arises from the behavior of CLF. As proposed in the literature (Cheng & Sybesma 1999, Her 2012a,b, Li 2013, a.o.), the class of CLF can be further subcategorized into sortal and measure CLF (CLF_s, CLF_m), where CLF_m has extra lexical meaning (e.g. 'box' in 15) allowing modification, and CLF_s is purely functional, hence not allowing modification, as shown with (14–15), adapted from Zhang (2011: 7).[9] For instance, in (14), since 'triangular' and 'square' both have to modify 'chips', the intended reading runs into a contradiction – the chips are claimed to be triangular and square at the same time. In contrast, with a CLF_m in (15), one modifier can take scope over CLF_m – yielding 'square box', and the other over the noun, yielding 'triangular chips'.

[9] In HPSG terms, we can say that a CLF_m is able to introduce its own INDEX, which can appear as an argument to elementary predications introduced by MODs; while a CLF_s always inherits the INDEX of its corresponding N, akin to the analysis of parasitic heads in Levine (2010); see also Bender & Siegel (2004) for a similar approach to Japanese classifiers.

(14) # *sanjiaoxing de* na fangfangzhengzheng de *san pian* shupian
triangular DE DEM square DE three CLF_{s} chips
Intended: 'those triangular square chips'

(15) *sanjiaoxing de* na fangfangzhengzheng de *san xiang* shupian
triangular DE DEM square DE three $\text{CLF}_{\text{m}} \approx$ 'box' chips
'those three square boxes of triangular chips'

The modifiability of (some) classifiers makes them more similar to Ns than Ds, blurring the distinction between functional and lexical categories. It also implies that the scope of MODs preceding CLF_{m} can be both CLF or N. This is shown in (16), where the MOD preceding CLF_{m} leads to an ambiguity.

(16) *haokan de* yi xiang shu
nice DE one $\text{CLF}_{\text{m}} \approx$ 'box' book
'a nice box of books' or 'a box of nice books'

Assuming locality (cf. Machicao y Priemer & Müller 2021: 8), these facts suggest two possible attachment positions for MODs preceding CLF_{m}: (i) adjunction inside CLFP and (ii) adjunction to the N projection, cf. Figure 4. This structure predicts the acceptability of (17) ruling out (18) (with the intended reading). However, (17) and (18), adapted from Zhang (2011: 7), pose a problem for the DP approach since MOD_1 in Figure 4 should not be able to locally modify N. In other words, for a right-branching DP approach, any MOD preceding CLF (i.e. the D) should only have scope over CLF.

One could try to derive pre-CLF MODs with scope over N (e.g. *chao haochi de* in 17) by moving them to the left-periphery over the CLF and reconstructing their interpretation at their original N-adjacent position. However, if this kind of movement/reconstruction is allowed for MODs, it becomes a mystery why MODs with CLF scope cannot be at the leftmost position inside NCs. E.g. (18) could be licensed by generating and interpreting *dada de* in a CLF-adjacent position and subsequently moving it to the left edge of the NC. Thus, in the absence of a restrictive theory of which MODs can move and reconstruct, this movement alternative would overgenerate.

(17) *chao haochi de* dada de yi wan chao xiao de yingtao
very delicious DE big DE one $\text{CLF}_{\text{m}} \approx$ 'bowl' very small DE cherry
Intended: 'a big bowl of very delicious small cherries'

(18) # *dada de* chao haochi de yi wan chao xiao de yingtao
big DE very delicious DE one $\text{CLF}_{\text{m}} \approx$ 'bowl' very small DE cherry
Intended: 'a big bowl of very delicious small cherries'

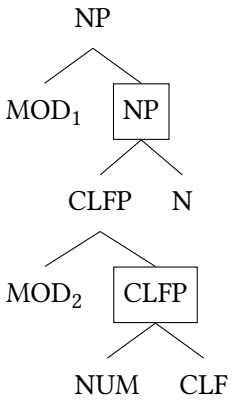

Figure 4: Possible positions for modifiers

Furthermore, it is not only the case that CLF_m can be modified with CLF_m; specification by DEM is also possible in these cases. This CLF_mP-internal DEM is supported by the observation that DEMs can act as semantic functors over CLF_m meanings. For instance, assume that three books are placed respectively in a box and in a basket. In case of contrast, the CLF can be contrastively emphasized: *na XIANG shu, haishi na LAN shu* 'that BOX of books or that BASKET of books'. Hence, DEMs appearing before CLF_mP are also structurally ambiguous, cf. (19).

(19) *na* san xiang shu
DEM three $CLF_{m \approx \text{'box'}}$ book
'those three boxes of books' or 'three boxes of those books'

Therefore, the next puzzle: an analysis of CNCs needs to account for the modifiability of CLF_m (vs. CLF_s) and the ambiguity of MODs and DEMs preceding CLFPs.

3.2 Challenges for the standard NP approach

Compared to the DP analysis, the NP (head-specifier) approach faces less difficulties with respect to the data, but there are still issues to be considered. For instance, taking (20) into account, there are at least two candidates for specifiers in CNCs: DEM and CLFP, which have to be realized in a specific order DEM-CLFP, cf. (20a) vs. (20b).[10] Similar to "standard" specifiers, neither DEM nor CLFP can

[10]Examples like (i) are also possible. But in this case, CLF-DEM-N can only be interpreted as *this kind of book* (singular). Here, we limit ourselves to CLF_s and CLF_m, excluding *kind* CLF, cf. Liao

be iterated, as (21a–21b) show. Crucially, the impossibility of iterating DEMs applies even when DEMs have different scopes, with one applying to N and the other to CLF_m, as in (21b). This is problematic for DP and NP approaches, since any left-peripheral DEM which scopes over N would need to look into the CLFP that it c-commands to see whether there is any other DEM contained in it – a clear violation of locality.

(20) a. *na san ben* guanyu yuyanxue de shu
DEM three CLF about linguistics DE book
'those three books about linguistics'

b. * *san ben na* guanyu yuyanxue de shu
three CLF DEM about linguistics DE book
'those three books about linguistics'

(21) a. * yi *xiang* yi *ben* shu
one $CLF_{m \approx \text{'box'}}$ one CL book

b. * [$_{NP}$ *na* [$_{CLFP}$ *zhe* liang xiang] shu]
DEM DEM two $CLF_{m \approx \text{'box'}}$ book
Intended: 'these two boxes of those books'

A specific problem for the standard NP approach concerns the valency of the SPR feature. On the one hand, it is possible to combine two different specifiers (DEM and CLF) with N, cf. (20a). That is, more than one "specifier" can be selected by N, contrary to (3). On the other hand it is also possible for N to not select either DEM nor CLF (12a), or to select only one of them (12b–12c). That is, the standard NP approach would require either disjunctive lists as the value of SPR (with DEM, with DEM and CLF, with CLF, without DEM and CLF) or it would require lexical rules adding/removing SPR elements. This suggests that DEMs and CLFs diverge from the properties of specifiers and behave more like MODs.[11] If DEMs and CLFs are treated as MODs, some information about the presence of these pre-N elements needs to be projected locally to higher projections in order to rule out multiple DEMs (21b) or combinations like CLF-DEM (20b), cf. Section 4.2.

& Wang (2011) for iteration of CLFPs. Beyond these cases, DEM always precedes CLF.

(i) san ben zhe (zhong) shu
three CLF DEM CLF book
'three books of this kind'

[11]Note that a restriction on the iteration of DEMs and CLFs as in (21) also applies to MODs of the same type (e.g. **the book about linguistics about psychology*) and is not specific to specifiers.

That brings us to the puzzle related to the NP approach: an adequate analysis of CNCs needs to account, on the one hand, for the similar behavior between DEMs, CLFs, and MODs, and, on the other hand, it needs to explain the different possible syntactic configurations with and without DEM and CLF.

3.3 The singular demonstrative paradox

There is a further puzzle for DP and NP approaches that is related to the number interpretation of NCs. When an overt CLFP is present, the number interpretation of DEM-CLFP-N comes from the cardinal relation encoded by the NUM inside the CLFP, as in (22a). Without an overt CLFP, bare Ns have number-neutral interpretations, i.e. both singular or plural readings are possible (22b). A combination of DEM-MOD-N in (22c) is also underspecified for number, since neither DEM nor MOD express number information. However, the paradox emerges when DEM is directly combined with a bare N, as in (22d). In that case, the NC can only be interpreted as singular. This raises the question: what is it about the presence of MOD in (22c) that allows the NC to retain the number-neutral interpretation lexically associated with bare Ns? Why should the absence of MOD have any influence over the absence of a plural interpretation in (22d), given that MOD does not encode plurality, as the singular reading of (22c) shows?

(22) a. wo mai-le na san ben shu.
1.SG buy-PFV DEM three CLF book
'I bought those three books.'

b. wo mai-le shu.
1.SG buy-PFV book
'I bought {a book / the book / ∅ books / the books}.'

c. wo mai-le na da de shu.
1.SG buy-PFV DEM big DE book
'I bought {that big book / those big books}.'

d. wo mai-le na shu.
1.SG buy-PFV DEM book
'I bought that book.'

4 The Head-Functor Approach in Mandarin Chinese

In this section, we introduce the Head Functor Approach (HFA) to NCs (Allegranza 1998, 2007, Van Eynde 2006, 2020, 2021) and propose a solution to the puzzles outlined in Section 3 based on this theory.

4.1 The Head-Functor Approach

The HFA can be defined by its rejection of two distinctions that are basic to NP and DP theories: the distinction between lexical and functional categories and, most importantly, the distinction between specifiers and modifiers.

The first of these contentions is motivated by the observation that the notion of a determiner does not correspond to a morphosyntactically uniform functional category. Expressions that typically fall under the class of determiners share characteristics with lexical parts of speech, such as N and ADJ. An example of the former is CLF in Mandarin Chinese, which, as we saw in (15), can be modified like an ordinary N. The structural parallelism between functional and lexical categories (e.g. CLFP and NP in Mandarin Chinese) is especially problematic for the DP theory, whose defining feature is precisely the idea that NCs are the combinatorial yield of selectional properties of a dedicated functional element (D), which takes a lexical N as its complement. If such Ds do not exist as a category distinct from N, then neither do DPs, by definition (Van Eynde 2006: 157).[12]

The elimination of the specifier-modifier distinction, in turn, is motivated by the fact that bearers of these grammatical relations share more syntactic properties than either DP or NP theories typically ascribe to them. First, both specifiers and modifiers can occupy prenominal positions. Second, both add information to the NC that must be projected for the purposes of semantic interpretation and selection by other heads.[13] For Mandarin Chinese, as we saw in (21), the information about whether a head has previously combined with a DEM or a CLF at some point is relevant for selection because DEM/CLF cannot be iterated. Third, specifiers of different types can be stacked, much like modifiers (e.g. *the* BIG RED *book*). We saw this in the case of CLF and DEM in Mandarin Chinese in (20a).[14] Fourth, specifiers like modifiers can be omitted, as bare singular Ns in Mandarin

[12] Another example of N-like Ds are adnominal pronoun constructions like *du Idiot* in (7), where the prenominal position is filled by a pronoun. Conversely, definite determiners in German (*der*, *die*, *das*) can function as pronouns without an accompanying N (Postal 1969, Wiltschko 1998). This can also be taken to suggest an N status, though something has to be said to explain the contrast in the dative plural (*den* vs. *denen*), see Wiltschko (1998: 155). Other putative determiners seem to function more like ADJs, like possessives in Mandarin Chinese.

[13] In the case of specifiers, this can be information about the cardinality of the plurality denoted by N (e.g. *two books*) or about definiteness (e.g. {*the* / *a*} *book*). In the case of MODs, the information is more diverse. It can be an expression of size (e.g. *big books*), color (e.g. *red books*), quality (e.g. *good books*), as well as cardinality (e.g. {*single* / *unique* / *numerous* / *various*} *books*).

[14] Similar examples may also exist in English, depending on how one analyzes sequences like ALL THESE THREE *books*. Though Van Eynde (2006) assumes the HFA approach is necessary for English, we believe that languages like Mandarin Chinese provide much stronger support for it. In spite of that, we cite some data from English and German to facilitate the exposition.

Chinese (12a) show. This is unexpected if specifiers (or modifiers) are treated as heads.

The projectability of prenominals is especially problematic for the standard NP theory because, after the specifier is combined with the head, only the properties of the latter project. The only residue of the presence of a specifier inside a NC is an empty SPR list. Stackability and omissibility are properties that the classic DP and NP theories both take to be exclusive to modifiers. Therefore, the fact that elements taken to be specifiers/Ds exhibit these properties cannot be expressed under either of these accounts without special stipulations. For instance, in order to derive omissibility (i.e. bare Ns), the DP approach would have to appeal to an empty D head, while the NP approach would need to posit an empty specifier or a unary rule that eliminates the element in the SPR list of the head.

Crucially, the HFA strives to capture all of the properties of specifiers and modifiers while preserving locality of selection and endocentricity within NCs (Chomsky 2007, Chomsky et al. 2019, Bruening 2009, 2020, Machicao y Priemer & Müller 2021). This leads the HFA to view N as the heads of NCs and prenominal elements previously analyzed as specifiers, modifiers or Ds as functors over N.

Following the rejection of the distinction between specifiers and modifiers, the selection features SPR, MOD and SPEC are replaced by a single feature SELECT. It is through this feature that functors (ADJs, DEMs, CLFPs, possessives, etc.) impose selectional constraints on the *synsem* of their corresponding N-heads.

The HFA assumes with previous theories the Head Feature Principle in (4) as a constraint on objects of the sort *headed-phrase*. Corresponding to the abandonment of SPR, MOD and SPEC, the schemas for *head-specifier-phrase* (3), and *head-adjunct-phrase* (5) are replaced by the more general Selector Principle in (23) (based on Van Eynde 2006: 164), which constraints objects of sort *head-functor-phrase*. This allows the (non-head) functor to select the head daughter.[15]

(23) *head-functor-phrase* ⇒

$$\left[\begin{array}{l} \textit{headed-phrase} \\ \textsc{head-dtr}|\textsc{synsem}\ \boxed{1} \\ \textsc{non-hd-dtr}\ \left\langle \left[\textsc{synsem}|\textsc{loc}|\textsc{cat} \left[\begin{array}{ll} \textsc{head}|\textsc{select} & \boxed{1} \\ \textsc{comps} & \langle\rangle \end{array}\right] \right] \right\rangle \end{array}\right]$$

To register the effects of prenominal elements on N the MARKING feature proposed by Pollard & Sag (1994: 46) is used. MARKING values can be used to state

[15] In comparison to Van Eynde's Selector Principle, we enforce the necessity of the functor's COMPS list to be empty. This parallels the constraints generally imposed on *head-specifier-phrase* and *head-adjunct-phrase* (cf. Müller & Machicao y Priemer 2019: 333 & 335). This condition is necessary to ensure that CLF (without NUM) cannot be a functor of N, cf. (27).

selectional constraints of functors or heads over NCs. We propose a MARKING value *weak* (for bare N and CLF) and *strong* (for DEM). These values play a similar role to SPR lists, however, as we will see in the next section, MARKING gives the HFA more flexibility than the distinction between empty and non-empty SPR, since different subsorts of *weak* and *strong* can be postulated (e.g. *n(oun)-marked*) with the purpose of modeling more fine-grained selectional constraints on NCs. E.g. some functor or V might be constrained in such a way that it can only select for NCs that have a specific subsort of *weak* (e.g. *n-marked*) as its value.

The projection of MARKING is governed by the Generalized Marking Principle in (24), which ensures that the MARKING values of a head-functor phrase come from its functor (Van Eynde 2006: 166).

(24) *head-functor-phrase* ⇒
$$\left[\begin{array}{l} \textit{headed-phrase} \\ \text{SYNSEM|LOC|CAT|MARKING } \boxed{1} \\ \text{NON-HD-DTR } \left\langle \left[\text{SYNSEM|LOC|CAT|MARKING } \boxed{1}\right] \right\rangle \end{array}\right]$$

Taken collectively, the Head-Feature Principle in (4), the Selector Principle (23) and the Generalized Marking Principle (24) yield the structure depicted in Figure 5.

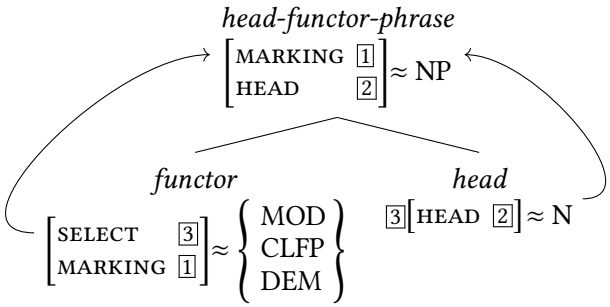

Figure 5: NP analysis (*head-functor-phrase*)

The structures licensed by the HFA combine aspects of both NP and DP theories. On the one hand, the HFA is unequivocally an NP approach, since the category D is not assumed and N functions as the head of NCs. On the other hand, however, the HFA departs from most NP analyses in two crucial respects: (i) it rejects the notion that N imposes selectional requirements on its prenominal dependents; and (ii) a nominal projection can, through its MARKING value, encode fine-grained categorial information about its prenominal daughters, providing a

local record of its "combinatorial history", much like a DP encodes information about D. As David Adger (p.c.) points out to us, the idea that a phrase may simultaneously inherit categorial properties of its lexical head and its non-head daughter makes the HFA essentially a version of Grimshaw's (1991) theory of extended projections encoded in the formalism of typed feature structures.

4.2 Accounting for the Mandarin Chinese puzzles

In the case of Mandarin Chinese, we want the HFA to account especially for the following properties, which lie at the heart of the puzzles discussed in Section 3: (i) the modifiability of CLF_m; (ii) the similar prenominal distribution of CLF, DEM, and MOD; (iii) the differences between MOD, CLF and DEM with respect to iteration; (iv) the optionality of CLF and DEM; (v) the singular DEM paradox.

Though each of these puzzles taken individually could be solved by adding some stipulation to standard NP or DP approaches, we are not aware of any version of these theories that could address all four of them simultaneously. We will show that the HFA is essential to provide a unified and coherent solution to all of these problems, while also raising interesting typological hypotheses.

The first ingredient of our theory is a hierarchy of nominal HEAD values, as depicted in Figure 6. Due to the different positions and interpretations MODs and DEMs can have inside NCs according to the subtypes of CLF (CLF_s and CLF_m), we assume that N and CLF constitute a natural class of type *noun*, which is divided in different subtypes, with measure classifiers (*m-cl-noun*) being at the same time subtypes of *n(ouny)-noun*, like lexical nouns (*lex-noun*), and of *cl(assifier)-noun*, like sortal-classifiers (*s-cl-noun*).[16] Prototypical Ns like *shu* 'book' have HEAD values of type *lex-noun*.

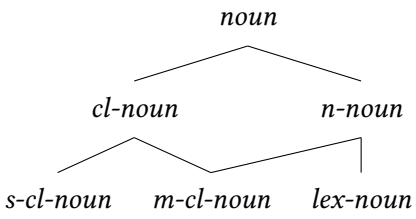

Figure 6: Hierarchy of nominal HEAD values

[16] Further evidence for this hierarchy comes from the historical development of classifiers out of nouns, see Huang (1964). On this picture, we can understand this diachronic development as a grammaticalization of elements of type *lex-noun* as *m-cl-noun* and, subsequently as *s-cl-noun*.

We posit that modifiers (i.e. DePs) and DEMs can attach only to elements of type *n-noun*. For this to work, we also need to assume a left-branching analysis, where NUM and CLF combine to form a CLFP before combining with the head N. This account explains why DePs and DEMs have a similar distribution and, moreover, why measure classifier phrases can be modified by DeP and DEMs just like ordinary lexical Ns.[17] Since any DeP or DEMs can in principle combine as a functor with CLF_m or N, cases where DeP (16) and DEMs (19) precede NUM-CLF_m-N sequences are predicted to be structurally ambiguous. No such ambiguity should exist for sortal classifiers, because they are not a subsort of *n-noun*. That is, our account derives the range of positions in Figures 7–8 for DePs and DEM in NCs with measure classifiers and for NCs with sortal classifiers.

This proposal correctly predicts non-spurious structural ambiguities in (25).

[17] As a reviewer notes, the class of *m-cl-noun* is not semantically homogeneous, given that some of its members can have both counting and measuring readings, as in (i) adapted from Li (2013: 135):

(i) a. wo ling-le *liang ping* *hongjiu.* (counting reading)
1.SG lift-PFV two $CLF_{m \approx \text{'bottle'}}$ red.wine
'I carried two bottles of red wine.'

b. ta-de jiuliang shi *liang ping* *hongjiu.* (measuring reading)
3.SG-DE drinking.capacity BE two $CLF_{m \approx \text{'bottle'}}$ red.wine
'The most he can drink (i.e. his 'drinking capacity') is two bottles of red wine.'

Li & Rothstein (2012) and Li (2013) attribute these two readings to different syntactic structures. This is not necessary under our analysis. Making use of the flexible syntax-semantics interface of HPSG, we can distinguish the two readings purely at the level of CONTENT. In the counting reading, *ping* conveys a nominal semantic relation *bottle-rel*, which is the semantic head of the whole NP, taking the relation expressed by N as an argument and the relation expressed NUM as essentially a modifier. In the measuring reading, *ping* conveys a measure function *bottle-measure-rel*, which relates the INDEX of the head N to the number expressed by NUM (see Krifka 1995: 400 for a similar idea). The two readings are depicted in (ii).

(ii) a. $\begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RELS} & \langle \textit{bottle-rel}(\boxed{1}, \boxed{2}), \textit{card-rel}(\boxed{1}, 2), \textit{wine-rel}(\boxed{2}) \rangle \end{bmatrix}$ (counting reading)

b. $\begin{bmatrix} \text{INDEX} & \boxed{1} \\ \text{RELS} & \langle \textit{bottle-measure-rel}(\boxed{1}, 2), \textit{wine-rel}(\boxed{1}) \rangle \end{bmatrix}$ (measuring reading)

The idea would be that the CONTENT value of *ping* is lexically underspecified with respect to whether it encodes *bottle-rel* or *bottle-measure-rel*. The advantage of this treatment is that the uniform syntactic structure is preserved while the different readings are resolved at the semantic level. We leave a more explicit formalization of the semantics of CLFPs for future work.

(25) wo mai-le da de na san xiang shu.
1.SG buy-PFV big DE DEM three $CLF_m \approx$ 'box' book
'I bought those three big boxes of books' or
'I bought those three boxes of big books' or
'I bought three boxes of those big books'

The interpretation 'three big boxes of those books' is ruled out by the structure in Figure 7 because, if *da de* 'big' is predicated of *xiang* 'boxes', then so must be the DEM to its right appearing before the CLF_m – i.e. given their position, these functors have to be the topmost DePs and DEMs inside the CLFP in Figure 7. An approach that allows DeP to raise over DEM (as we suggested above in connection to Cinque 2005) would have trouble capturing this restriction, since there could be a lower copy of *da de* 'big' inside the CLF_mP that is chosen for reconstruction, while DEM is attached high directly to the NP, above the CLF_mP.

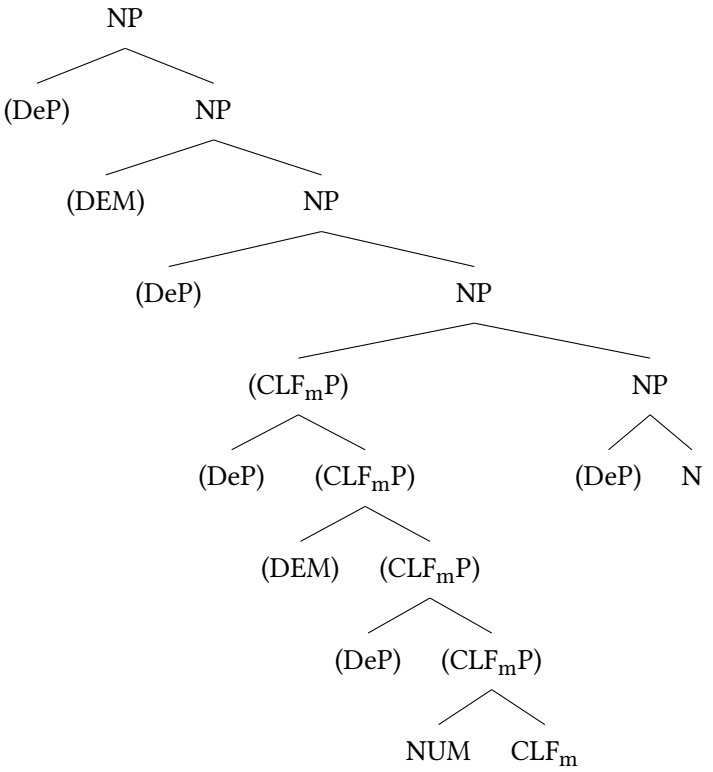

Figure 7: NP structure with CLF_m

The structures in Figures 7–8 model quite well the distribution of DEM, DeP, and CLFP observed in Section 3. In particular, the structural ambiguity of DePs and DEMs preceding NUM–CLF_m is derived because DePs and DEMs can combine either with CLF_mP or higher up with NP. CLFPs are also similar to DePs and DEMs in the sense that they are prenominal and optional. Overall, DePs, DEMs, and CLFPs in Mandarin Chinese have similar collocational properties, which is a natural consequence of the unification of modifiers and specifiers in the HFA.

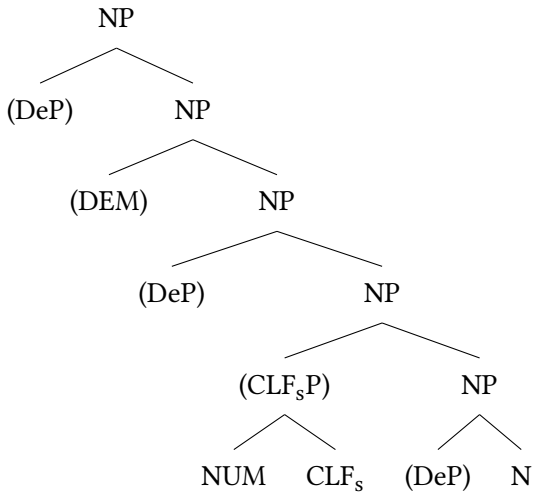

Figure 8: NP structure with CLF_s

There is, however, a difference between DEMs, CLFPs, and DePs that we also observed in Section 3, namely, the fact that DePs can be indefinitely iterated and CLFPs and DEMs can only appear once per NP – in the case of DEMs, regardless of whether they combine inside the CLF_mP or directly with the NP.

To explain why multiple DEMs/CLFPs cannot appear at the same time and DePs can, we need to invoke another ingredient of the HFA. Elements in the NC carry different MARKING values, only some of which can be selected by CLF and DEM. We propose that objects of sort *marking* are arranged as in the hierarchy in Figure 9, where *n-marked* is the MARKING value of N and *cl-marked* is the MARKING value of CLF.[18]

[18]We believe that the hierarchy in Figure 9 provides a more natural encoding for the Mandarin Chinese data than the one in Van Eynde (2006: 167), which is motivated for European languages. That said, for ease of exposition, one can think of *n-marked* as being equivalent to Van Eynde's *bare*, and *weak* and *strong* as being parallel to his *unmarked* and *marked* sorts, respectively.

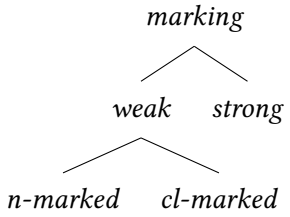

Figure 9: Hierarchy of MARKING values

Recall that, in virtue of the Generalized Marking Principle in (24), the MARKING value of the combination between a functor and a head is the MARKING value of the functor. To explain why DeP functors like the adjectival *haokan de* ('nice') can be freely iterated and combined with either N or CLF_m in any order, we propose the general structure in (26). We assume that DePs are head-complement phrases, with the dependent-marking particle *de* serving as the head daughter. What *de* effectively does, according to (26), is take a predicate of some sort (an adjective, in that case) and map it into a functor that selects an N.

(26) Sample *DeP* (for adjectives)

$$\left[\begin{array}{ll} \textit{head-complement-phrase} & \\ \textsc{phon} & \langle \textit{haokan,de} \rangle \\ \textsc{synsem|loc|cat} & \left[\begin{array}{ll} \textsc{head} & \boxed{2} \\ \textsc{comps} & \langle\rangle \\ \textsc{marking} & \boxed{1} \end{array}\right] \\ \textsc{hd-dtr|synsem|loc|cat} & \left[\begin{array}{ll} \textsc{head} & \boxed{2} \\ \textsc{comps} & \langle \boxed{3} \rangle \\ \textsc{marking} & \boxed{1} \end{array}\right] \\ \textsc{non-head-dtrs} & \left\langle \boxed{3} \left[\textsc{synsem|loc|cat} \left[\begin{array}{ll} \textsc{head} & \textit{adj} \\ \textsc{comps} & \langle\rangle \end{array}\right]\right] \right\rangle \end{array}\right]$$

Crucially, DeP does not impose any requirement on the MARKING value of the head – it inherits its own MARKING value from the *n-noun* (N or CLF_m) it selects. This MARKING value is, by virtue of (24), projected the mother of DeP.

The non-iterability of CLFPs is due to the constraints on the MARKING values of the heads they select. We treat CLFPs as signs of type *num-cl-phrase*, a subtype of

head-complement-phrase, subject to (6). What defines this specific type of head-complement structure is the fact that it is headed by a non-phrasal CLF with a non-phrasal NUM as its complement. The non-phrasal status of the CLF and NUM daughters of CLFP is represented by a positive specification for the boolean LEX feature (Pollard & Sag 1987: 72–73).[19] This ensures that no modifiers can be inserted between NUM and the CLF head – i.e. it rules out structures like **san da de xiang shu* 'three big DE box book'. Crucially, all CLFP functors select a *n-marked* head of type *lex-noun* (in virtue of their CLF head) and have the MARKING value *cl-marked*, which (24) ensures is transmitted to their mother. (27) exemplifies this.

(27) Sample structure for *Classifier Phrase*

$$\left[\begin{array}{l} \textit{num-cl-phrase} \\ \textsc{synsem}|\textsc{loc}|\textsc{cat} \left[\begin{array}{ll} \textsc{head} & \boxed{2}\left[\begin{array}{ll} \textit{cl-noun} & \\ \textsc{select} & \left[\begin{array}{ll} \textsc{head} & \textit{lex-noun} \\ \textsc{marking} & \textit{n-marked} \end{array}\right] \end{array}\right] \\ \textsc{comps} & \langle\rangle \\ \textsc{lex} & - \\ \textsc{marking} & \boxed{1}\ \textit{cl-marked} \end{array}\right] \\ \textsc{hd-dtr}|\textsc{synsem}|\textsc{loc}|\textsc{cat} \left[\begin{array}{ll} \textsc{head} & \boxed{2} \\ \textsc{comps} & \langle\boxed{3}\rangle \\ \textsc{lex} & + \\ \textsc{marking} & \boxed{1} \end{array}\right] \\ \textsc{non-head-dtrs} \left\langle \boxed{3}\left[\textsc{synsem}|\textsc{loc}|\textsc{cat} \left[\begin{array}{ll} \textsc{head} & \textit{num} \\ \textsc{lex} & + \end{array}\right]\right]\right\rangle \end{array}\right]$$

Since *cl-marked* is not a subtype of *n-marked*, a second CLFP cannot be added to a NC after a CLFP has already marked the nominal projection – even if there is an intervening DeP between them, as Figure 10 illustrates (the offending phrases are signaled with an asterisk, the remainder of the structure is well-formed).

DEMs in Mandarin Chinese have minimally the structure in (28). What is essential is that DEMs select a phrasal *n-noun* head with a *weak* MARKING value. This predicts that DEM can precede a CLFP (20a), because the MARKING value of the latter is *cl-marked*, i.e. a subsort of *weak* – the value selected by DEM.

[19] The fact that the daughters of these structures have to be non-phrasal likens *num-cl-phrase* to compounds. Unlike compounds, however, the output of the combination is LEX – (this allows DEMs to select CLFPs, cf. 28). We assume that, due to constraints on the sort *phrase*, the result of any phrasal combination (*head-complement*, *head-functor*, etc.) is always LEX –. The fact that the PHON of the complement of CLF (i.e. NUM) precedes that of CLF follows from a general linear precedence rule for all nominal head-complement structures in Mandarin Chinese.

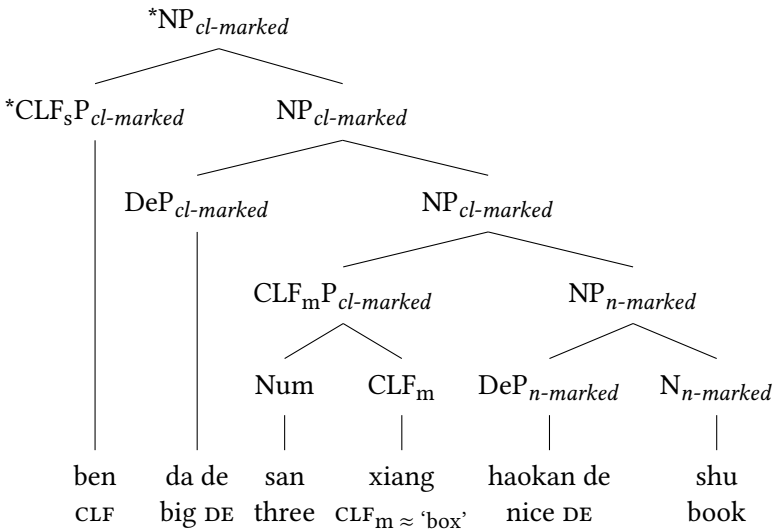

Figure 10: Ill-formed NP structure with two CLFPs

Therefore, we effectively solve one of the puzzles that Mandarin Chinese NCs posed for *head-specifier* approaches (and to some extent also DP theories): the fact that the same structure can have multiple D-like elements.

(28) Minimal structure for *demonstratives*

$$\left[\begin{array}{l}\textsc{cat}\ \left[\begin{array}{ll}\textsc{head} & \left[\begin{array}{ll}\textit{demonstrative} & \\ \textsc{select} & \left[\begin{array}{ll}\textsc{head} & \textit{n-noun}\\ \textsc{marking} & \textit{weak}\\ \textsc{lex} & -\end{array}\right]\end{array}\right]\\ \textsc{marking} & \textit{strong}\end{array}\right]\end{array}\right]$$

After a DEM functor combines with CLF_m or N, the resulting phrase inherits the *strong* MARKING of DEM. An NP marked with *strong* has no problem being selected by a DeP, assuming the latter has a structure like (26). This allows us to solve the puzzle for the DP approach pointed out in connection to (13c) – namely, the fact that DePs can precede DEMs, as Figure 12 illustrates.[20]

The iteration of DEMs is ruled out because DEM is *strong*-marked but selects *weak*-marked elements. Note that *strong* marking projects regardless whether the

[20]The fact that prenominal DeP can appear both before and after DEM, apparently contradicting Greenberg's (1963) Universal 20, arguably follows from the fact that both DEMs and DeP in Mandarin Chinese are subsumed under the general category of functors. We can hypothesize that Universal 20 only applies to languages where DEMs function as specifiers.

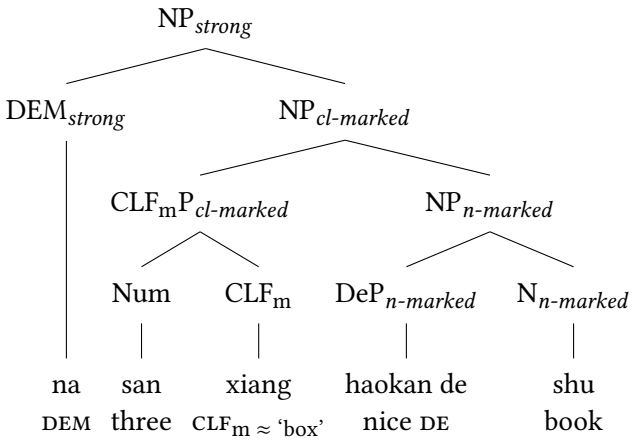

Figure 11: NP structure with DEM and CLFP

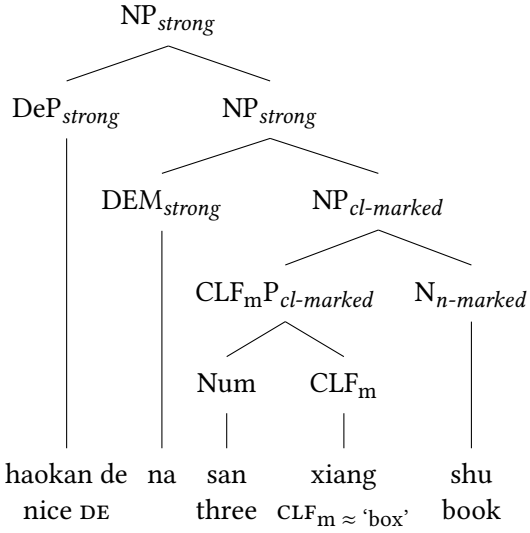

Figure 12: NP structure with DeP preceding DEM

most embedded DEM is attached to N or CLF_m. In the latter case, the MARKING value *cl-marked* that is lexically associated with CLF_m is overwritten by *strong* as soon as DEM is merged. This becomes the MARKING value of CLF_mP, so no further DEM can be added to N to the left of the CLF_mP, as Figure 13 shows.

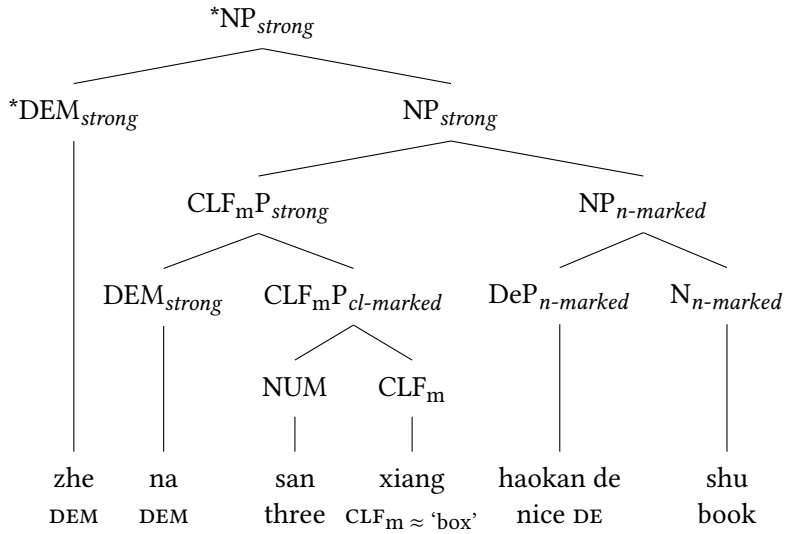

Figure 13: Ill-formed NP structure with two DEMs

As we hinted at in Section 3, in the absence of a MARKING feature, it would not be possible to capture this effect without somehow relaxing locality of selection. On a DP theory, one would have to say that DEM can probe inside the non-immediate daughters of its complement to make sure that no other DEM was combined inside of them. On standard NP theories, one would have to first allow N to have two optional specifiers (see for instance Ng 1997) and then impose a constraint to ensure that, if the second specifier contains DEM somewhere among its non-head daughters, DEM cannot appear as the first specifier.

This account also explains why CLFPs cannot precede DEMs within the NP, as we saw in (20b). Given (28), any NP mother of DEM will have *strong* MARKING value. This is incompatible with the selectional requirements imposed by CLFPs (27), which require *n-marked* NPs as their sisters, as Figure 14 illustrates.

With these ingredients, we can also envision a solution to the two of the remaining puzzles: the optionality of CLF and DEM (Section 3.1) and the singular demonstrative paradox (Section 3.3). The optionality of prenominal elements like CLF and DEM can be explained by positing that verbs and other heads that can

take NP as their valents in Mandarin Chinese simply do not care about the MARKING values on NP [21]. That is, the MARKING values of NP valents are underspecified, as illustrated by the partial entry for *mai* 'buy' in (29).

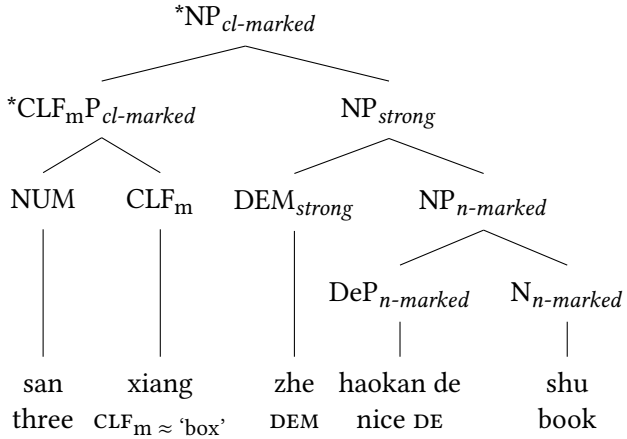

Figure 14: Ill-formed structure with CLFP preceding DEM

$$(29)\quad \begin{bmatrix} \textsc{phon} & \langle mai \rangle \\ \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & verb \\ \textsc{subj} & \langle \text{NP}_{marking} \rangle \\ \textsc{comps} & \langle \text{NP}_{marking} \rangle \end{bmatrix} \end{bmatrix}$$

We can also solve the singular demonstrative paradox in (22) – i.e. the observation that the combination of a DEM and a bare N can only be interpreted as singular, while the combination of a DEM with a modified N can be singular or plural. The key to solving this puzzle lies in the requirement that DEM select an element of type *n-noun* with the LEX value − (28).[22] A bare N is of type *lex-noun* (i.e. a subtype of *n-noun*, along with *m-cl-noun*) and has the LEX value +, as in (30). But after combining with a DeP, the resulting phrase becomes LEX −. The number neutrality of the resulting phrase follows from the fact that N and DeP are both underspecified for number.

[21]Verbs in Mandarin Chinese do impose requirements on their valents beyond what we formalize in (29), depending on the grammatical function of arguments (Huang et al. 2009). Subjects, for instance, can only be definite NPs, whereas some combinations like CLFP-N (with a null NUM proform meaning *one*, see below) are only possible as objects. These semantic restrictions can be encoded as constraints on the CONTENT values of the elements in the SUBJ or COMPS of verbs.

[22]With respect to the LEX feature, see Pollard & Sag (1987) and Arnold & Sadler (1992).

(30) Minimal structure for *lex-noun*s (a subtype of *n-noun*)

$$\begin{bmatrix} \textsc{synsem|loc|cat} & \begin{bmatrix} \textsc{head} & \textit{lex-noun} \\ \textsc{marking} & \textit{n-marked} \\ \textsc{lex} & + \end{bmatrix} \end{bmatrix}$$

A consequence of (30) is that DEM cannot directly combine with a bare N.[23] We propose that when DEM combines with a seemingly bare N, there is actually a covert singular CLF_sP. We must posit, therefore, a phonologically empty NUM expressing a singular cardinality relation and a null CLF_s selecting this singular NUM via *head-complement-phrase*, giving rise to a structure like Figure 15.

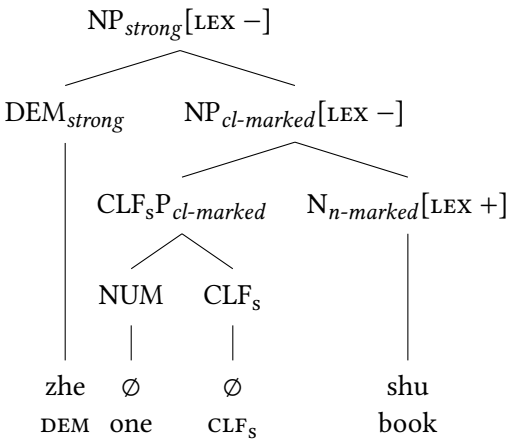

Figure 15: NP structure with covert singular CLF_sP

There is independent evidence for a null proform for 'one' in Mandarin Chinese. Phrases where NUM does not overtly occur can only be interpreted as singular (e.g. *na ben shu* 'that CLF book'), indicating the presence of a covert singular NUM (see Her et al. 2015 and Zhang 2019: 183–187 for more discussion).[24]

[23] This also predicts that DEM cannot combine directly with a CLF_m head (a subtype of *n-noun*), before CLF_m combines with its NUM complement giving rise to a phrasal structure like (27).

[24] Similarly, the existence of a null CLF_s can be supported by structures where CLF_s is optional, like *wuqian (ge) ren* '5000 (CLF) person' (Her 2012a: 1669). In some northern Chinese dialects and formal registers, NUM-N sequences are even more productive and can occur with other kinds of Ns (Her et al. 2015). The fact that the null CLF_s has a more widespread distribution in some forms of speech follows from variation in its selectional properties. We can speculate that, unlike in standard Mandarin Chinese, the null CLF_s in these varieties does not require the element in its COMPS list to be the null NUM proform. The association between lexemes and particular registers or situational parameters can be modeled using an extension of the HPSG formalism, see Machicao y Priemer et al. (2022) and Varaschin et al. (2024).

Our theory can, thus, derive these seemingly paradoxical facts from independently motivated assumptions, without attributing contradictory properties to DEM (singular number in DEM-N, number neutrality in DEM-DeP-N sequences).

5 Conclusion and typological hypothesis

In this study we proposed a Head-Functor Analysis (HFA) for NCs in Mandarin Chinese. This is motivated by the observation that, as opposed to what we see in languages with dedicated determiners, in Mandarin Chinese bare Ns can appear as arguments in all contexts and typical modifiers (e.g. APs) and specifiers (DEMs) can be freely interweaved and co-occur. The structural ambiguity of elements that appear before NUM also supports this approach and provides evidence for a left-branching [[NUM CLF] N] structure headed by N.

All in all, the HFA allows us to solve the puzzles that NCs in Chinese pose for standard NP and DP theories. Bare and complex NCs are licensed as full NPs, without the need to posit empty specifiers or Ds. DEM, CLF, and MODs can be unified under the category of functors which select and mark N-heads, which explains their prenominal status and optionality. Constraints on the MARKING values of the heads selected by each of these functors account for the distributional differences between them, e.g. for the fact that DEM can precede CLFP (but not vice versa), and that MODs can be iterated but DEM and CLFP cannot. We also proposed that CLF_{m} and CLF_{s} have different structures and that DEM and MOD can attach only to elements of type *n-noun*, i.e. CLF_{m} or lexical Ns. The singular demonstrative paradox is solved by postulating a lexicon containing only one phonologically empty CLF_{s} and an independently motivated a singular NUM.

The behavior of prenominal elements in Mandarin Chinese is very different from what we see in languages like German or English, both of which have dedicated determiners (Pollard & Sag 1994, Machicao y Priemer & Müller 2021). In our view, both types of languages favor an NP account, but require different combinatorial mechanisms: in German and English, prenominal elements fall more naturally into two different categories (specifiers vs. modifiers) while in Mandarin Chinese, all prenominal elements seem to behave similarly and preserving the modifier/specifier distinction seems unworkable.

This general outlook suggests a typology of languages which is parallel to the NP/DP parameter proposed in the minimalist tradition, from which many properties have been argued to follow (Cheng & Sybesma 1999, Bošković 2007, Bošković et al. 2013). Rather than interpreting this in terms of the presence of DPs, these properties could be due to the presence of structures of the sort *specifier-head-phrase* or *head-functor-phrase* in each language. D-less languages like Mandarin

Chinese, Polish and Turkish would only have the latter, while English and German would only have the former. It remains to be seen the extent to which Mandarin Chinese conforms to these generalizations and how they can be derived from the differences between *head-functor* and *specifier-head* phrases.

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Abbreviations

N(P)	noun (phrase)
D(P)	determiner (phrase)
NUM	numeral
CLF(P)	classifier (phrase)
DEM	demonstrative
V	verb
ADJ	adjective
MOD	modifier
PFV	perfective
SG	singular
CLF_m	measure classifier
CLF_s	sortal classifier
DeP	arguments/modifiers of N marked with *de*
SYNSEM	syntax-semantics
DTRS	daughters
CAT	category
SPR	specifier
SPEC	specified
COMPS	complements
SUBJ	subject
PHON	phonology
CONT	content
LOC	local
LEX	lexical
MOD	modified

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Chapter 4

Using belief-perception mismatch to assess the meaning of Subjective Attitude Verbs

Achille Fusco[a], Cristiano Chesi[a] & Valentina Bianchi[b]
[a]NeTS Lab, IUSS Pavia [b]University of Siena

Subjective Attitude Verbs (SAVs) like *find* and *consider* are known to embed only propositions that express a subjective judgement or opinion of the attitude holder. A point of contention, however, is whether both of the subjective attitudes involve a doxastic component. In this study, we empirically assess the doxastic status of SAVs by testing the acceptability rating of attitude reports with the two SAVs in contexts of potential doxastic conflict (PDC). Results showed that attributions with *find* in PDC contexts produced significantly lower acceptability rates than their counterparts with *consider*, suggesting that *find*, but not *consider*, lacks a doxastic component in its denotation.

1 Introduction

Since the seminal papers by Lasersohn (2005) and Kölbel (2004), there has been much interest, both in philosophy of language and in natural language semantics, in linguistic phenomena related to subjectivity, in particular with regards to faultless disagreement and predicates of personal taste (PPT; Stephenson 2007a, Stojanovic 2007, Moltmann 2010, Barker 2013, Bylinina 2014, Gunlogson & Carlson 2016, Muñoz 2019). Such phenomena seem to suggest that the interpretation of certain natural language expressions does not depend on matters of fact alone, but also on the assessment of some relevant individual or group.

It comes by no surprise, then, that a considerable attention has been devoted to Subjective Attitude Verbs (SAVs), such as *find* and *consider*, which are known

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to embed only subjective clauses, e.g., clauses containing a PPT (e.g., *tasty*) or, more generally, a gradable predicate (e.g., *heavy*) that allows for a subjective interpretation (Sæbø 2009, Kennedy 2013, Bouchard 2012, Fleisher 2013, Coppock 2018, Kennedy & Willer 2022). This is illustrated by the contrast between (1) and (2-3):

(1) # I find/consider dinosaurs extinct.

(2) I find/consider this chili tasty.

(3) I find/consider this luggage heavy.

However, SAVs do not form a uniform class, as asymmetries have been observed between *find* and *consider*. In particular, *find* seems to require some first-person experience relevant to the judgement expressed by the complement clause, while *consider* may elude such a requirement. The question then arises whether *find* really resembles its cognates *consider* and *believe* in expressing, at its core, a belief of the subject (Stephenson 2007b, Fleisher 2013, Kennedy & Willer 2022, Vardomskaya 2018, Korotkova & Anand 2021). On the other hand, non-doxastic analyses of *find* include so-called radical reductionist theories (Sæbø 2009, Bouchard 2012), the theory of Muñoz (2019) based on perceptual alternatives and the expressivist proposal by Franzén (2020).

This investigation is not only crucial for precisely characterizing the semantics of *consider* and *find*, but also for contributing to the broader debate about subjectivity in natural language. Indeed, given that embedding under SAVs has been taken as a diagnostic test for subjectivity, we think it is important to disentangle what it is exactly that SAVs select for and what they contribute, compositionally, to the meaning of a subjective attitude report. Therefore, the aim of the present work will be to assess the presence of a doxastic component in the semantics of *consider* and *find*.

It is important to emphasize here that we are not assuming that *consider*, when paired with an appropriate (i.e., subjective) complement clause, behaves exactly like *believe*. In fact, there are good empirical reasons to question such an assumption: *believe* has in fact been argued to encode a weaker commitment of the attitude holder (Koev 2019) and to be incompatible with direct evidence (Charlow 2023).[1] Rather, our focus is on the presence or absence of a doxastic component in the denotation of the two SAVs – specifically, whether the content of the complement clause must be interpreted as compatible with the beliefs of the attitude

[1]We thank an anonymous reviewer for bringing up this important point.

holder. In possible world terms, we set to investigate whether *find* should be regarded as an intensional operator that quantifies over doxastic alternatives. So in the following, we will use the term "belief" to refer to an abstract attitude of a subject *s* towards a proposition *p* such that *s* regards *p* to be true. Thus, if *s* has a belief that *p*, it does not follow that it should be felicitous to utter "s believes that p". Again, since the scope of this work is the strict comparison between *consider* and *find*, we leave aside more fine-grained discussion about *believe* reports.[2]

To address the issue presented above, we investigated experimentally how speakers evaluate 3rd-person SAV ascriptions in contexts of potential doxastic conflict (PDC), where a mismatch between belief and perception arises. By comparing the acceptability of *find* and *consider* reports in such contexts, we aim to elucidate the nature of the attitudes they describe. The remainder of this paper is organized as follows: Section 2 presents the main observations about SAVs, focusing on the asymmetries between *find* and *consider*; Section 3 discusses major accounts that have been proposed in the literature; Section 4 introduces the idea of Potential Doxastic Conflict as a possible way to disentangle belief from perception; Section 5 reports the experimental study we conducted; Section 6 discusses the implications of the results for existing theories and suggests future research directions.

2 Empirical observations

SAVs are a cross-linguistic class of propositional attitude verbs which require that their complement clause express a subjective judgement or opinion of the attitude holder, i.e., the matrix subject. Specifically, embedding objective clauses under SAVs like English *find* results in strong infelicity (4b). This behavior contrasts with plain doxastic attitude verbs like *believe* or *think*, which felicitously embed objective and subjective clauses alike (5).

(4) a. Alice finds the drink delicious.
b. # Alice finds the drink fermented.

(5) a. Alice believes/thinks that the drink is delicious.
b. Alice believes/thinks that the drink is fermented.

Similar patterns are attested with German *finden* (Sæbø 2009, Umbach 2016), French *trouver* (Bouchard 2012), Norwegian *synes* (Sæbø 2009), Swedish *tycka* (Sæbø 2009, Coppock 2018) and Italian *trovare* (Fusco 2022).

[2] 'Believe reports' are attitude reports with *believe*.

Apart from these verbs, however, the class of SAVs also include other clause embedding verbs, like English *consider* and Italian *considerare*. Such verbs show a somewhat more nuanced behavior: they are like *find* verbs in banning clearly objective complement clauses, as in (6), but generally display more relaxed embedding requirements. More specifically, *consider*, but not *find*, can embed propositions expressing judgements or opinions that allow for coordination by stipulation (Kennedy & Willer 2016, 2022), i.e., propositions whose truth can be established if speakers could reasonably set, by stipulation, the arbitrary criteria for the meaning of the main predicate. For example, although the predicate *vegetarian* may strike one as objective, the *consider* report is acceptable in (7a), where the continuation makes it clear that its meaning is deliberately "stretched" as to include anyone whose meat consumption is restricted to shellfish. By contrast, this is not possible with *find*, as shown in (7b).

(6) # I consider the sum of two and two equal to four.

(7) a. I consider Nick vegetarian...
b. # I find Nick vegetarian...
... because the only animals he eats are shellfish.

The two verbs can be distinguished by another important feature, already mentioned in Section 1: Although both seem to enforce some familiarity requirement with respect to the content of the complement clause (Kennedy & Willer 2022), it appears that *find* requires some relevant first-hand experience, whereas *consider* may not have this requirement. First, note that a *find* report is infelicitous if it is made explicit that the attitude subject lacks relevant direct experience:

(8) #Although I haven't tried it, I find this chili tasty (because everyone seems to enjoy it).

This has been taken by some authors to be related to the fact that PPTs like *tasty* already trigger an inference of acquaintance, even when unembedded, as evidenced in (9) (Dilip 2014, 2020; see also Gunlogson & Carlson 2016 on Predicates of Experience and Crespo & Veltman 2019 on the Experience Principle). However, it has been observed that the acquaintance inference is triggered by *find* even when the embedded predicate does not give rise to it when unembedded (Korotkova & Anand 2021, Kennedy & Willer 2022), as shown in (10), taken from Korotkova & Anand (2021):

(9) This chili is tasty, # although I haven't tried it.

(10) Context 1 (direct): The speaker has eaten at this restaurant.
Context 2 (indirect): The speaker read reviews about this restaurant on TripAdvisor.
a. Food in this restaurant is authentic. OK Context 1, OK Context 2
b. I find food in this restaurant authentic. OK Context 1, # Context 2

On the contrary, Kennedy & Willer (2022) argue that *consider* also comes with some familiarity with relevant facts, but not necessarily related to direct experience. Consider the example in (11), taken from Kennedy & Willer (2022), in which a relevant comparison is made with a *believe* report:

(11) Context 1 (direct): Kim doesn't know the ingredients that went into this cake, but based on its taste...
Context 2 (indirect): Kim hasn't tried the cake, but she knows that it was made using rice flour from a mill that also produces wheat flour, so ...
a. ... she doesn't consider it gluten-free. # Context 1, OK Context 2
b. ... she doesn't believe that it's gluten-free. OK Context 1, OK Context 2

A different but related asymmetry regards evaluativity, i.e., the feature of certain natural language expressions of conveying a positive or negative attitude, especially in aesthetic and moral domains. In a series of works on the topic (McNally & Stojanovic 2017, Stojanovic 2019, Stojanovic & McNally 2023), Isidora Stojanovic and Louise McNally have argued that *find* anti-selects for pure evaluativity. As evidence in favor of this hypothesis they report the contrast in (12):

(12) a. ? I find Miró's mosaic on the Rambles mediocre.
b. I consider Miró's mosaic on the Rambles mediocre.

According to the authors, the oddness of (12a) would imply that an (aesthetic) evaluation cannot be made on experiential grounds alone. This point was confirmed by a search on the BNC corpus, which showed that *find* rarely embeds prototypically evaluative predicates like *good*, *bad* and *beautiful*.

Similarly, Stojanovic & McNally (2023) presented a more systematic study on the COCA corpus investigating the subjective nature of moral predicates by examining their combination with the two subjective attitude verbs, *find* and *consider*. The study found that, although moral predicates can naturally occur with both verbs, they exhibit a clear preference for *consider* over *find*. Conversely, PPTs frequently and naturally embed under *find*, but rarely under *consider*. This, again, suggests that the subjectivity observed in moral judgments may differ

from the subjectivity of personal taste. Interestingly, the authors claim that, when embedded under *find*, aesthetic and moral judgements are coerced into being not purely evaluative, but rather introduce an experiential component.

We will now turn our attention to how these observations have been explained by previous accounts of SAVs.

Table 1: Summary of empirical observations on *find* and *consider*

	FIND	CONSIDER
objective complement	#	#
complement supporting stipulation	#	OK
no direct experience	#	OK
evaluative complement	?	OK

3 Accounts of subjective attitude verbs

Stephenson (2007b) first recognized that *find* implies a knowledge of a particular kind with respect to the content of the complement clause. In her account, this intuition was implemented as a requirement of direct experience built right into the denotation of *find*. Sæbø (2009) criticized this analysis and proposed a radical reductionist approach, whereby the only requirement for the embedded clause is to be subjective, i.e., dependent on a 'judge' contextual parameter (Lasersohn 2005, Stephenson 2007a, Stojanovic 2007 a.m.o.), and the only semantic contribution of *find* is to shift the judge to the matrix subject (see also Bouchard 2012).

One of the problems with these earlier theories is that they did not account for the similarities and differences between *find* and *consider*. In particular, in Stephenson's framework, it is hard to imagine a corresponding requirement for *consider* that would explain its embedding patterns. Similarly, on a radical reductionist account, it is not clear whether *consider* should also shift the judge parameter and whether it should contain a doxastic component (see also other problems with these accounts, discussed in detail in Anand & Korotkova 2022).

Later approaches have attempted to tackle the issue in terms of different patterns of presupposition and assertion. Kennedy & Willer (2016, 2022) take both SAVs to express, at their core, a plain doxastic attitude, like *believe*. To explain the embedding patterns and the asymmetries of *find* and *consider*, however, they propose that SAVs trigger specific presuppositions of contingency of the complement clause. More specifically, they propose that SAV ascriptions generate a set

of contextual alternatives to the subject's doxastic state, named *counterstances*. All of the counterstances agree on the objective facts but disagree on the judgements about those facts, reflecting speakers' choices about language use.

Thus, a *consider* ascription would carry the presupposition that the content of the embedded clause is counterstance contingent, in the sense that its truth is not constant across all the counterstances generated. This captures the contrast in (7), p. 94. On the other hand, embedding under *find* would trigger the stronger presupposition of radical counterstance contingency, which implies that the proposition expressed by the complement clause is contingent with respect to each of the counterstances. In other words, not even single counterstances are able to establish the truth of the embedded proposition.

Therefore, in Kennedy & Willer's account, the issue raised by the complement of *consider* is not resolved by matters of fact alone, but also by decisions about linguistic norms. By contrast, the issue raised by the complement of *find* is not resolved even when such decisions are fixed (see Coppock 2018 for a similar strategy reframed in an outlook-based semantics).

Muñoz (2019) proposes that *find* and *consider* differ with respect to both presupposed and asserted content. Casting his analysis in terms of hyperintensions sensitive to patterns of relevant linguistic behaviour, Muñoz's definition of *consider* reports is close in spirit to the counterstance approach: They presuppose that the agent's beliefs about the world falsify the hyperintension of the complement at some model, meaning that a different linguistic behavior may determine a content which is false at all the doxastic alternatives.

Find, on the other hand, presupposes that there is no other agent and world pair (different from the ones to which the report is anchored) at which there is direct evidence verifying the hyperintension as it is anchored to the agent: In other words, no agent other than the subject of the attitude verb can have the relevant direct evidence. The asserted content, in turn, involves quantification over perceptual alternatives, defined as the set of worlds compatible with the agent's direct perceptions. By default, doxastic alternatives are a subset of perceptual ones: In other words, speakers generally believe what they perceive. However, Muñoz admits situations in which they could not take themselves as accurate perceivers, perhaps because perception conditions are not ideal: In this case, the entailment of belief would be blocked.

A crucial difference between the two latter approaches is that in Kennedy & Willer's proposal, both SAVs have a doxastic base; in Muñoz's approach, instead, *find* differs from *consider* in that it does not involve a doxastic component.

4 Potential doxastic conflict

Concerning the presence or absence of the doxastic component in SAVs, the evidence discussed in the literature is limited and controversial: In particular, it revolves around situations of potential doxastic conflict, i.e., a conflict between the subject's perceptions and their beliefs about the referent of the small clause.

Firstly, Muñoz (2019) claims that while a sentence like (13b) would always be infelicitous, (13a) would be acceptable in two kinds of situations: i) one in which Alphonse has forgotten what licorice tastes to him, and mistakenly believes it is tasty to him, or ii) one in which he is abstracting away from his own taste, maybe taking into account how licorice tastes to people in general (therefore evaluating it non-autocentrically; see Lasersohn 2005, Stephenson 2007a).

(13) a. Alphonse doesn't find licorice tasty, but he thinks that it is.
b. # Alphonse doesn't consider licorice tasty, but he thinks that it is.

Secondly, Muñoz (2019) also reports that a first-person *find* report like (14a) would be felicitous when uttered by someone who has seen the movie numerous times and is therefore not interested in it anymore, but who nonetheless thinks that it would be interesting to others in ideal conditions. Again, the felicity of an analogous *consider* report (14b) would not be saved in such circumstance.

(14) a. I don't find the movie interesting (anymore), but it is interesting.[3]
b. # I don't consider the movie interesting (anymore), but it is interesting.

Regarding interpretation (i) for the contrast in (13), Kennedy & Willer (2022: fn. 9) note that there may be nothing irrational in believing a proposition by hearsay while believing its negation through direct acquaintance. Presumably, however, this would be possible only when the subject is not aware of the contradiction.

However, the same objection does not seem to apply to (14a), where the report is in the first-person. One possible worry with (14a) is that, in the complement of *find*, the predicate *interesting* seems to be anchored to the speaker, while in the unembedded clause it does not. Therefore, (14a) is compatible with believing

[3]Note that (14a) would be bad with an overt experiencer PP referring to the subject in the second clause:

(i) # I don't find the movie interesting (anymore), but it is interesting to me.

This shows that the second clause must indeed be interpreted non-autocentrically. We thank an anonymous reviewer for providing this example.

autocentrically the proposition expressed by the complement clause while believing its negation exocentrically. These observations would also apply to the interpretation (ii) of (13).

Finally, Crespo & Veltman (2019) provide evidence that a proposition embedded in a first-person report can, in fact, be believed to be false even without taking into account exocentric interpretations. They report that, when looking at the picture of a Müller-Lyer illusion (Fig. 1), a rational speaker may utter (15) even when realizing that the two arrows are of equal length.

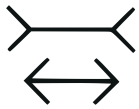

Figure 1: The Müller-Lyer illusion

(15) I find the upper arrow longer than the lower one.

Before proceeding, we wish to address a potential concern that may arise here. The relevance of (15) becomes doubtful if one takes into account that dimensional predicates like *long* or *heavy* often display an ambiguity between "quantitative" and "qualitative" interpretations (see Kennedy 2013 for discussion).[4] This ambiguity is well illustrated in the following example (taken from Kennedy 2013):

(16) The flight from Chicago to Tokyo is longer than the one from Chicago to Hong Kong.

According to Kennedy (2013), there is one reading in which (16) refers to the actual amount of time of the flight and is, therefore, objectively false. However, in a second reading, (16) may refer to the subjective experience of the flight time, which could be affected by other factors such as comfort, weather, travel companions, etc. For clarity, we can indicate the two readings of *longer* as $longer_{quant}$ and $longer_{qual}$, respectively. Once this potential ambiguity is acknowledged, one may worry that (15) is not surprising after all, since two distinct propositions may be at stake:

(17) The upper arrow is longer_{quant} than the lower one.

(18) The upper arrow is longer_{qual} than the lower one.

[4]We thank an anonymous reviewer for highlighting this point.

According to this line of reasoning, (18) would be the content of the *find* attitude in (15), while the belief of the subject would involve either (17) or its negation: Consequently, no contradiction ensues. Although well-founded, there are other empirical facts that show that this analysis is not to be preferred for (15). First of all, notice that, if this were a genuine ambiguity of the predicate *long*, we would expect it to arise also in unembedded contexts, as in (16). However, this does not seem to be the case:

(19) The upper arrow is longer than the lower one.

To our judgement, (19), when referring to a picture of a Müller-Lyer illusion, can only be taken to mean (17), not (18): in other words, the ambiguity does not seem to arise here. The same goes, apparently, for a doxastic attitude report:

(20) I believe/think that the upper arrow is longer than the lower one.

Thus, even postulating the ambiguity, the subjective or qualitative reading of the predicate *long* in the Müller-Lyer scenario would arise only when embedded under *find*, while it would not be available in both unembedded judgements and doxastic reports.[5] Therefore, we assume that no ambiguity arises with *longer* in (15) and that the reason for its acceptability is, indeed, the lack of a doxastic meaning.

According to Crespo & Veltman (2019), however, this would be possible only with ordinary gradable adjectives like *tall* and *long*. In contrast, they claim that a similar pattern would not be possible with adjectives like PPTs. In the following, we would like to propose that it is, in fact, possible to create contexts analogous to the Müller-Lyer illusion for PPTs.

Consider, for example, the scenario in (21):

(21) Context: Mary has to take some medicines that alter her taste for a little while. Nonetheless, one day, after taking her medicines, she can't help taking a slice of her mum's apple pie, her favorite. The taste is terrible due to the medicines.
Mary (to her mother): Your apple pie is tasty, but I have just taken my medicines so it doesn't taste good to me right now.

The sentence uttered by Mary is perfectly natural. However, if we make the assumption that something that tastes good to Mary is tasty to Mary, we observe it is not possible to express the second conjunct of (22) with a doxastic attitude:

[5]Notice that Kennedy (2013) argued that *find* only selects qualitative readings, however, nothing in his theory should prevent qualitative readings to show up in other contexts, as testified by (16).

(22) # Your apple pie is tasty, but I have just taken my medicines so I don't believe it's tasty.[6]

Indeed, (22) gives rise to the well-known Moore's paradox. Note that, *ex hypothesi*, Mary is acquainted with the taste of the pie under normal conditions, so the apple pie is actually tasty according to her: In other words, the first conjunct is naturally interpreted as being anchored to Mary's judgement. Moreover, we are taking Mary as not changing her belief about the pie.

In order to avoid a doxastic conflict, (22) would be felicitously paraphrased using a verb of perception, since this would not entail a belief, as in (23):

(23) Your apple pie is tasty, but I have just taken my medicines so I don't perceive/feel it (as) tasty.

Turning now to SAVs, we observe that *consider* gives rise to the same contradiction as (22), thus confirming that *consider* does have a doxastic component, as expected:

(24) # Your apple pie is tasty, but I have just taken my medicines so I don't consider it tasty.

$\Longrightarrow$ # I believe your apple pie is tasty $\wedge$ I don't believe your apple pie is tasty.

If *find* implied a belief, embedding under *find* should be equally unacceptable, since Mary would still be in a doxastic conflict.

(25) Your apple pie is tasty, but I have just taken my medicines so I don't find it tasty.

Fusco (2022) set up a forced-choice task in Italian, assessing speakers' preferences between *trovo* ('find') and *considero* ('consider') in sentences like (25). The results gave partial support to the hypothesis that *trovo* lacks a doxastic component, however no significant effect of the PDC factor was found with PPTs, since *trovo* was the preferred option across both conditions. This was possibly due to the limitations of the forced-choice design, which doesn't allow to measure fine-grained variations in acceptability among conditions. Moreover, one potential

[6] As mentioned in Section 1, there may be another reason why (22) is infelicitous: *believe* reports are typically not felicitous with direct evidence (Stephenson 2007b, Charlow 2023). Having said that, no such incompatibility is present with *consider*, so we can reasonably attribute the unacceptability of (24) to a genuine doxastic clash.

confound is that in sentences like (25), the referential noun phrase in the introductory clause refers to a kind ("the kind of pie that you usually make"), but in the second clause, the anaphoric pronoun it refers to a specific instance of that kind in the relevant situation.

5 Experimental study

In order to assess the empirical adequacy of various theoretical proposals about the precise characterization of SAVs, this study investigates the effect of PDC contexts, i.e. contexts of belief-perception mismatch, on the perceived acceptability of SAV reports in English. More specifically, building on the experimental setup adopted by Fusco (2022), we ask whether the presence of a PDC affects the perceived acceptability of sentences where *find* or *consider* embed a small clause complement. The present study, then, had a 2x2, within-subjects design, with "Context" (PDC vs no-PDC) and "SAV" (*find* vs. *consider*) as main factors. To overcome the limitations of the previous study, we devised a 7-point acceptability task, in which participants were presented with contexts followed by a monoclausal target sentence. Also, by separating the context and the target sentence, the potentially problematic anaphoric relation (discussed above) was avoided. Subjects were then asked to rate the target sentence as a possible description of the preceding context.

5.1 Materials and procedure

Each experimental item contained a context and a target sentence. In every context a subject has a general evaluation about an object (or a type of object), but, while in situations with no PDC her perception gives rise to an evaluation that is consistent with the general one, contexts with PDC give rise to a contrasting evaluation. Therefore, all the contexts, presented in short narrative texts, described a situation in which a subject *S* has a certain belief *p* about some object, with which *S* is already acquainted. However, contexts varied in whether a PDC, due to a belief-perception mismatch, arises.

The target sentences consisted of present tense 3rd-person attitude attributions, having *S* as matrix subject and *p* as (reduced) complement clause, and were manipulated as to have *find* or *consider* as their matrix verb. To present a complete example, (26) describes a scenario in the PDC and no-PDC condition respectively, while (27) lists the two possible target sentences.

(26) a. Context (PDC): Nora has to take some medicine that alters her taste for a little while. Nonetheless, one day, after taking her medicine, she can't help having a slice of her mother's apple pie, her favorite. The taste is terrible due to the medicine, but she knows it is tasty.

b. Context (no-PDC): Nora is at her parents' house. She's on a diet but she can't help having a slice of her mother's apple pie, her favorite one. The taste is delicious, but Nora regrets eating the cake afterwards.

(27) a. Nora finds the pie tasty.

b. Nora considers the pie tasty.

In this design, target sentences are in the affirmative form, in order to avoid a potential scope ambiguity of negation. Thus, assuming that *find* lacks a doxastic component and tracks direct experience instead, reports with *find* in PDC scenarios are expected to be less acceptable. 16 scenarios were created, each involving a different vague adjectives/PPTs. The adjectives used as main predicates of the complement clauses are the following:

(28) *annoying*, *dangerous*, *easy*, *fragrant*, *frightening*, *funny*, *light*, *long*, *moving*, *pleasurable*, *shabby*, *small*, *tall*, *tasty*, *warm*, *worrying*

Every scenario was developed in the 4 factor combinations described above, yielding a total of 64 context-target pairs. The total number of pairs was split into 4 lists, so that each list contained 4 items for each factor combination. 16 filler items were also added to all lists, resulting in a total of 32 items per list.

5.2 Procedure

Subjects were automatically assigned to one of the four lists as to ensure equal distribution among lists. Therefore, each participant saw a total of 32 items in random order. Participants were asked to rate, on a 7-point Likert scale, how much they agreed with the target sentence as a possible description of the preceding context. The test was administered online on the NeTS Lab experimental platform. Figure 2 illustrates an experimental item in the PDC – *find* condition, as shown on the online platform.

A total of 51 self-reported native speakers of English (21 American, 3 Australian, 27 British; Age range=24-74, M=38.16, SD=13.71) took part in the experiment.

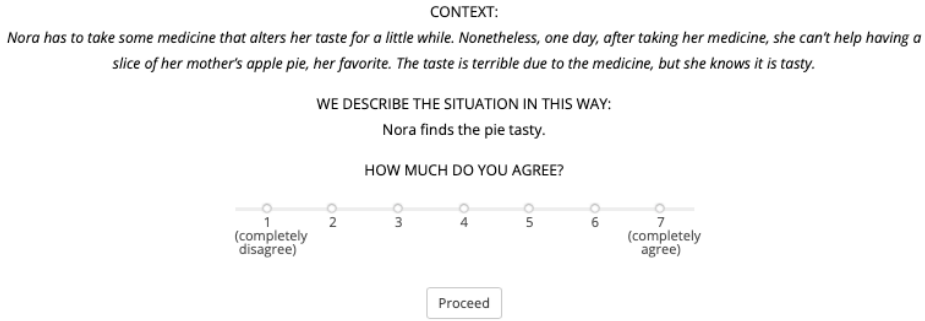

Figure 2: Sample item as viewed from the experimental platform.

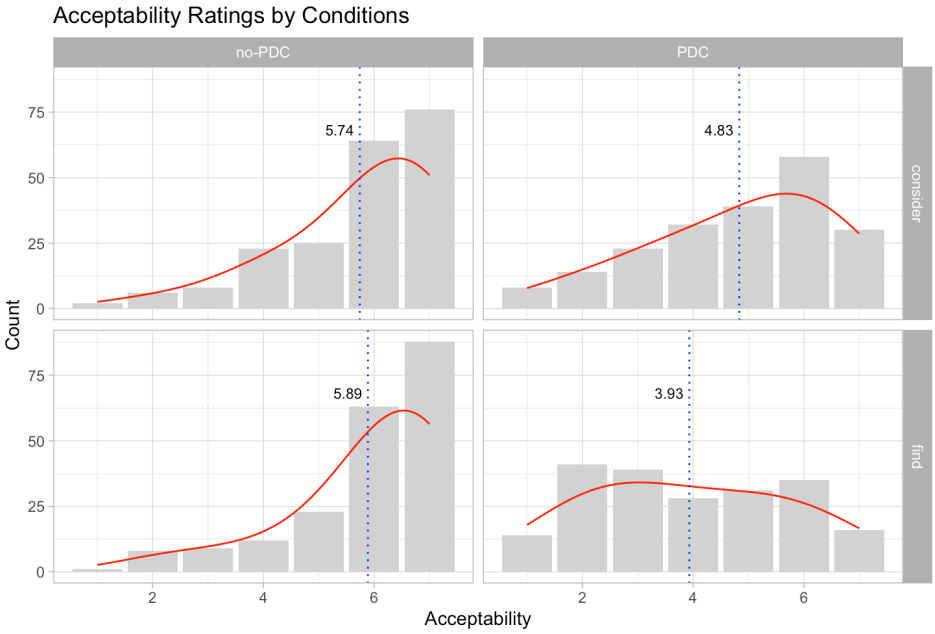

Figure 3: Acceptability ratings according to the various experimental conditions. Acceptability ratings (from 1 = unacceptable to 7 = completely acceptable) for SAVs (*consider* and *find*) after contexts triggering a potential doxastic conflict (PDC) or not (no-PDC). Gray bars indicate response counts, solid lines kernel density estimation of the distribution, dotted lines the mean values.

5.3 Results

Figure 3 shows the distribution of Likert responses (1-7) for each combination of context and SAV. Table 2 provides descriptive statistics.

Table 2: Descriptive statistics for raw ratings across conditions

Context	SAV	mean	sd	median
no-PDC	*consider*	5.74	1.40	6
	find	5.89	1.39	6
PDC	*consider*	4.83	1.65	5
	find	3.93	1.78	4

The results were analyzed with the R programming language using the *ordinal* package (Christensen 2023). Data were fitted against a mixed effects ordinal logistic regression model, with a fixed effect structure of the form CONTEXT×SAV and a random effect structure allowing for by-subject and by-item intercepts. Therefore, the model estimated 2 fixed effect parameters and 1 interaction parameter. A type III analysis of variance based on mixed ordinal logistic regression indicated no statistically significant effect on acceptability of CONTEXT ($\chi^2(1) = 4.34\times10^{-10}$, n.s.) or of SAV ($\chi^2(1) = 1.74\times10^{-8}$, n.s.). However, there was a statistically significant CONTEXT×SAV interaction ($\chi^2(1) = 27.067$, $p < .001$).

To further understand the interaction, a pairwise comparison using Tukey's HSD test was performed. The comparison revealed that the PDC condition triggered significantly lower acceptability rates both with *consider* (no-PDC consider – PDC consider: estimate = -1.258, SE = 0.187, z = -6.739 p < .0001) and with *find* (no-PDC find – PDC find: estimate = -2.623, SE = 0.204, z = -12.877, p < .0001). However, in the no-PDC condition, acceptability is not significantly affected by the kind of SAV present (estimate = 0.292, SE = 0.190, z = 1.534, n.s.), while in the PDC condition, acceptability with *find* is significantly lower than with *consider* (PDC consider - PDC find: estimate = -1.073, SE = 0.181, z = -5.916, p < .0001). This indicates that when the context did not trigger a PDC, the type of SAV used for the attitude report did not significantly affect the ratings. In contrast, contexts that triggered a PDC, although leading to generally lower ratings, asymmetrically impacted the acceptability of the two SAVs in the target sentences. Specifically, the decrease in acceptability was greater for *find* reports than for *consider* reports.

6 Discussion

In this study, the doxastic status of SAVs was assessed by eliciting acceptability judgements of 3rd-person attributions preceded by relevant contexts, which were manipulated in order to license or not license a PDC. We hypothesized that a *find* ascription reports the subject's experience rather than a doxastic attitude. Therefore, in contexts that allow a PDC, a judgment compatible with belief but not with direct experience would be less acceptable under *find* than under *consider*. In fact, results seem to confirm this hypothesis: attributions with *find* after PDC contexts produced significantly lower acceptability ratings than their counterparts with *consider*.

This outcome clearly favours some accounts of SAVs over others. A doxastic theory, such as the one proposed by Kennedy & Willer (2022), fails to account for the contrast observed, since in both cases the corresponding belief ascription is true and, additionally, being felicitously embedded under *find* in the no-PDC condition, the content of the ascription qualifies as counterstance contingent: therefore, the lower acceptability of *find* ascriptions could not be attributed to presupposition failure.

On the other hand, the analysis proposed by Muñoz (2019) is better suited to explain the results: The absence of a doxastic component in the denotation of *find* allows the system the necessary flexibility to represent experiential content independently enough from belief. More generally, we take the results to support the idea that direct experience is indeed essential for the kind of subjectivity that licenses *find* reports, as in the original proposal by Stephenson (2007b).

Our results also seem to point towards a more substantial difference between the two attitude verbs, such that one is not just more restrictive than the other in terms of embedding behaviour. Rather, as it was suggested by Stojanovic & McNally (2023), the two verbs would represent different kinds of attitudes. In this perspective, we think that a promising direction for future work would be to place the discussion about SAVs in the broader context of attitude predicates, and thus to assess similarities and differences with a wider range of verb classes (see e.g., Anand & Hacquard 2013).

Before concluding, we would like to address a few concerns about the study presented here, which will highlight further directions for future research. The first one, which has been raised by Caroline Heycock (p.c.), is that the present tense form of both *find* and *consider* may be associated with both generic and episodic readings. This ambiguity could represent a potential confounding factor in the experiment: Indeed, even after PDC contexts, mean ratings for *find*

ascriptions are still around the scale midpoint, suggesting not complete unacceptability. This could be seen as an unwelcome result, given our hypothesis about the lack of a doxastic component for *find*. We acknowledge the possible ambiguity of our target sentences, which could be avoided in future studies by using adverbial markers like *now* that would force an episodic reading.

Apart from this recommendation, we would like to offer a few observations about the potential ambiguity and the interpretation of the present results. On one hand, under a generic reading, doxastic and non-doxastic theories would both predict the acceptability of *find* reports after PDC: Recall that the scenarios made clear that the subject is already acquainted with the object of the attitude and that she already has a belief about it. On the other hand, under the episodic reading, a doxastic analysis would still predict acceptability, while a non-doxastic account would predict unacceptability, because the situation does not prompt the subject to revise her previous beliefs. This becomes clear if, from a *find* ascription, we generate different paraphrases to reflect the relevant interpretations, as in (30a–d):

(29) Context: as in (26a)

(30) Nora finds the pie tasty.
   a. ≈ Generally, Nora thinks that the pie is tasty.
   b. ≈ Generally, the pie tastes good to Nora.
   c. ≈ Right now, Nora thinks that the pie is tasty.
   d. ≈ # Right now, the pie tastes good to Nora.

Therefore, after a context triggering a PDC, a doxastic analysis would always predict acceptability, whereas a non-doxastic analysis would predict acceptability only with the generic reading.[7] Consequently, even if the ambiguity is taken into account, the contrast observed in the data in the PDC condition seems to be best predicted by a non-doxastic account.[8]

[7] Of course, all the readings would be available in no-PDC notexts, given that the current experience and belief about the pie would be in agreement with the past experiences and the beliefs formed upon them.

[8] A more compelling argument could be made if we could demonstrate that the observed contrast does not arise from an aversion of *consider* to episodic readings. While we do not have data on this matter, future research would benefit from examining sentences like (i):

(i) ?Today/this morning everyone considers me crazy.

If such examples are deemed acceptable, it would suggest that *consider* indeed allows for both readings while still producing the observed contrast.

Of course, the issue will need further scrutiny. One way to address it would be to disentangle the various readings using suitable adverbial modifiers, such as *generally* and *(right) now*, thus producing a paradigm along the following lines:

(31) Generally, Nora finds the pie tasty.

(32) Generally, Nora considers the pie tasty.

(33) Right now, Nora finds the pie tasty.

(34) Right now, Nora considers the pie tasty.

Our prediction would be that, after PDC contexts, both (31) and (32) would be fine, since, presumably, previous generalizations are not affected by the present experience. Although there is reason to believe that both (33) and (34) would be degraded to some extent (since the adverbial modification would make the present experience more salient) we would expect an asymmetry to arise, with (33) more acceptable than (34).

The second concern that we would like to tackle pertains to an aspect of SAV embedding patterns that we have ignored so far, namely the syntactic structure of their complement clauses. In the foregoing discussion and in the experiment, we have considered only patterns of SAVs involving small clauses. However, the literature also reports the possibility for *find* to embed finite clauses (see e.g., Bouchard 2012, Kennedy & Willer 2022), while in some languages this is the only option available for *find*-verbs (Sæbø 2009, Korotkova & Anand 2021). The question, then, is whether the two structures are equivalent with respect to the phenomena discussed so far and, in particular, with respect to the results obtained from the experiment. To that regard, while small clauses under SAVs are generally treated as analogous to finite clausal complements in expressing a proposition, Crespo & Veltman (2019) provide evidence against such a simplistic view. They report the following contrast:

(35) Context: Anna is a newborn baby.

a. Look! Anna finds infant formula tasty!

b. # Look! Anna finds that infant formula is tasty!

This asymmetry suggests, at the very least, that syntactic differences may correlate with differences in semantic interpretation. Specifically, (35a) is compatible with our proposal that *find* does not involve a doxastic component, assuming that the speaker does not intend to attribute a doxastic attitude to the baby.

From this perspective, however, (35b) is unexpected and suggests that *find* + finite clause may convey a slightly different attitude.[9] Thus, it is not at all obvious that the results we obtained with small clause complements would apply to *find* ascriptions with finite complements. Determining this, however, is beyond the scope of the present work and will have to be addressed in future research.

A third limitation, which has been raised by several anonymous reviewers, is the lack of a direct comparison with *believe* reports in the relevant conditions. As we noted in Section 1, we deliberately restricted this study to *find* and *consider*. One reason for this choice was that, as seen above, *believe* has other implications regarding weak commitments and/or lack of direct evidence. The other is that including such verbs into our experimental setting would require us to test items in a slightly different syntactic form: Instead of using a small clause, which is not ideal for the complement clause of *believe*, we should adopt an infinitive *to be* clause. However, we are not sure that our predictions would be borne out in such a syntactic environment, for the reasons also mentioned above. Therefore, we opted for a more minimal comparison between *consider* and *find*. However, future research into this topic should also include a more comprehensive comparison with other clause embedding verbs, including doxastics such as *believe* and *think* but also perception predicates like *perceive* or *feel*. This will surely shed more light on the subject under investigation.

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[9] A possible interpretations could be that, with *find* + finite clause, the embedded proposition *p* must be accessible to the subject, in the sense of Yalcin (2018), i.e., the subject must be able to ask herself *whether-p*. A thorough examination of this hypothesis is deferred to future research efforts.

Abbreviations

SAV	subjective attitude verb	PDC	potential doxastic conflict
PPT	predicates of personal taste		

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Chapter 5

Paradigms and discourse effects of English rising declaratives

Junseon Hong
Stanford University

The aim of this paper is to make a predictable model for rising declaratives (RDs) based on the division of labor between semantics and pragmatics. Building on the major classification of RDs into assertive and inquisitive (Jeong 2018), I first explore a wide range of different functions of RDs. Then, I show how each subtypes of RDs are interpreted by the interaction of conventional meaning and pragmatic reasoning, based on extended Lewisian model. The key proposal lies on the contributions of rising intonation on discourse effects, both on semantic content and projection of commitments.

1 Introduction

In all languages, there is a significant correlation between three grammatical moods and speech acts they issue (Roberts 2018): declaratives provide information, interrogatives request information, whereas imperatives issue a direction. Within these three moods, the former two are associated with speech acts that are related to changing the discourse context, which are assertions and questions. That is, they are basic direct speech acts that are used to exchange information, and each canonically aligns with a distinct syntactic form in English: assertions with falling declaratives and questions with polar interrogatives.[1] However, rising declaratives (henceforth, RDs), such as (1), are non-canonical structures that accompany declarative sentences with rising intonation.

[1]Note that polar interrogatives are not the only type of interrogatives. There are other major classes of interrogatives, illustrated as follows (Ciardelli et al. 2018):

(i) a. Is he attractive$^{\uparrow}$ or charming$^{\downarrow}$? Alternative Interrogatives

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(1) *She's home?*

Due to their linguistic mismatch, RDs highlight the complex pattern of phonetic, syntactic, semantic, and pragmatic interface. Compared to canonical clause types, it is widely recognized that RDs provide further information beyond the expressed proposition (e.g., Gunlogson 2003, 2008, Malamud & Stephenson 2015, Farkas & Roelofsen 2017, Jeong 2018, Rudin 2022). Still, RDs share similarities in their speech acts with both of the two canonical types: falling declaratives, as in (2a), and polar interrogatives, as in (2b), since they possess properties of both (Jeong 2018).

(2) a. Assertive rising declaratives: overlap with assertions
[Context: A asks B where Sally is. B is not sure of Sally's whereabouts:]
A: Where's Sally?
B: (Um...) *She's home?* / She's home. / #Is she home?

b. Inquisitive rising declaratives: overlap with questions
[Context: Sally has been skipping school without any specific reason. B has just come back from work and A wants B to speak with Sally immediately about her issues.]
A: You should speak to Sally right away.
B: *She's home?* / #She's home. / Is she home?

An RD in (2a) functions as an assertion, in which Speaker B responds to the addressee's question by providing information without a concrete certainty. In contrast, an RD in (2b) functions like a question implicating that the uttered proposition is highly likely. From this contrast, RDs can be respectively substituted with either falling declaratives or polar interrogatives. I refer to the former as Assertive Rising Declaratives (henceforth, ARDs) and the latter as Inquisitive Rising Declaratives (henceforth, IRDs), following Jeong (2018).

The central question that arises from this phenomenon is how to account for the two distinct types. To answer this question, a few previous approaches seek a unified account (e.g., Rudin 2022), while others focus on more specific types of RDs, acknowledging the existence of other types (e.g., Farkas & Roelofsen 2017). Jeong (2018) is the first approach arguing for two fundamentally different types

b. Is he attractive$^{\uparrow}$ or charming$^{\uparrow}$? Open Disjunctive Interrogatives

c. Who is attractive? Constituent Interrogatives

For the purposes of this paper, I restrict my discussion to polar interrogatives, which specifically ask for the truth value of the expressed proposition, and omit others from consideration.

of RDs. This paper further extends her idea. I propose a model that delineates the role of semantics and pragmatics, based on the exploration of diverse types of RDs that have not been widely discussed.

This paper is structured as follows: Section 2 takes a close look at four specific functions of RDs that can convey either assertive or inquisitive meanings. Section 3 introduces the adopted framework and outlines relevant approaches. Section 4 draws the detailed contributions of rising intonation in the interpretation process of RDs, and Section 5 explains how each function can be drawn from the interaction of sentence type, conventional intonation, and discourse context. Finally, Section 6 concludes.

2 The pattern of rising declaratives

This section provides a brief discussion of the empirical patterns of RDs, which perform the speech act of either asserting or questioning. Let us begin with the first type, ARDs. I propose two paradigms of ARDs in terms of the uncertainty they implicate: epistemic and metalinguistic.

(3) a. Epistemic Uncertainty ARD
A: Where's Sally?
B: (Um...) *She's home?*

b. Metalinguistic Uncertainty ARD
A: Does he speak Chinese?
B: *He speaks Cantonese?*

The distinction between the two comes from whether the speaker is conveying uncertainty about the truth condition of the proposition or other aspects. (3a) indicates the speaker's tentativeness on the truth value of the expressed proposition. In contrast, (3b) conveys an uncertainty of the relevance to the context, which is not directly associated with the truth value of the proposition: the speaker is unsure whether they are giving an adequate answer to the prior question.

Modal substitution and subordination are two pieces of evidence for the two subtypes of ARDs. First, Epistemic Uncertainty ARDs can be freely substituted with epistemic modals, while Metalinguistic Uncertainty ARDs cannot, as in (4).

(4) a. Epistemic Uncertainty ARD
A: Where's Sally?
B: (Um...) *She's home?* (necessarily means 'She **may** be home.')

b. Metalinguistic Uncertainty ARD
A: Does he speak Chinese?
B: *He speaks Cantonese?*
(does not necessarily mean 'He **may** speak Cantonese.')

Second, parallel behaviors of Epistemic Uncertainty ARDs and epistemic modals are also observed in terms of modal subordination (Roberts 1987, 1989). An Epistemic Uncertainty ARD can be followed by a modal utterance, as in (5a), while a Metalinguistic Uncertainty ARD does not exhibit modal subordination, as in (5b).

(5) a. Epistemic Uncertainty ARD
A: Where's Sally?
B: (Um...) *She$_i$'s home?* She$_i$ **must** have come from school early.

b. Metalinguistic Uncertainty ARD
A: Do you speak Chinese?
B: *He$_i$ speaks Cantonese?* #He$_i$ **must** be born in Hong Kong.

I also follow Jeong (2018, 2021)'s approach that each type of ARDs can bear politeness, often used as a rapport-building process (Podesva 2011, Levon 2016, Jeong 2018, 2021).[2] Each politeness use in (6a) and (6b) corresponds with the paradigm of ARDs in (3a) and (3b), respectively.[3] A more detailed analysis will be provided in Section 5.1.

(6) Politeness effect invoked by ARDs

a. Epistemic Uncertainty Politeness
A: Do you want a glass of water?
B: *I'll have a wine?*

[2]RDs can be used as conversational starters, as shown in (i) below.

(i) A: Hello, *my name is David? I'll be your waiter today?*

Jeong (2021) suggests that this usage may be allowed because checking in to see if the new topic is relevant or informative appears to be more polite than not checking in. I argue that this is closely related to metalinguistic uncertainty.

[3]An anonymous reviewer points out that, in French, lexical material is necessary to make dialogues like (6a) well-formed. While I acknowledge potential differences in the role of intonation in conveying certain meanings or intentions, I leave cross-linguistic generalization for future research.

b. Metalinguistic Uncertainty Politeness
A: Which city is Lenny from?
B: (to the supervisor) *She's from Yemen?*

Two paradigms are contrasted for IRDs as well, according to the bias, as illustrated in (7).[4]

(7) a. Confirmative IRD
[Context: B is buying a ticket for a flight to Seoul at the airport.]
A: There's one flight to Seoul.
B: *The flight leaves at 5pm?*

b. Contradictory IRD
A: I went to the concert last night. Dave is a good singer.
B: *Dave is a good singer?* You must be thinking about Anna.

c. Mirative IRD
[Context: B thought that Dave is the only child in his family.]
A: I met Anna's brother yesterday.
B: (What?) *She has a brother?*

(7a) and (7b) differ in terms of the speaker's epistemic bias toward the expressed proposition. The former illustrates the speaker's high degree of certainty on the expressed proposition. As this type of IRDs is used to confirm the speaker's prediction (7a), they are named Confirmative IRDs.[5] In contrast, the latter implicates the speaker's disbelief in the proposition as it is to ask a question with high suspicion. As this type of IRDs contradicts the addressee's expressed or presupposed content (7b), I call it Contradictory IRDs.[6] Additionally, IRDs that convey the speaker's surprise are classified as a subtype of Contradictory IRDs (c.f., Goodhue 2021). In (7c), the speaker is surprised by the expressed proposition and a surprised speaker would not have prior knowledge or belief that the proposition is true, which is related to a negative bias.[7] As they implicate mirativity, they are named Mirative IRDs.

[4]The rise of IRDs is steeper than that of ARDs. See Jeong (2018)'s experimental result in Section 3.2.4.

[5]The overall contrast is first brought up in Gunlogson (2003, 2008), though may not in the exact labels.

[6]There are also other clause types that indicate bias, which include negative polar questions and tag questions. While space precludes a detailed discussion, interested readers may consult Romero & Han (2004), Malamud & Stephenson (2015), Farkas & Roelofsen (2017), Frana & Rawlins (2019), Goodhue (2022) and references therein.

[7]An anonymous reviewer points out that Mirative IRDs may not be necessarily related to negative bias and could instead be associated with the absence of bias. For a more discussion on the difference between negative bias and the absence of bias, see Sudo (2013).

The negative bias of Contradictory IRDs can be emphasized by an overt dissent expression such as *No way* (8b), while Confirmative IRDs cannot be followed by such expressions (8a).

(8) a. Confirmative IRD
[Context: Same as (7a).]
A: There's one flight to Seoul.
B: *The flight leaves at 10am?* **#No way.**

b. Contradictory IRD
A: Dave is a good singer.
B: *Dave is a good singer?* **No way.**

The distinctive bias of each IRD also leads to a difference in the licensed particle responses, analogous to positive and negative polar questions (Roelofsen & Farkas 2015). Bare particle responses to positive polar questions are unambiguous while those to negative polar questions are ambiguous. The same phenomenon is observed for IRDs.

(9) [Context: Same as (7a).]
A: There's one flight to Seoul.
B: *The flight leaves at 10am?*

a. A: {Yes / #No}, it does. [AGREE, +]

b. A: {#Yes / No}, it doesn't. [REVERSE, −]

(10) A: Dave is a good singer.
B: *Dave is a good singer?*

a. A: {Yes / No}, he isn't. [AGREE, −]

b. A: {Yes / No}, he IS. [REVERSE, +]

As in (9) and (10), particle responses bear two features: [+, −] and [AGREE, REVERSE] (Roelofsen & Farkas 2015). The former are absolute features whereas the latter are relative features. Absolute features are responses for being positive or negative about the truth value of the prejacent proposition, while relative features are responses for agreeing or reversing. The bare particle response *yes* signals [AGREE] and [+], while *no* signals [REVERSE] and [−]. Aligning with this distinction, in (9), *yes* is an acceptable response according to the features [AGREE] and [+] (9a), while *no* is acceptable with [REVERSE] and [−] (9b), identical to positive polar questions. In contrast, Contradictory IRDs can have both (10a) and (10b) as felicitous responses, and thus particle responses are ambiguous like negative polar questions: *no* in (10a) confirms $\neg p$, but *no* in (10b) rejects $\neg p$.

3 Background

3.1 Framework

Before turning into the formalization, this section briefly introduces a framework widely accepted for capturing the conventional effects of sentence types and their associated discourse moves. Since Lewis (1979) introduced conversational scoreboard, extended and enriched models have been developed in the literature (e.g., Farkas & Bruce 2010, Malamud & Stephenson 2015, Rudin 2022). I also adopt the discourse components proposed by Farkas & Bruce (2010) and Malamud & Stephenson (2015).

The Common Ground (henceforth, *CG*) is a set of commitments shared by discourse participants and is assumed to play a significant role in tracking participants' commitments throughout the discourse (Stalnaker 1978). Generally, the role of the discourse is often considered as expanding the *CG* and reducing the context set (henceforth, *cs*). However, subsequent works have identified a limitation of Stalnakerian *CG* in its incapability to represent the individual commitment of each participant with a single set. For example, Gunlogson (2003) defends the necessity of separate tracking of each participant's commitments. Following her idea, Farkas & Bruce (2010) set each participant's discourse commitment (henceforth, DC_X) apart from the *CG*, while the *CG* is reserved as a set of propositions that all interlocutors have agreed upon. Each interlocutor has individual DC_X which is a belief of one's own, having a possibility to be added to the *CG*. Thus, the total commitment of speaker *X* throughout the discourse is $DC_X \cup CG$. This commitment is doxastic by default and does not need to be true in the world where the conversation takes place.[8]

In the process of discourse, the *Table* records the Question Under Discussion (henceforth, *QUD*; Ginzburg 1996, Roberts 1996, 2012). In other words, the *Table* is a stack that records 'at-issue' items. When the item is added to the *Table*, the speaker projects possible future *CG*, which is called the projected Common Ground (henceforth, CG^*). For example, an assertion projects the expressed proposition p to the *CG* ($CG^* = \{CG \cup \{p\}\}$) and a polar question projects each of two possibilities, p or $\neg p$ ($CG^* = \{CG \cup \{p\}, CG \cup \{\neg p\}\}$). The projected commitments of discourse participants (henceforth, $DC_X{}^*$) are defined as analogous to the CG^*. Malamud & Stephenson (2015) posit the $DC_X{}^*$ to allow the moves for tentative commitments of the speaker (speaker's projected commitment; henceforth,

[8]There are different assumptions for other types of speech acts. For example, the speaker of an imperative is assumed to have preferential commitments (Condoravdi & Lauer 2012, Rudin 2018a,b).

DC_{sp}*) or the speaker's best guess on commitments of the addressee (addressee's projected commitment; henceforth, DC_{ad}*).[9]

A cooperative discourse participant would remain consistent with their doxastic commitments in a single discourse move (Krifka 2015). I also suppose that the DC_X* should be consistent throughout the discourse, along with the present ones (i.e., $\cap DC_X \neq \emptyset$, $\cap DC_X{}^* \neq \emptyset$, and $\{\cap DC_X\} \cap \{\cap DC_X{}^*\} \neq \emptyset$). If the commitment, whether present or projected, is restricted to worlds where p is true, the worlds where p does not hold are eliminated. As a result, the intersection with worlds where p does not hold is bound to be empty, which is an unexpected outcome considering that the discourse aims to expand the *CG*.

The discussion up to this point is summarized in (11).

(11) Discourse Components

a. Common Ground (*CG*): the set of propositions that all speakers are publicly committed to (Stalnaker 1978).

b. Discourse Commitment (DC_X): the set of propositions that the speaker has publicly committed to during the conversation up to the relevant time, and which are not shared by all the other participants (Farkas & Bruce 2010).

c. Table (*T*): the stack that records the at-issue content in the conversation (Farkas & Bruce 2010).

d. Projected Common Ground (*CG**): the set of potential *CG*s that gives possible resolutions for the top issue on the *Table* in the next expected stage of the conversation (Farkas & Bruce 2010, Malamud & Stephenson 2015).

e. Projected Discourse Commitment (DC_X*): the set of propositions that the speaker is expected to become committed to or the best guess of commitments made by other interlocutors (Malamud & Stephenson 2015).

3.2 Previous approaches

Numerous accounts of RDs have been proposed based on the components introduced above. Although the space precludes comprehensive overview of every approach, I will investigate a few representative analyses. All of these approaches involve both semantics and pragmatics, though the exact allocation between the two varies.

[9]When the DC_X and the DC_X* are contrasted, I refer to the former as the *present* commitment.

3.2.1 Gunlogson (2003, 2008)

Gunlogson (2003) supposes commitment requirements for both falling and rising declaratives, but the former type locates the commitment to the speaker while the latter type locates it to the addressee. Consequently, falling declaratives update the speaker's commitment set, whereas rising declaratives update the addressee's commitment set. She also supposes that contextual evidence should support the addressee's commitment to make RDs felicitous. By attributing the commitment to the addressee while leaving the speaker's commitment open, the speaker can exhibit bias toward or commitment to $\neg p$. However, it remains unclear for cases where the speaker lacks contextual evidence on the addressee's commitment to the expressed proposition.

Her later work (Gunlogson 2008) focuses on biased questions in out-of-blue contexts that function as questions with the speaker's commitment being contingent on the addressee's. This concept can properly capture Confirmative IRDs with a positive bias of the addressee's commitment. However, as pointed out by Jeong (2018), negative epistemic bias that could previously be explained by Gunlogson (2003) cannot be predicted anymore. It is also unclear how her approaches can be expanded to ARDs which seem to be more related to speaker-oriented commitments.

3.2.2 Malamud & Stephenson (2015)

Malamud & Stephenson (2015) develop an analysis of the tentativeness expressed by RDs in terms of projected commitment sets and metalinguistic issue (henceforth, MLI^p), which is an inquisitive issue having a non-singleton set. The core effect of RDs consists of adding MLI^p and p to the *Table* and adding p to the DC_{sp}*. Since MLI^p takes the priority to be added to the stack, its two possible resolutions must precede the resolution of p.[10] That is, the issue regarding $\{p\}$ can only be taken into consideration after the resolution of MLI^p. Moreover, unlike canonical assertions, the proposition p is added to the DC_{sp}* in the first place, and if the addressee uptakes the move and resolves the MLI^p on the *Table*, it would be moved to the DC_{sp}. Provided with the addressee's ratification, the resulting effect would be very similar to simply asserted p in the first place. This approach is advantageous for predicting ARDs. However, it is insufficient to capture IRDs, especially Contradictory IRDs where the speaker is not committed to the proposition, but its negation ($\neg p$). One might attempt to apply the notion of MLI^p to negatively

[10] Often, only two possible resolutions for MLI^p ($R1$ and $R2$) are assumed for the sake of simplicity, but there can be more than just two potential resolutions.

biased RDs, but to the best of my knowledge, it has nothing to do with reversing the interlocutor's epistemic bias.

3.2.3 Farkas & Roelofsen (2017)

Farkas & Roelofsen (2017) present the discourse effects of IRDs, couched in the Inquisitive Semantics framework (Ciardelli et al. 2013, 2018). Their approach narrows the scope to IRDs and assumes ARDs are of a different nature. IRDs share the inquisitive sentence radical with rising polar interrogatives, while the former is more marked than the latter. As their special effect, IRDs signal the credence level of the speaker, which is zero to low. Their model has an advantage in negative bias with zero evidence of Contradictory RDs. That is, the speaker's negative bias is implied by having low credence at best (i.e., a preference for $\neg p$ over p).

However, in their analysis it seems difficult to capture the case with a positive bias. In a positively biased case, the speaker assumes that p is more probable than $\neg p$: the credence level seems to be higher than the average.

3.2.4 Jeong (2018)

Jeong (2018) makes a clear distinction between two types of RDs, which are classified as either tentative assertions or as biased questions based on intonational structures. Rising intonations, RISE-A (assertive rises) and RISE-I (inquisitive rises), call for a marked interpretation of morphosyntactically declarative utterances. ARDs are marked because they are essentially assertive but are paired with rising intonation, while IRDs are marked because they are essentially inquisitive but are paired with declarative syntax. For ARDs, MLI^p added to the *Table* is what makes them differ from canonical falling declaratives. As MLI^p is at the top of the table, it must be resolved prior to p, identical to Malamud & Stephenson (2015). For IRDs, they have the same sentence radical as polar interrogatives which are contributed from RISE-I, but update the positive answer p to the $DC_{ad}{}^*$. This account is assumed to predict both positive and negative bias, the latter resulting from redundancy, which triggers the pragmatic reasoning that the speaker has a reason to elicit further explanation or justification from the addressee.

However, it is not clear how this account can be expanded to cases when the addressee's present and projected commitment sets are not redundant, yet the speaker coveys a negative bias. To properly account the negative bias, the analysis to come entertains an alternative way of relaxing 'prior addressee utterance

that entails p' to 'prior contextual information that addressee thinks that p'.[11] Nonetheless, the overall idea that the inference of negative bias arises in cases where the prior context is such that the addressee is pivoted toward p (instead of being neutral) still holds.

3.2.5 Rudin (2018a, 2022)

Adopting Jeong (2018)'s key distinction between two fundamental types of RDs, Rudin (2018a) presents a formal pragmatic examination, drawing on Farkas & Bruce (2010). He assumes that falling intonation adds the informative content of a sentence in the speaker's commitment and rising intonation adds *W*, the denotation of $\{p, \neg p\}$ that makes the commitment trivial. He also assumes a pragmatic competition between discourse move minimal pairs. Falling declaratives and RDs constitute a minimal pair, but the distinction lies in the fact that the former type commits the speaker to p while the latter type does not, because of the conventional effect of the rising intonation. RDs also constitute a minimal pair with rising polar interrogatives, only differing in whether $\neg p$ is contained in the issue. The specific convention of RDs stems from the competition between their second minimal pair, rising polar interrogatives. If the speaker chooses an RD, a polar interrogative would be uncooperative. The only source for being uncooperative is $\neg p$, since they both contain p. Also, as the speaker chose not to commit to p (from the effect of the rising tune), it should be the addressee's private beliefs that prevent p to be added to the *CG*. To put it together, the speaker expects the addressee to say p is true, soliciting the addressee to commit to p. Meanwhile, the bias of RDs arises from the pragmatic competition with the other element of the minimal pair, falling declaratives, which differs in whether the speaker commits to p. The speaker has limited evidence (positive bias) or the speaker knows the proposition is false (negative bias). Rudin (2022) extends this idea by applying pragmatic analysis using the style of Optimality Theoretic tableaux.

However, expanding his account to ARDs, with which the speaker apparently gives new information, is left open. The issue seems to be more complicated when metalinguistic issues are involved. He would say that the rising tune associated with ARDs is associated with a different convention, but its exact nature requires further clarification, as he explicitly mentions that the discussion is restricted to IRDs.

[11] Related discussion will be presented in Section 5.2.

4 Contributions of rising intonation

Previous researchers have made various proposals on the effect of rising intonation in RDs: (i) eliminating commitments (e.g., Gunlogson 2008, Rudin 2018a, 2022), (ii) adding metalinguistic issues (e.g., Malamud & Stephenson 2015), (iii) indicating the violation of Gricean Maxims (e.g., Westera 2017, 2018), or (iv) composing markedness (e.g., Farkas & Roelofsen 2017). Instead, I propose that rising intonation overrides the convention of falling declaratives as in (12) in two ways: (i) conventionally increasing the inquisitive content of the proposition, and (ii) contextually projecting discourse components. That is, assertive and inquisitive meanings are conventionally derived, while specific functions are determined by the pragmatic reasoning.

(12) Convention of falling declaratives

a. $Table_o = Table_i \cup \{p\}$

b. $DC_{sp,\,o} = DC_{sp,\,i} \cup \{p\}$

4.1 Semantic convention

To elaborate the effect of rising intonation on semantic content, I adopt the framework of Inquisitive Semantics (Ciardelli et al. 2013, 2018, and references therein). This framework posits that a sentence not only conveys informative content but also expresses inquisitive content by raising an issue. To illustrate, consider Figure 1. Purely informative propositions are represented on the horizontal axis, where inquisitive content is trivial. For example, falling declaratives are non-inquisitive by default. Meanwhile, propositions on the vertical axis are purely inquisitive. Rising polar interrogatives are basically non-informative with informative content being trivialized. All other propositions, of which informative and inquisitive content are both non-trivial, are located off the axes.

Since the convention of each RDs partially overlaps with the corresponding two canonical sentence types, I argue that both the informative content and inquisitive content of RDs are not trivial. Therefore, I place RDs off the axes where neither informative content nor inquisitive content is trivial, as illustrated in Figure 2.[12] This figure illustrates that ARDs are more informative than inquisitive, while IRDs are more inquisitive than informative. ARDs are located closer to the informative horizontal axis than to the inquisitive vertical axis, demonstrating

[12] I suppose other types of non-canonical interrogatives (e.g., tag questions, negative polar questions) can also be located off the axes. Due to space limitations, further discussions on other types are left for future work.

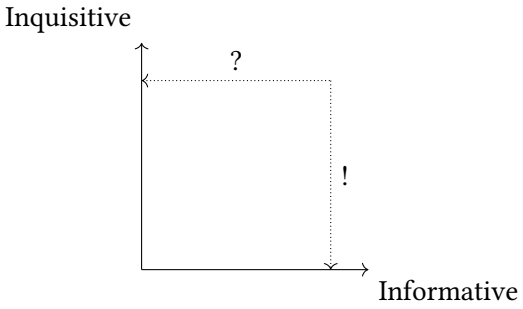

Figure 1: Informative content and inquisitive content

that they are more informative than inquisitive. While primarily remaining informative, ARDs are less informative than canonical falling declaratives as they are tentative assertions. On the other hand, the pattern is reversed for IRDs, as they are located closer to the inquisitive vertical axis: IRDs exhibit more inquisitiveness than informativeness. Compared with canonical rising polar interrogatives, IRDs are more informative since they convey additional information on the bias.

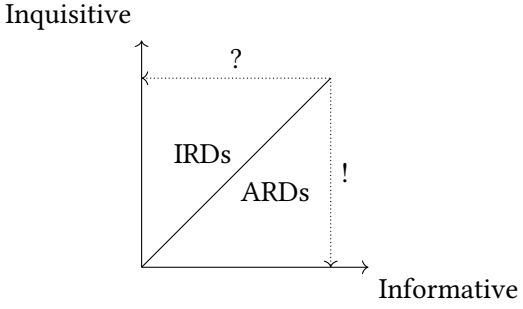

Figure 2: Informative content and inquisitive content of RDs

The distinction between two RDs reflects that ARDs denote a singleton set $\{p\}$ like falling declaratives (Hamblin 1971), whereas IRDs denote a non-singleton set $\{p, \neg p\}$ like polar interrogatives (Karttunen 1977). This difference between singleton and non-singleton sets arises from the effect of rising intonation, which increases the inquisitiveness of the semantic content. According to Jeong (2018)'s experimental results, lower rise with a high nuclear pitch accent (H*H-H%) indicates ARDs, while a steeper rise with a low nuclear pitch accent (L*H-H%) is related to IRDs. I further propose that a weak rise increases inquisitive content up to the point where it is no higher than informative content, maintaining the

proposition primarily informative with a singleton set. In contrast, with a steep rise, inquisitive content surpasses informative content, and thus the content is shifted to a non-singleton set, turning the speech act of a clause into a question. As a result, ARDs denote $\{p\}$, whereas IRDs denote $\{p, \neg p\}$, aligning with our intuitive observation that ARDs are *assertion-like* while IRDs are *question-like*.

4.2 Discourse components

The second contribution of rising intonation is projecting discourse components. The idea is that the update convention of commitments is not completely restricted syntactically. The notion that a clause type does not deterministically constrain the commitments aligns with the perspective of Beyssade & Marandin (2006). They propose that the default case, in which the speaker's commitment aligns with their call on the addressee, can be hybrid. Similarly, I intend to come up with a model that allows a syntactic structure to be involved in a twofold update. However, unlike theirs, my model does not necessarily require that a declarative clause updates the speaker's commitment, and is closer to the approaches of Gunlogson (2008) and Rudin (2018b, 2022), with a few modifications.

Gunlogson (2008) proposes that rising intonation indicates contingent commitment, which is dependent on the addressee's commitment. However, RDs need not always be dependent on the prior utterance of other interlocutors, as in (13).

(13) [Context: A and B made plans two days ago to get drinks tonight. They haven't spoken about it since.]
A: *We're still on for tonight?*

The IRD in (13) does not require the addressee's prior utterance but it is merely the speaker's expectation toward the addressee (i.e., $DC_{ad}{}^{*}$) which differs from Gunlogson's (2008) contingent commitment. It demonstrates that, although the speaker assumes that the addressee is committed to p, it does not necessarily imply that the commitment is contingent.

As summarized in Section 3.2.5, Rudin (2018a, 2022) argues that final rising tone in an RD indicates the speaker's lack of commitment to its expressed proposition. Following some core ideas of his view, I analyze rising intonation as modifying the status of commitments. However, in my proposal, rising intonation projects commitments, rather than indicating a lack of commitment. For example, the speaker can project p to either their own commitment ($DC_{sp}{}^{*}$) or the addressee's ($DC_{ad}{}^{*}$) with rising intonation. I further argue that the application

of the projection can be expanded to other discourse components as well, especially the projected Table (*Table**), which will be defined in Section 5.1.

5 Interpreting rising declaratives

This section focuses on systematizing the specific contextual conditions that determine the projection of a discourse component, leading to a particular interpretation. I then present discourse effects for each paradigm of RDs.

5.1 Assertive rising declaratives

5.1.1 Contextual interpretation

For ARDs, contextual information about their relevance to the current QUD determines their specific paradigm. This relevance can be assessed by comparing the semantic content of the current QUD with that of the ARD. An ARD that conveys a proposition that is a subset of the current QUD is construed as an Epistemic Uncertainty ARD, whereas an ARD that conveys a proposition that is not a subset of the current QUD is understood as a Metalinguistic Uncertainty ARD. To illustrate, compare two ARDs in (3), repeated in (14).

(14) a. Epistemic Uncertainty ARD
A: Where's Sally?
B: (Um...) *She's home?*

b. Metalinguistic Uncertainty ARD
A: Does he speak Chinese?
B: *He speaks Cantonese?*

In (14a), the content of an ARD is {*Sally is home*}. This proposition is a subset of the current QUD, {*Sally is home, Sally is at school, Sally is at the café, ...*}, which is updated to the topmost stack of the *Table* (i.e., $p \in P$). In contrast, in (14b), {*He speaks Cantonese*} is not a subset of {*He speaks Chinese, He doesn't speak Chinese*} (i.e., $p \notin P$). The result correctly categorizes (14a) as an Epistemic Uncertainty ARD and (14b) as a Metalinguistic Uncertainty ARD.

5.1.2 Discourse effects

Based on the contextual cues discussed above, rising intonation of ARDs projects discourse commitments, accordingly. Epistemic Uncertainty ARDs are analyzed as updating p to the $DC_{sp}{}^{*}$, since the speaker's uncertainty is concerned with the

truth value of the expressed proposition.[13] Alternatively, to incorporate Metalinguistic Uncertainty ARDs into the Table model, I introduce a modified version of the 'projected' *Table* (henceforth, *Table**; Malamud & Stephenson 2012, Bhadra 2020), which represents a tentative proposal of raising an issue.[14] The *Table** is defined analogous to the $DC_X{}^*$ and the *CG**, since they all reflect the expected next stage of conversation. The *CG** is a set of potential future *CG*s relative to the at-issue content on the *Table*. Likewise, the $DC_X{}^*$ is a tentative commitment of the speaker (the $DC_{sp}{}^*$) or the speaker's expectation or guess to the commitment of other participants in the discourse (the $DC_{ad}{}^*$) and thus the $DC_X{}^*$ also represents the expected next stage of conversation. In the same way, the propositional content added in the *Table** represents the speaker's expectation on the issue to be relevant to the current QUD. Therefore, updating semantic content to the *Table** reflects the speaker's uncertainty on the relevance to the current QUD (Roberts 1996, 2012) and their expectation of the information becoming relevant to it.

To recapitulate, the discourse effects of ARDs are presented in (15) where a subscripted *i* stands for 'input' and a subscripted *o* stands for 'output'.

(15) a. Discourse effect of Epistemic Uncertainty ARDs
(i) $Table_o = Table_i \cup \{p\}$
(ii) $DC_{sp,o}{}^* = DC_{sp,i}{}^* \cup p$
b. Discourse effect of Metalinguistic Uncertainty ARDs
(i) $Table_o{}^* = Table_i{}^* \cup \{p\}$
(ii) $DC_{sp,o} = DC_{sp,i} \cup p$

The proposed account also provides an explanation for the politeness effect observed in both types of ARDs within a unified discourse process (cf., e.g.,

[13] To some extent, my account is similar to Malamud & Stephenson (2015) and differs from Jeong (2018) by updating p to the $DC_{sp}{}^*$ instead of the DC_{sp}, but differs from both in that I do not utilize *MLP*.

[14] Bhadra (2020) defines the *Table** as an ordered stack which contains tentative issues (i.e., proposals to be added to the Table for future resolution). I follow her account with the formulation of the *Table** as a stack, but additionally provide a more restrained definition for the tentative issue: the issue which the speaker expects to be relevant to the current QUD. A further difference between her approach and mine comes from the *CG**. She claims that the tentative issue updated to the *Table** does not update the *CG**, but I argue that the issue on the *Table** also affects the *CG**, remaining consistent with Malamud & Stephenson (2012). Moreover, in treating the *CG** projected by questions, my approach aligns with the framework proposed by Farkas & Bruce (2010) and Malamud & Stephenson (2015) with a non-singleton set. In contrast, Bhadra (2020) deviates from these and adopts a singleton-set approach to polar interrogatives, which traces its roots back to Bolinger (1978) and proposes salient alternatives (SalientAlts), provided by the context, to capture the interrogative force of polar interrogatives.

Jeong 2021). This process involves moving an item from projected components to present ones. Projected components require the addressee's ratification for the progression of discourse, enhancing the addressee's face by being indirect, which contributes to politeness. Since both types of ARDs update projected components, either $DC_{sp}{}^{*}$ or *Table**, they can both be employed as politeness strategies.

I now move on to the visual representation of updates within the conversational scoreboard model. Consider (16) with the proposed analysis in Table 1.[15] At t_3, speaker A ratifies the proposition p which speaker B is uncertain about. Then, p is automatically moved to DC_B (step 1), allowing the issue to be resolved in a way that expands the *CG* (step 2).[16]

(16) [Context: A and B are sorting paint cans in a store into a 'red' bin and an 'orange' bin. A points to orangish-red paint.]
A: What color would you say this is? t_1
B: *It's red?* t_2
A: Yeah, I think so too. t_3

Table 1: Formal analysis of (16) with an Epistemic Uncertainty ARD

	A utters *q?* in t_1	B utters *p?* in t_2	A utters *Yeah* in t_3	after t_3 step 1	after t_3 step 2
Table	$\langle\{q, \neg q\}\rangle$	$\langle\{\boldsymbol{p}\}\rangle$	$\langle\{\boldsymbol{p}\}\rangle$	$\langle\{\boldsymbol{p}\}\rangle$	
*Table**					
DC_A			$\{\boldsymbol{p}\}$	$\{p\}$	
$DC_A{}^{*}$					
DC_B				$\{p\}$	
$DC_B{}^{*}$		$\{\{\boldsymbol{p}\}\}$	$\{\{p\}\}$	$\curvearrowleft$ $(\{\{p\}\})$	
CG	s_1	s_1	s_1	s_1	$s_2 = \{s_1 \cup \{p\}\}$
*CG**	$\{s_1 \cup \{q\}, s_1 \cup \{\neg q\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	

[15] Following Jeong (2018), I assume $\{q, \neg q\}$ at t_1 is retracted and replaced by $\{p\}$ at t_2. This can be done as speaker B takes p as a partial answer. This retraction process is accepted only when the speaker has assurance on the fact that p is relevant to the issue on the *Table*.

[16] These two steps take place simultaneously, but are visually separated only for the ease of explanation.

Metalinguistic Uncertainty ARDs can also be analyzed as automatic movement of {*p*} from the *Table** to the *Table* with the addressee's ratification. Consider (17) with the proposed analysis in Table 2. With the falling *Oh* at t_3, speaker A confirms speaker B's expectation to update the *Table*. After the automatic move process to the *Table*, the rest of the convention is identical to that of falling declaratives.

(17) A: Does he speak Spanish? t_1
B: *He speaks Ladino?* t_2
A: Oh, I see. t_3

Table 2: Formal analysis of (17) with a Metalinguistic Uncertainty ARD

	A utters *p?* in t_1	B utters *p?* in t_2	A utters *Oh* in t_3	after t_3	
				step 1	step 2
Table	$\langle\{\boldsymbol{p}, \neg\boldsymbol{p}\}\rangle$			$\langle\{\boldsymbol{p}\}\rangle$	
*Table**		$\langle\{\boldsymbol{p}\}\rangle$	$\langle\{p\}\rangle$	$(\langle\{p\}\rangle)$	
DC_A			$\{\boldsymbol{p}\}$	$\{\boldsymbol{p}\}$	
$DC_A{}^*$					
DC_B		$\{\boldsymbol{p}\}$	$\{p\}$	$\{p\}$	
$DC_B{}^*$					
CG	s_1	s_1	s_1	s_1	$s_2 = \{s_1 \cup \{p\}\}$
*CG**	$\{s_1 \cup \{p\}, s_1 \cup \{\neg p\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$	

5.2 Inquisitive rising declaratives

5.2.1 Contextual interpretation

Analogous to ARDs, the specific use of IRDs is also communicated throughout the close interaction with discourse context. Contradictory IRDs are attested when the context indicates that the addressee believes (or is at least biased toward) *p*. Consider the examples below:

(18) a. Confirmative IRD
[Context: Same as (7a).]
A: There's one flight to Seoul.
B: *The flight leaves at 10am?*

b. Contradictory IRD
A: Dave is a good singer.
B: *Dave is a good singer?*

(18a) is biased toward the expressed proposition p, whereas (18b) is biased toward its negation $\neg p$. In both contexts, the speaker assumes that the addressee would be committed to p, but they differ in contextual cues. In (18a), the context does not directly indicate whether the addressee (speaker A) has a commitment on p. In other words, there is no explicit evidence in the context to support the addressee's belief that the flight leaves at 10am. On the contrary, the addressee's belief on p is evident to the speaker in (18b) from the explicit expression. It is shown that the contradictory use of IRDs is not permitted unless it is supported by the appropriate contextual information. This aligns with the arguments put forth in previous studies (Gunlogson 2003, Farkas & Roelofsen 2017) and experimental results (Jeong 2018) regarding the necessary contextual condition for contradictory IRDs: Contradictory IRDs are attested when the context indicates that the addressee believes p.

With this account, the cognitive process of deriving negative bias becomes apparent. Similar to Jeong (2018), the negative bias arises from the pragmatic reasoning which suggests that the speaker has a reason to seek further explanation or justification from the addressee. The expression of negative bias occurs when the speaker, in a context where the addressee's commitment on p is evident, makes a best guess on the addressee's commitment (in accordance with the definition of the DC_{ad}*). This intentional opening up of the issue regarding $\{p, \neg p\}$ in order to double-check the addressee's commitment on p is unnecessary in typical context. However, as the speaker deliberately brings up the issue of the interlocutor's assumed commitment, this leads to the pragmatic reasoning of urging for an additional explanation on the addressee's commitment, due to the speaker's negative bias.

5.2.2 Discourse effects

I propose that Confirmative IRDs exhibit a positive bias by adding p to the DC_{sp}*, indicating the speaker's 'weaker' commitment. In contrast, Contradictory IRDs convey a negative bias by lacking speaker's commitment and instead adding it to the DC_{ad}*. This effect stems from the following pragmatic reasoning: In a context in which Contradictory IRDs are possible, it is assumed that the addressee has either asserted or presupposed the proposition p. The fundamental assumption for cooperative discourse is to enhance mutual information, and thus expanding

the common ground among participants is the most plausible act. However, the fact that the speaker refrains from adding p to their own commitment sets, and instead updates it to the $DC_{ad}{}^{*}$ may present two potential interpretations regarding bias: either ignorant or negative. Given that an ignorant speaker might have chosen polar interrogatives instead (Goodhue 2022), the decision to update the $DC_{ad}{}^{*}$ signals a negative bias.

Regarding Mirative IRDs, I follow Rett's (2021) concept of illocutionary not-at-issue content. Rett distinguishes illocutionary not-at-issue content (e.g., mirative markers) from descriptive not-at-issue content. A key divergence lies in phenomena related to denial: while denying descriptive not-at-issue content leads to contradiction, denying illocutionary not-at-issue content results in Moore's Paradox. Similarly, the direct negation of Mirative IRDs doesn't yield contradiction but rather invokes Moore's Paradox. Consider the example in (19): the last sentence which follows a Mirative IRD is infelicitous, but it is not a contradiction.

(19) [Context: A and B are watching a girl give a very professional performance in a school debate. From this, A is thinking that she might be 12 or 13 years old.]
A: She's amazing.
B: I know, and she's only 9 years old.
A: (What?) *She's nine?* # I KNEW that she is nine.

From this evidence, I model Mirative IRDs as illocutionary not-at-issue content which updates flavored commitment to the DC_{sp} (Rett 2021), as defined in (20). Flavored discourse commitment reflects the speaker's attitude other than belief, including mirativity.[17]

(20) Discourse Commitments (Rett 2021: 326)
Let DC_a be sets of propositions of the form *is-surprised*$_a(p)$, representing the public commitments with respect to a discourse in which a and b are the participants, where *is-surprised*$_a(p)$ is a public commitment of a iff 'a is surprised with p' is a mutual belief of a and b.

To summarize, the discourse effects of IRDs are proposed in (21): in (21a) for Confirmative IRDs, in (21b) for Contradictory IRDs, and in (21c) for Mirative IRDs. Note that (21c) is identical to (21b), except for the update of DC_{sp} with *is-surprised*$_a(p)$. In this respect, Mirative IRDs are analyzed as additionally implicating not-at-issue content, i.e., mirativity, on top of Contradictory IRDs.

[17] Other sets of propositions of the form *believes*$_a(p)$, *is-pleased*$_a(p)$, or *is-not-surprised*$_a(p)$ are also proposed by Rett (2021).

(21) a. Discourse effect of Confirmative IRDs
   i. $Table_o = Table_i \cup \{p, \neg p\}$
   ii. $DC_{sp,o}{}^* = DC_{sp,i}{}^* \cup p$
   b. Discourse effect of Contradictory IRDs
   i. $Table_o = Table_i \cup \{p, \neg p\}$
   ii. $DC_{ad,o}{}^* = DC_{ad,i}{}^* \cup p$
   c. Discourse effect of Mirative IRDs
   i. $Table_o = Table_i \cup \{p, \neg p\}$
   ii. $DC_{ad,o}{}^* = DC_{ad,i}{}^* \cup p$
   iii. $DC_{sp,o} = DC_{sp,i} \cup \textbf{is-surprised}_a(p)$

The procedure for resolving the issue with Confirmative IRDs as in (22) is schematized in Table 3. The resolution of the issue is rendered by the automatic movement of p from $DC_B{}^*$ to DC_B as presented in step 1. In step 2, speakers have a joint commitment to p. Thus, the issue is resolved from the *Table* and expands the *CG*.

(22) [Context: B is buying a ticket for a flight to Seoul at the airport.]
A: There's one flight to Seoul. t_1
B: *The flight leaves at 10am?* t_2
A: Yes, from Gate 5. t_3

The issue of Contradictory IRDs is more difficult to resolve. Due to the empty DC_{sp} and $DC_{sp}{}^*$, the discourse remains in a conversational crisis even after the addressee's ratification. An illustration of the analysis proposed for a Contradictory IRD such as in (23) is given in Table 4.

(23) A: (student) The answer to this problem is 5 because the square root of 9 is 2 and 2+3 is 5. t_1
B: (teacher) *The square root of 9 is 2?* t_2
A: Yes. t_3

In (23), speaker B does not update any own commitment with the Contradictory IRD at t_2. Due to the lack of commitment from one participant, the issue cannot be resolved even after the other participant utters *Yes* at t_3. The consequence will lead participants to the next stage of the discourse, pursuing to 'agree to disagree' (Farkas & Bruce 2010) or putting the issue at the bottom of the *Table*

Table 3: Formal analysis of (22) with a Confirmative IRD

	A utters q in t_1	B utters p? in t_2	A utters *Yes* in t_3	after t_3	
				step 1	step 2
Table	$\langle\{\boldsymbol{q}\}\rangle$	$\langle\{p, \neg p\}\rangle$	$\langle\{\boldsymbol{p}\}\rangle$	$\langle\{\boldsymbol{p}\}\rangle$	
*Table**					
DC_A	$\{\boldsymbol{q}\}$	$\{q\}$	$\{\boldsymbol{p}\}$	$\{p\}$	
$DC_A{}^*$					
DC_B		$\{q\}$		$\{p\}$	
$DC_B{}^*$		$\{\{\boldsymbol{p}\}\}$	$\{\{p\}\}$	↑ $(\{\{p\}\})$	
CG	s_1	$s_2 = \{s_1 \cup \{q\}\}$	s_2	s_2	$s_3 = \{s_2 \cup \{p\}\}$
CG^*	$\{s_1 \cup \{\boldsymbol{q}\}\}$	$\{s_2 \cup \{\boldsymbol{p}\}, s_2 \cup \{\neg p\}\}$	$\{s_2 \cup \{\boldsymbol{p}\}\}$	$\{s_2 \cup \{\boldsymbol{p}\}\}$	

Table 4: Formal analysis of (23) with a Contradictory IRD

	A utters p in t_1	B utters p? in t_2	A utters *Yes* in t_3
Table	$\langle\{\boldsymbol{p}\}\rangle$	$\langle\{\boldsymbol{p}, \neg\boldsymbol{p}\}\rangle$	$\langle\{p\}\rangle$
*Table**			
DC_A	$\{\boldsymbol{p}\}$	$\{p\}$	$\{\boldsymbol{p}\}$
$DC_A{}^*$		$\{\{\boldsymbol{p}\}\}$	
DC_B			
$DC_B{}^*$			
CG	s_1	s_1	s_1
CG^*	$\{s_1 \cup \{\boldsymbol{p}\}\}$	$\{s_1 \cup \{p\}, s_1 \cup \{\neg\boldsymbol{p}\}\}$	$\{s_1 \cup \{\boldsymbol{p}\}\}$

to not be discussed unless one of the speakers changes their own commitments. Whatever treatment we may assume, it prevents the issue from expanding the *CG*.

6 Conclusion

This paper presented a diverse paradigm of RDs, focusing on their speech acts and how their meanings are acquired throughout the discourse. Given that RDs serve both informative and inquisitive functions, they exhibit a multi-functional behaviour. From this observation, I proposed an analysis that delineates the role of semantics and pragmatics by explaining their interface in generating the discourse effects observed in different types of RDs. Most importantly, rising intonation affects both semantic content and discourse components. Depending on its steepness, rising intonation modifies the semantic content of the clause. Then, through the interaction with the context, it subsequently projects discourse components. By establishing this framework, the proposed analysis provides a predictable model for semantic and pragmatic properties of RDs.

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Chapter 6

Next mention biases predict the choice of null and pronominal subjects

Fabian Istrate[a], Ruxandra Ionescu[a] & Barbara Hemforth[b,a]
[a]Université Paris Cité [b]CNRS

In this paper we investigate the production of null and pronominal subjects in Romanian. Data from corpus and experimental studies show that several factors need to be taken into account for this alternation beyond the syntactic role of the antecedents. Subject pronouns in Romanian seem to be sensitive to semantic and pragmatic factors influencing accessibility or predictability, induced among others by the interaction between verb semantics and coherence relations. Our results contribute to the larger debate regarding the extent to which predictability affects the choice of referring expressions, suggesting that null subjects are preferred not only for a subject antecedent, but also for a referent that is more predictable in the context.

1 Introduction

1.1 Pronoun resolution and predictability

Pronoun resolution (i.e., the question of how pronouns retrieve their antecedents in discourse) is one of the most studied phenomena in psycholinguistics (see, for recent studies, Holler & Suckow 2016, Arnold 2010, Kehler & Rohde 2019, Schulz et al. 2021, Colonna et al. 2012). While much of the empirical work concerns processes in comprehension, a closely related question is which type of referential expression a speaker will use to refer back to a specific antecedent (Fukumura et al. 2022). In this paper, we aim to add both corpus and experimental evidence about the division of labor between null and pronominal subjects in a pro-drop language like Romanian. In particular, we are interested in investigating which

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factors affect speakers' choices between these referential expressions and how next mention biases (i.e., the probability of mentioning a particular referent next) influence their production (Arnold 2001).

As a general principle of communication, when referring back to a previously mentioned and highly accessible entity in discourse, speakers tend to use shorter or less specific forms of reference, while making their exchanges as informative as necessary. This tendency to make the communication as economical as possible was captured by Grice (1975) in his *Maxim of Quantity*. Communication becomes more efficient as it requires less speaker effort without generating significant communicative cost (see also Levy & Jaeger 2007). To ensure that a referent is still accessible to the listener, the entity should be in the focus of attention, making it highly predictable to be mentioned next. A current debate in the literature addresses the question whether a more predictable referent will be recovered by a pronoun or a more complex referential expression (such as proper names, definite descriptions, etc.). In this respect, previous studies offer contradictory results: while some of them show no evidence that pronoun production is affected by referent predictability (Ferretti et al. 2009, Fukumura & Van Gompel 2010, Kehler & Rohde 2013, Rosa 2015, Patterson et al. 2022, among others), others suggest the existence of such an effect (Arnold 2001, Rosa & Arnold 2017, Lindemann et al. 2020, among others). Theories about the choice of a given referential form can be traced back to earlier hypotheses proposed in the literature on pronoun resolution. Givón (1983)'s *Topic Continuity Theory* posits that the degree of topicality that a given entity has in discourse is correlated with the usage of referential forms. In subsequent work, Ariel (1994) proposed in her *Accessiblity Theory* that referential forms can be ranked on an explicitness scale, ranging from full names to zero expressions. The more accessible an entity is in discourse, the less complex its corresponding anaphoric expression will be. In line with these hypotheses, von Heusinger & Schumacher (2019) put forward the concept of *prominence* aiming to characterize *a highlighted entity* in discourse. The properties of a prominent referent are based on the following criteria of prominence in grammar, given by Himmelmann & Primus (2015): (i) linguistic units of equal rank compete for the status of being in the center of attention, (ii) their status may shift, (iii) prominent units act as structural attractors in their domain. They suggest that the focus of attention can be shifted by linguistic means, thus updating the prominence structure. Similar observations postulate that semantic/coherence-driven predictability of referents in discourse may come from multiple sources, inducing next mention biases (see Gernsbacher & Hargreaves 1988, Gordon et al. 1993, Grosz et al. 1995, Fukumura & Van Gompel 2011): intrinsic properties like animacy, grammatical factors like subjecthood, information

structural factors like topichood, or semantic and pragmatic factors like verb semantics or coherence relations.

1.2 Null and pronominal subject alternation in pro-drop languages

A prominent account of the alternation between null and pronominal subjects is the *Position of Antecedent Hypothesis* (henceforth, *PAH)* proposed by Carminati (2002) for intra-sentential anaphoric subjects in Italian. The *PAH* posits that null subject pronouns generally refer back to subject antecedents (1a) whereas pronominal subjects usually prefer a non-subject antecedent (1b).

(1) a. Marta scriveva frequentemente a Piera quando era negli
Marta write.PST.IPFV.3SG frequently to Piera when was in
Stati Uniti.
States United
'Marta wrote to Piera often when she was in the United States.'

b. Marta scriveva frequentemente a Piera quando **lei** era
Marta write.PST.IPFV.3SG frequently to Piera when she was
negli Stati Uniti.
in States United
'Marta wrote to Piera often when she was in the United States.'

A similar pattern has also been observed by de la Fuente & Hemforth (2013) for Spanish, showing the impact of grammatical role of the antecedents. However, in their experimental study, tendencies in Spanish seem to be less strong than those found for Italian, i.e. null subjects can also take object antecedents. Moreover, aside from the subject function of antecedents, de la Fuente & Hemforth (2013) point out that left-dislocation of the antecedents increases their discourse accessibility, thus being mostly retrieved by null subjects (see Runner & Ibarra 2016 for similar observations about information structure). In a production and a comprehension experiment on Greek and Italian, Torregrossa et al. (2020) confirmed the left-dislocation effect by arguing that null subjects have a bias for left-dislocated objects compared to *in-situ* objects. In line with the previous studies, Contemori & Di Domenico (2021) postulate that Italian and Spanish display a distinct division of labor between null and pronominal subjects: whereas in Italian the production of the referential form seems to be very distinct according to the grammatical role of the antecedent, in Spanish the division of labor is less clear. The results of their production experiment show that verb bias and causal coherence relations might play a role in Italian and in Mexican Spanish, although

to a lesser extent in the latter: speakers produce a null subject to corefer to the object when an object-biased verb is present in the context. However, Chamorro (2018) suggests different tendencies for Spanish in an offline judgment task and an online eye-tracking study showing that null subjects do not exhibit a clear preference while pronominal subjects mostly prefer object antecedents. She also postulates that clause order (i.e., main-subordinate vs. subordinate-main) may also be responsible for the antecedent preferences of pronouns in the case of intra-sentential anaphora. Regarding the choice between a null and a pronominal subject in Romanian, Lindemann et al. (2020) and Istrate et al. (2022) have shown that grammatical role plays an important role in this alternation, the tendencies being close to those found for Spanish (de la Fuente & Hemforth 2013). Moreover, Lindemann et al. (2020) argues that null subjects are the most preferred choice when referring back to a more prominent or accessible referent, i.e. a subject antecedent which is also the *goal*, in terms of thematic roles. Divergent results concerning the production of these referential expressions might be due to different experimental tasks (online vs. offline), but also to existing differences in the experimental material. Further parallel corpus and experimental studies are necessary in order to make a proper crosslinguistic comparison between pro-drop languages.

1.3 The current study

The goal of the current study is to add evidence about the production of intra-sentential anaphoric subjects combining corpus and experimental data on Romanian, a pro-drop language in which the choice of null and pronominal subjects has not been extensively studied from a quantitative perspective so far. In particular, we are interested in investigating which role predictability and prominence may play in pronoun production, by shedding light on the potential influence of grammatical and semantic-pragmatic factors. In Section 1, we present some background about pronoun resolution and predictability, followed by empirical evidence on the choice of referential expressions in pro-drop languages. Then, we focus on Romanian as a consistent null subject language and we put forward our hypothesis regarding Romanian based on previous studies. In Section 2, we present a corpus study on complex sentences (sampling, annotation, results and discussion). Given the results we found in particular with respect to discourse relations, we ran a follow-up experiment in order to test to what extent the choice of referential expressions is sensitive to predictability invoked by implicit causality verbs in causal relations (Section 3). In Section 4, we put together the corpus and experimental results, by pointing out that preferences in the production of

null and pronominal subjects in Romanian go beyond the grammatical role of the antecedents and must include predictability and discourse relations.

1.4 Hypotheses about Romanian as a pro-drop language

Romanian is a language that licenses the presence of null subjects (Dobrovie-Sorin & Giurgea 2013). In this subsection, we firstly present the classification of pro-drop languages proposed by Holmberg (2010), which underpinned the predictions made for Romanian. Consistent null subject languages (Italian, Spanish, European Portuguese[1], Greek, etc.) permit the use of a null subject irrespective of number, person or verb tense. A second category includes partial pro-drop languages (such as Russian), which limit null subjects to the 1st and 2nd person in finite clauses, and 3rd person pronouns *bound by a higher argument*. A third category consists of expletive null subject languages (such as German), allowing null expletive subjects but not referential ones.[2] The last category is represented by radical pro-drop languages (or *discourse pro-drop languages*, such as Japanese or Chinese), which permit other nominal arguments (e.g. objects) to be null, in addition to null subjects. According to Holmberg (2010), Romanian falls into the category of consistent null subject languages. In Romanian, there are several ways in which speakers may refer to an entity, including null subjects (2a), but also overt subjects realized as personal pronouns (2b), demonstratives (2c), proper names (2d), definite descriptions (2e), etc.[3]

(2) a. A ajuns la petrecere.
has arrived at party
'He/she has arrived at the party.'

b. *El* a ajuns la petrecere.
he has arrived at party
'He has arrived at the party.'

c. *Acesta* a ajuns la petrecere.
this has arrived at party
'This one has arrived at the party.'

[1]The pro-drop status of Brazilian Portuguese is controversial (see Duarte 1995, 2000 for *ongoing parameter change* of Brazilian Portuguese).

[2]German has more recently also been described as a topic drop language, see Schäfer (2021).

[3]In this paper, we will make the distinction between pronominal subjects (personal pronouns) and lexical subjects (proper names, definite descriptions) for methodological reasons regarding the annotation of the collected data.

d. *Alexandru* a ajuns la petrecere.
Alexandru has arrived at party
'Alexandru has arrived at the party.'

e. *Colegul nostru* a ajuns la petrecere.
colleague POSS.1PL has arrived at party
'Our colleague has arrived at the party.'

With respect to consistent null subject languages, the alternation between null and pronominal subjects has attracted particular attention in the linguistic as well as the psycholinguistic literature (Carminati 2002, Chamorro 2018, Torregrossa et al. 2020, Lindemann et al. 2020, Contemori & Di Domenico 2021). According to Ariel's (1994) *Accessibility Theory*, null and personal pronouns (either stressed or unstressed) are very close on the accessibility scale, compared to definite descriptions or proper names. Alternation between these two referential expressions therefore needs quantitative research to shed light on the sometimes fine-grained distinctions determining their choice. Thus, we will only focus on these two referential expressions, in line with previous work.

Based on previous work on Romanian (see Lindemann et al. 2020), we hypothesize that null subjects will be preferred not only for subject antecedents, but also for more prominent or predictable referents in the context. We seek to establish: (i) in how far verb semantics and discourse relations render antecedents more predictable, and (ii) to what extent the referent predictability impacts on pronoun resolution in Romanian (see Demberg et al. 2023). From a comparative perspective, we expect to observe a similar pattern in Romanian as in Spanish, Italian (Contemori & Di Domenico 2021) and Catalan (Mayol 2018): null subjects should mostly be produced when the choice of the referent in the upcoming subordinate clause is in line with next mention biases. More precisely, we predict that the implicit bias of a verb for an upcoming referent makes the choice of a null subject for this referent more likely. However, if our predictions are on the right track, Romanian should be different from Mandarin Chinese, *a discourse pro-drop language*, where no evidence has been found for next mention biases affecting the production of referential expressions (Hwang et al. 2022).

2 Corpus study

2.1 Details about Romanian corpora

We used two corpora in our studies: the *Parseme-ro 1.2* corpus for written Romanian and the *CoRoLa* corpus for spoken Romanian. The *Parseme-ro 1.2* corpus

(Savary et al. 2018) is a written corpus of texts collected from the *Agenda* newspaper (containing 56,703 sentences and 1,015,624 words). Although the corpus has no subsections, it is a homogeneous journalistic corpus. Some texts included in *Parseme-ro 1.2* are also part of the *Romanian Universal Dependencies* corpus.

The *CoRoLa* corpus (*The Reference Corpus of the Contemporary Romanian Language*, Barbu Mititelu et al. 2018) comprises a written part and an oral part. In order to compare the production of null and pronominal subjects in Romanian, we extracted data from the oral part of the *CoRoLa* corpus (covering 151 hours, 57 minutes and 21 seconds). The oral texts in *CoRoLa* are mainly professional recordings from various sources (radio stations, recordings) for which transcriptions are available. Another part of the oral corpus is represented by texts read by various speakers in various circumstances: news read on radio stations, texts read by people close to them and texts read by professional speakers recorded in studios. However, we focused on spontaneous speech, taking into account only extracts from radio news and interviews. The reason for this choice was to have two sufficiently different sub-corpora so that we could expect to find interesting effects. We did not find any a priori reason to believe that read texts should be particularly different from written texts.

2.2 Corpus sampling

As the *Parseme-ro 1.2.* corpus is morpho-syntactically annotated, we used SQL query formulas to collect the data, both for null and pronominal subjects. However, for the *CoRoLa* corpus there is currently no such automatic annotation. We extracted occurrences with null and pronominal subjects, using the most common verbs in Romanian (a total of 552 verbs).[4] We thus constructed a sample of 368 complex sentences.[5] Following Oakhill et al. (1989), who point out the role of semantic and pragmatic effects of main clause factors in pronoun resolution, and in line with previous studies (Soares et al. 2020, Costa et al. 2004, de la Fuente & Hemforth 2013), we analyzed the production of null and pronominal subjects occurring in subordinate clauses. Moreover, since main sentences generally did not provide information about the previous antecedent in the context (such as syntactic function), we decided to analyze the choice of null and pronominal subjects in subordinate sentences. We excluded a number of occurrences in which the alternation between null and pronominal subjects was not possible in the context

[4]While lexical subjects certainly play a role for referential expressions, we only focused on null and pronominal occurrences in this study in line with much of the experimental work on this topic.

[5]The production of null and pronominal subjects in simple clauses is part of a separate study.

or in which annotation of our factors of interest in this study was not possible. More precisely, we did not retain in our study sentences that met the following criteria: (i) when a null subject was impossible in the context, i.e. pronominal subjects of non-finite verbal forms (infinitives and gerunds), as in (3a); (ii) when null subjects or pronominal subjects were discourse persons (1st or 2nd person) as in (3b), since it is often impossible to establish information about the factors of interest such as the grammatical role of the antecedent;[6] (iii) when null subjects were the only option in the context, i.e. null subjects of impersonal reflexive verbs (3c).

(3) a. Când ne întâlnim, vorbim pe ungurește, el fiind
when CL.1PL.ACC meet.PRS.1PL talkPRS.1PL PREP Hungarian he being
pe jumătate maghiar.
PREP half Hungarian
'When we meet, we speak Hungarian, as he is half-Hungarian.'
(corola-38914)

b. Dar când trebuie să fiu eu, atunci roșesc, ne
but when have SBJV be.SBJV.1SG I then blush.PRS.1SG CL.1PL.DAT
mărturisește.
confess.PRS.3SG
'But when I have to be myself, then I blush, he confesses.'

c. Deși starea carosabilului este deplorabilă, nu se pot
although state.DEF road.DEF.GEN is deplorable NEG REFL.3 can
face lucrările de reabilitare necesare, din lipsa fondurilor.
do work.PL.DEF of repair necessary of lack funds.DEF.GEN
'Although the state of the road is deplorable, the necessary repair work cannot be carried out due to a lack of funds.' (corola-56647)

During the data collection and annotation process of intra-sentential anaphoric subjects, we faced a number of problematic cases. Firstly, for both corpora we had to manually extract the complex sentences we were interested in in this study. With the data available to us, we unfortunately had to limit our analysis to a relatively small number of pronominal subjects for the written corpus (68 occurrences). In order to have a balanced set of observations for statistical analyses, we applied the *upSample* function from the *caret* package (Kuhn 2008) that

[6]The person factor was shown to influence the production of referential expressions (see Soares et al. 2020 for Brazilian Portuguese). However, for the goal of this paper, we will only study anaphoric subjects.

allows to add simulated observations without changing the general distribution. Annotating antecedents was constrained at some points by limited access to the previous context (the sentence preceding the target sentence we annotated). This concerned in particular antecedents of pronouns in main clauses and is the main reason why, while we annotated each factor both for main clauses and subordinate clauses, we decided to analyze only the production of null and pronominal subjects occurring in subordinate sentences for the variables where properties of the antecedent were at stake.

2.3 Annotated factors

Comparative studies on pro-drop languages (see Contemori & Di Domenico 2021, Torregrossa et al. 2020, among others) have revealed that crosslinguistic variation may exist in pronoun resolution as well in the choice of referential expressions in production. It is, thus, not necessarily the case that results from previous studies can be taken for granted for Romanian. Following our main research question, we annotated a list of factors which have been shown to affect the choice of antecedents or referential expressions across several languages. Table 1 shows the 15 factors we manually annotated for complex sentences.

Table 1: Factors used for annotation

Annotated element	Factors
Sentence	modality, polarity
Subordinate clause	position (right, left)
Adverbial clause	discourse relation, connectives
Verb	agentivity, mood, tense, voice
Subject	number, gender, animacy, type (null vs. pronominal), place (main vs. subordinate)
Antecedent	syntactic function

While we annotated a variety of factors that may influence the choice of null and pronominal subjects, our general question mainly concerns factors influencing the next mention probability, that means in particular factors affecting the prominence of a referent as well as discourse relations. We generally assume that higher prominence will increase the probability of null subject choices. Following Carminati (2002), we annotated the syntactic function of antecedents in order

to test possible preferences for subject antecedents. Animacy has been shown to have a strong influence on pronoun choice in corpus studies on Brazilian Portuguese (Soares et al. 2020, Duarte 2000 a.o.). Agentivity seems to predict preferences for pronoun antecedents aside from topicality and subjecthood in German (Schumacher et al. 2016). Voice also seems to impact pronoun resolution. Colonna et al. (2018) show that the use of passives increases the accessibility of the subject antecedent (see also d'Arcais 1973, Burmester et al. 2018). We predict that the salience-enhancing effect of passives may also increase the probability of null subject choices in production. Moreover, as shown by Rohde & Kehler (2014), pronoun resolution might be sensitive to discourse relations. We therefore also annotated discourse relations. Next mention probability may also be affected by gender, which has been shown to affect choices of subject types in Italian (Cacciari et al. 2011) but also antecedent choices in English (Ferstl et al. 2011). Beyond these factors, verb mood, tense and number have been found to play a role in the frequency of null and pronominal subjects in Granada Spanish (Manjón-Cabeza Cruz et al. 2016).

2.4 Results

All data were analyzed using logistic regressions (*glm* function in the *lme4* package, cf. Bates et al. 2015, *lmerTest* function for *p*-values, cf. Kuznetsova et al. 2017). Our data did not allow us to calculate a single general model with all factors, due to overfitting problems. We therefore analyzed the choice of subject type (dependent variable) based on the annotated factors in the main clause (independent variable) one by one. All factors were mean centered such that *p*-values reflect main effects.[7] Table 2 shows the full set of results in raw numbers. For better comparability with data from previous studies, the variables *Antecedent function*, *Animacy*, *Agentivity*, *Voice*, *Gender*, *Number* and *Discourse relations* reflect subject choices in the subordinate clause. Descriptive (Table 2) and inferential statistics (Table 3) are calculated for subordinate clauses only for these variables. Effects of *Mood*, *Polarity* and *Tense* were calculated across main and subordinate clauses.

Different from previous studies, we did not find significant effects of animacy or number of the main clause subject, or of polarity, mood, and tense.

Figure 1 and Figure 2 show the distribution of null and pronominal subjects in main and subordinate clauses. Null subjects are more frequent in subordinate clauses while pronominal subjects are more frequent in main clauses (Est. = -2.889, std. error = 0.288, z=-10.043, $p < 0.001$). For both main and subordinate

[7] m = glm(response ~ FactorC, data=data, family = "binomial"), where *response* corresponds to *subject type*.

Table 2: Descriptive statistics (raw numbers)

Factors	Values	Null subjects	Pronominal subjects	Total
Antecedent function	subject	149	31	180
	non-subject	30	30	60
Discourse relations	temporal	57	12	69
	causal	47	48	95
	condition	11	7	18
	concession	18	2	20
	result	14	1	15
	other	35	2	37
Animacy	animate	151	56	207
	non-animate	31	16	47
Agentivity	agentive	93	15	108
	non-agentive	89	57	146
Voice	active	139	63	202
	non-active	43	9	52
Gender (animates)	feminine	43	44	87
	masculine	110	71	181
	other	14	16	30
Number	singular	136	48	184
	plural	46	24	70
Polarity	affirmative	179	158	337
	negative	21	10	31
Mood	indicative	181	153	334
	conditional	4	0	4
	subjunctive	15	15	30
Tense	present	122	109	231
	compound past	57	38	95
	imperfect and pluperfect	10	11	21
	future	10	10	20

Table 3: Inferential statistics

Factors	Estimate	Std. error	z value	Pr (|z|)
Antecedent function	1.570	0.325	4.831	< 0.001
Discourse relations	1.579	0.378	4.177	< 0.001
Animacy	0.058	0.278	0.211	0.832
Voice	-0.773	0.397	-1.947	0.052
Agentivity	1.379	0.326	4.231	< 0.001
Gender (animates)	0.522	0.249	2.097	< 0.05
Number	-0.391	0.303	-1.292	0.197
Polarity	0.617	0.399	1.545	0.122
Mood	0.068	0.362	0.189	0.850
Tense	0.166	0.217	0.767	0.443

clauses, null subjects are more frequent in the written modality (main clauses: Est. = 0.806, std. error = 0.328, z=2.46, $p < 0.05$; subordinate clauses: Est. = -1.333, std. error = 0.333, z=-4.008, $p < 0.001$).

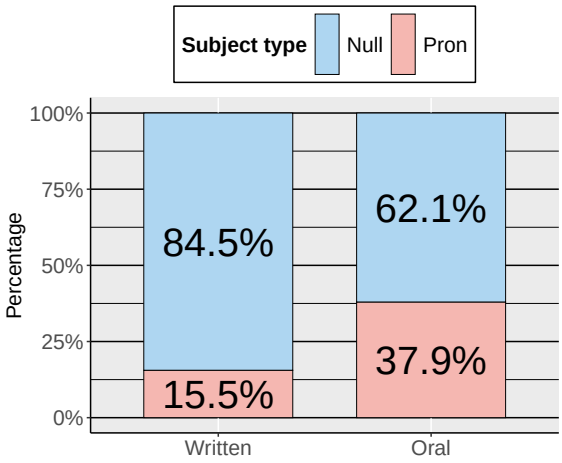

Figure 1: Modality subordinate clauses

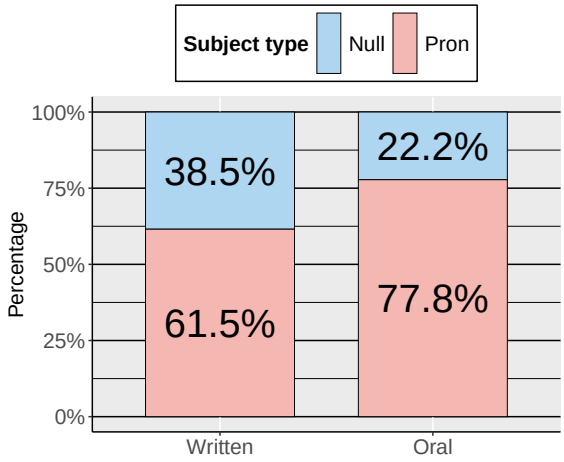

Figure 2: Modality main clauses

For the syntactic function of the antecedent, we only analyzed antecedents for the subordinate clauses. Antecedents for main clauses were not possible to identify in more than 30% of the cases. For the subordinate clauses, we found a significantly higher frequency of null subjects with a subject antecedent (see Table 3 and Figure 3). However, in the case of non-subject antecedents, there is no preference for a null or pronominal subject.

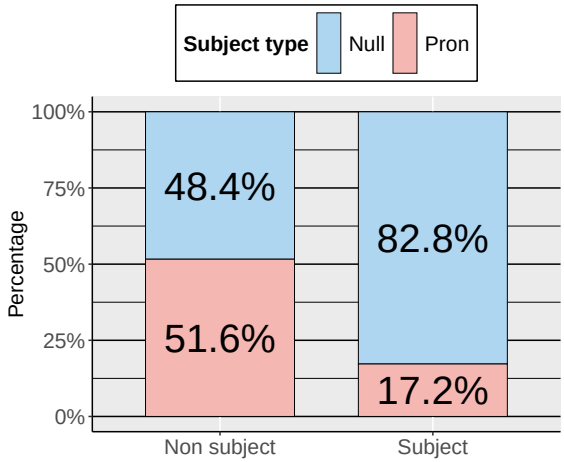

Figure 3: Subject distribution (Antecedent function)

With respect to factors that may increase the salience of an antecedent, we

looked at the effects of animacy of the subject and agentivity as well as voice of the verb in the main clause on subject choices in the subordinate clause. Animacy did not show a reliable effect. For voice, we found that non-active voice in the main clause (most often passives) marginally favors null subject pronouns in the upcoming subordinate clause (see Table 3 and Figure 4).

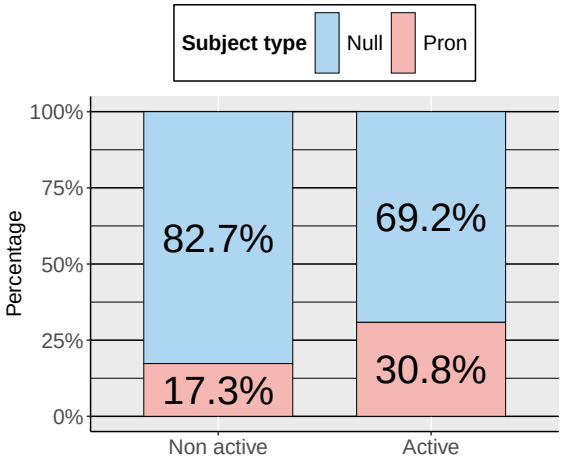

Figure 4: Subject distribution (Voice in main clause)

Another variable we assumed to be related to salience is the agentivity of the verb in the main clause. Agents have a higher next mention probability. In line with this hypothesis, we found that agentive verbs in the main clause lead to significantly more null subjects in the subordinate clause (see Table 3 and Figure 5).

Gender could be a further variable related to antecedent salience. Looking only at animate antecedents, we found that null subjects were reliably more frequent for male antecedents while null and pronominal subjects were equally distributed for female antecedents (see Table 2 and Table 3). This result could be interpreted as evidence that male antecedents are seen as more salient (although more detailed analyses would be necessary to confirm this hypothesis).

Finally, we looked at the distribution of null and overt subjects in the subordinate clauses based on discourse relations (Figure 6). Temporal and causal relations were the most frequent in our data, thus we compared only these two relations through statistical analysis. In adverbial temporal subordinates, we found an increased tendency for producing null subjects compared to pronominal subjects (see Table 3), whereas in causal subordinates the distribution between the two types of subjects is roughly balanced.

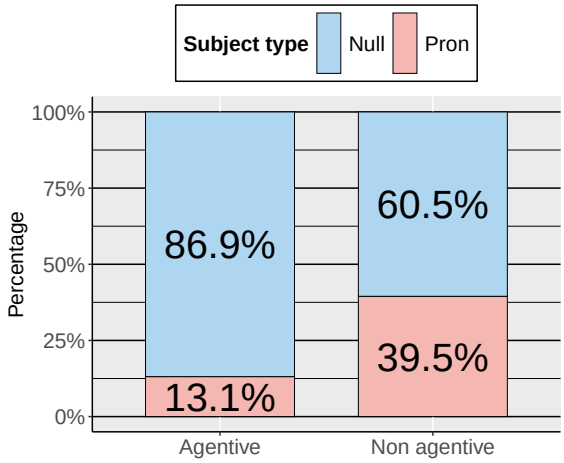

Figure 5: Subject distribution (Agentivity in main clause)

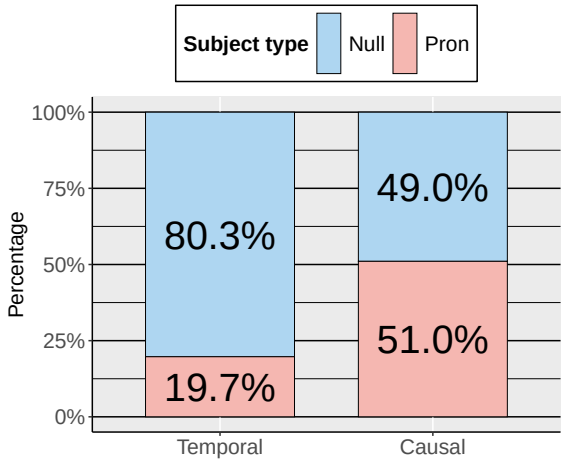

Figure 6: Subject distribution (Discourse relations)

2.5 Discussion: corpus study

Overall, we observed that modality (written vs. spoken) has a clear influence on referential expression production in Romanian. The lower frequency of pronominal subjects in the written corpus might be due to the role of normative grammar reserving the use of pronominal subjects solely for emphatic contexts (cf. Avram 2001). Moreover, we suggest that the higher frequency of pronominal subjects in spoken corpora might be explained by some version of a noisy channel model

(Gibson et al. 2013). According to this model, given the increased noise in oral communication, a rational speaker might opt to be more redundant in order to ensure the message is understood, thus using more pronominal subjects. Regarding antecedent function, null subjects were mostly produced when referring back to a subject antecedent, with an even higher proportion in the written modality. This tendency found for Romanian seems to be in line with previous findings in the literature, postulating that subjects make particular good antecedents (Crawley et al. 1990, Arnold 1998). Further, in a controlled experimental study using items with transitive verbs, Istrate et al. (2022) found a clear preference of null subjects for subject antecedents, although less categorical than in our corpus study (see de la Fuente & Hemforth 2013 for similar tendencies in Spanish). Moreover, in the corpus study, the production of pronominal subjects did not show a clear preference for subject or non-subject antecedents. Grammatical properties of the antecedents, such as *PAH* (Carminati 2002), seem to not fully capture the division of labor in null and pronominal subjects. Moreover, following Givón's (1983) *Topic Continuity Hypothesis*, a preference for null subjects with subject antecedents may be explained by information structure as suggested by Mayol (2010). Subjects as default topics have a higher probability of being mentioned next in the discourse.

Factors influencing the salience of a referent in the discourse, such as agentivity, voice and possibly gender, were shown to play a role in our corpus study. As argued before, we assume that higher salience increases the probability of being mentioned next in the discourse and, thus, the probability of a null subject.

Discourse relations also play a role in the present corpus study. In temporal subordinates, null subjects were more frequent, while for causal relations the results show no clear preference for a referential form. How can these results be related to next mention probabilities or predictability?

The high frequency of null subjects in temporal relations might be explained by the *Topic Continuity Hypothesis* (Givón 1983, Runner & Ibarra 2016). Temporal relations are typically part of a narration where topics rarely shift (see 4a).

For causal relations, we suggest that next mention probabilities may play a role as observed in examples from our corpus data. Implicit causality biases of the verbs may play a role here. In (4b), a null subject in the causal clause retrieves an object antecedent (*doamnei Mihaela* 'to Mrs. Mihaela'). The object in this case is the most predictable referent due to the implicit causality bias of a verb like *a mulțumi* 'thank' that induces an expectation for a reason why Mihaela should be thanked. Null subjects will refer back to the object antecedent when it is foregrounded by the implicit causality bias of the verb. The foregrounded antecedent becomes the most predictable in the discourse. Subject-biased verbs

like *fascinate* would predict the subject of the main clause to be mentioned next and to be referred to with a null subject in the causal subordinate clause.

(4) a. Procedând în acest fel, Martin Șluț și-a încălcat
doing in this manner Martin Șluț REFL.DAT.3-AUX.3SG broke.PST
promisiunea făcută anul trecut, atunci când a fost
promise.DEF made.SG.F year.DEF past when AUX.3SG be.PST
ales în fruntea Parlamentului de la Strasburg.
elected in head.DEF parliament.DEF.GEN of Strasbourg
'By doing so, Martin Sluț has broken the promise he made last year when he was elected to lead the Strasbourg Parliament.'

b. Mă numesc Nicolae Maria, doresc să-i
CL.1SG.ACC name.PRS.1SG Nicolae Maria wish.PRS.1SG SBJV-CL.3SG.DAT
mulțumesc doamnei Mihaela pentru că mi-a
thank.PRS.1SG madam.GEN Mihaela because CL.1SG.DAT-AUX.3SG
dezlegat cununia.
save.PST marriage.DEF
'My name is Nicolae Maria, I would like to thank Mihaela because she saved my marriage.' (corola-32168)

The overall results of the corpus study suggest that semantic-pragmatic factors seem to affect the production and interpretation of null and pronominal subjects. Their distribution was shown to be influenced by causal relations which differ considerably compared to temporal relations. However, while the role of implicit causality biases for the choice of null and pronominal subjects in the causal subordinate clause is plausible (Mayol 2018), we cannot confirm it based on the corpus data alone. This is why we ran the controlled experimental study reported in the next section.

3 Experiment: sentence completion task

3.1 Implicit causality verbs

Our corpus study showed no clear preference for null or pronominal subjects for sentences with causal relations. In the following experimental study, we want to shed light on why this may be the case. In previous studies taking into account semantic-pragmatic factors, two main classes of verbs were tested for potential predictability effects: implicit causality verbs (see Caramazza et al. 1977, Costa et

al. 2004, Fukumura & Van Gompel 2010, Rohde & Kehler 2014, Holler & Suckow 2016, Mayol 2018, Weatherford & Arnold 2021, Bott & Solstad 2023) and transfer-of-possession verbs (Stevenson et al. 1994, Rohde 2008, Vogels 2019, Lindemann et al. 2020). We will only focus on implicit causality verbs in the following. So-called implicit causality verbs possess an inherent causal meaning introducing a semantic bias towards continuations referring back to the entity related to the underlying causer of the event, which can appear in either subject position (subject-biased implicit causality verbs) or object position (object-biased implicit causality verbs). In (5a), the verb bias increases the prediction of the upcoming cause to be attributed to the subject *Mary* while in (5b) the upcoming cause is predicted to be attributed to the object *Peter*.

(5) a. *Mary* fascinated Peter because ...→ *Mary* more likely continuation
b. Mary criticized *Peter* because ...→ *Peter* more likely continuation

Ferstl et al. (2011) moreover suggest that, beyond the next mention bias invoked by the verb, the gender of the antecedents may play a role in that male antecedents have a slightly higher probability of being seen as the causer of an event. The general gender effect we found in our corpus study makes a similar prediction.

3.2 Methods

3.2.1 Hypotheses

With a sentence completion task, we tried to answer the following hypotheses that are, to some extent, interconnected. According to the *PAH* (Carminati 2002, and see also *topic continuity* in Givón 1983 or similar approaches), null subjects have a strong tendency to go with a subject antecedent, which is compatible with the corpus study presented in the previous section. This hypothesis predicts that participants produce more null subjects when referring back to a subject antecedent. Pronominal subjects should be used more when participants refer back to non-subjects. If, however, null subjects prefer more predictable antecedents that are likely to be mentioned next, verb biases may change the picture: Null subjects should be more frequent when the continuation is in line with the verb bias.

The gender of the antecedents might also be affected by next mention biases, as suggested by Ferstl et al. (2011). Our results from the previous corpus study revealed that masculine antecedents are more prominent, thus we also expect to

observe a higher preference for null subjects with masculine antecedents compared to feminine ones.

To sum up our hypotheses:

- A null subject will be produced more often when retrieving a subject antecedent.
- Based on the implicit causality biases of the verbs, continuations should refer to the antecedent foregrounded by the verb (the more predictable antecedent). The choice of the referential expression (null vs. pronominal subject) will then be influenced by the verb bias.
- Following results from Ferstl et al. (2011), we may also find a gender effect with a preference to choose male antecedents as the causer of an event, leading to a preference for null subjects to refer to male antecedents.

3.2.2 Participants

Thirty-one native Romanian speakers (age range 19 to 32 years, mean age: 27 years) participated in our experiment. All of the participants spent their childhood in Romania. They were students recruited at the University of Bucharest. Given that the participants are enrolled in an institution of higher education, their level of instruction is fairly homogeneous (a minimum of 12 years of instruction). Thus, the participants had no difficulty in reading, understanding, or continuing the sentences. Participation was voluntary and participants were not paid for their contribution. The experiment was run on a version of Ibex farm installed on a local server at Université Paris Cité. Participants' data were immediately anonymized. At no moment was identifying information stored.

3.2.3 Materials

The experiment focuses on testing the production of referential expressions (lexical vs. pronominal vs. null subject) in Romanian as well as the preference for an antecedent using a free passage completion task with a paradigm similar to Kehler & Rohde (2019). In order to increase the predictability of an antecedent, we chose implicit causality verbs that increase the next mention probability of the subject as in (6a)-(6b) with subject-biased verbs, or the object as in (6c)-(6d) with object-biased verbs.

(6) a. Maria îl dezamăgește pe Victor pentru că …
Maria CL.3SG.M.ACC disappoint.PRS.3SG DOM Victor because
'Maria disappoints Victor because…'

b. Victor o dezamăgește pe Maria pentru că …
Victor CL.3SG.F.ACC disappoint.PRS.3SG DOM Maria because
'Victor disappoints Maria because …'

c. Alexandra îl adoră pe Albert pentru că …
Alexandra CL.3SG.M.ACC adore.PRS.3SG DOM Albert because
'Alexandra adores Albert because …'

d. Albert o adoră pe Alexandra pentru că …
Albert CL.3SG.F.ACC adore.PRS.3SG DOM Alexandra because
'Albert adores Alexandra because …'

One of the antecedents was always a feminine first name, the other a masculine first name. We created two conditions for each sentence switching the gender of the subject and the object to test for possible gender effects as they were found in Ferstl et al. (2011). Participants were asked to continue sentences following the pattern in (7) using a plausible continuation of their choice (freely choosing a referential expression for the subject of the causal clause). According to the literature, participants continue with either a pronominal, a lexical or a null subject in more than 85% of the cases (see Kehler & Rohde 2019).

(7) Female/Male first name + implicit causality subject/object-bias verb + Male/Female first name + *because*

In order to create our experimental items, we selected a total of 48 implicit causality verbs (24 subject-biased verbs and 24 object-biased verbs) chosen from the database created by Ferstl et al. (2011). Given the fact that there is no similar database in Romanian, we based the choice of our verbs on the English verbs with the highest implicit causality biases (above 70%) which were then translated and adapted to Romanian. The verbs as well as the experimental items were reviewed by an independent native Romanian speaker (other than the creators and annotators of the experiment). We selected approximately 50% of verbs with a positive connotation (e.g. *impress, congratulate*) and 50% with a negative connotation (e.g. *disappoint, envy*). The names used for our items were very common, well-known, typical Romanian names to limit other potential biases as much as possible.

3.3 Procedure

Completions in the kind of task we use here can be free or constrained. In a constrained completion task, participants are invited to write completions referring

back to an entity that is somehow marked. For the unconstrained or free sentence completion task that we applied, participants were asked to complete the items without any constraints for the antecedent, providing likely continuations to the given sentences. Relying on the strength of the implicit causality biases, we opted for a free completion task (for a discussion of advantages and disadvantages of both paradigms, see Demberg et al. 2023). The task was conducted online on the Ibex Farm platform at Université Paris Cité (created by Alex Drummond and maintained by Achille Falaise). The experiment began with instructions for the task as well as a series of demographic questions (age, gender, first language, i.e. language spoken since early childhood). Participants gave their informed consent to the use of their anonymized data for research purposes. A total of 1071 completions were annotated excluding ambiguous or inappropriate answers. The continuations were independently annotated separately by two native Romanian speakers (both coauthors of the paper) with respect to the intended antecedent of the continuation as well as with respect to the referential expression used for the subject of the causal subordinate sentence introduced by *because*.

3.4 Results

In the annotation process, the antecedent of a null subject cannot be determined by syntactic markers given the nature of a null pronoun. Hence, when null subjects were produced, antecedent choice was determined by the meaning of the causal subordinate clause. The two annotators agreed on all decisions.[8] All data were analyzed using logistic regressions (*glmer* function in the *lme4* package, cf. Bates et al. 2015, *p*-value being estimated using *lmerTest*, cf. Kuznetsova et al. 2017). We first analyzed the effect of implicit causality and gender on antecedent choice. Gender of the subject of the root clause as well as verb bias were added as mean centered fixed factors and participants and items as random factors. Random slopes could not be added due to convergence failure. This is true for all models presented here. As shown in Figure 7, participants' continuations were highly consistent with the verb bias. They mostly chose a continuation consistent with a subject antecedent after subject-biased verbs and with the object antecedent after object-biased verbs (Est. = -6.90, std. error = .6176, z=-11.179, p <.001). There was also a small numeric effect of gender with slightly more subject choices (less object choices) when the subject antecedent was male (Est. = -.5938, std. error = .3586, z=-1.656, p = .0977).

[8] E.g., in a sentence like *Peter thanked David because he proofread the thesis*, it is highly plausible to assume that the null subject refers back to the object of thanking.

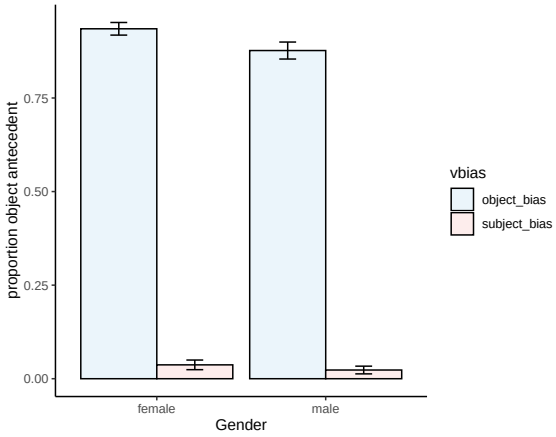

Figure 7: Next mention and verb bias

Participants chose null or pronominal subjects in more than 95% of the cases. We therefore excluded other referential expressions from our analyses. Participants overwhelmingly produced null subjects in the *because*-subordinate clause independently of verb bias (Est. = 4.8020, std. error = .6262, z=7.669, p < .001). As shown in Figure 8, null subjects were moreover chosen more frequently for sentences with subject-biased verbs where verb bias and the general preference of null subjects for subject antecedents align (Est. = 1.6934, std. error = .5866, z=2.887, p <.01). We finally looked at the frequencies of null and pronominal subjects depending on the antecedent choice made by the participants. Logistic regressions included antecedent choice and verb bias as fixed factors (both mean centered) and participants and items as random factors. Figure 9 shows that participants chose null subjects more often in cases where the verb bias and the antecedent choice aligned, i.e. when they produced a continuation consistent with an object antecedent in sentences with object-biased verbs or a continuation consistent with a subject antecedent in sentences with subject-biased verbs (Est. = 4.3433, std. error = 1.2946, z=3.355, p < .001).

3.5 Discussion

All in all, the results of our free passage completion task in Romanian confirm the hypothesis that null subjects are the most preferred referential form to retrieve subject antecedents. However, null subjects can also easily be produced for non-subject antecedents when they are highly predictable in the context. This can

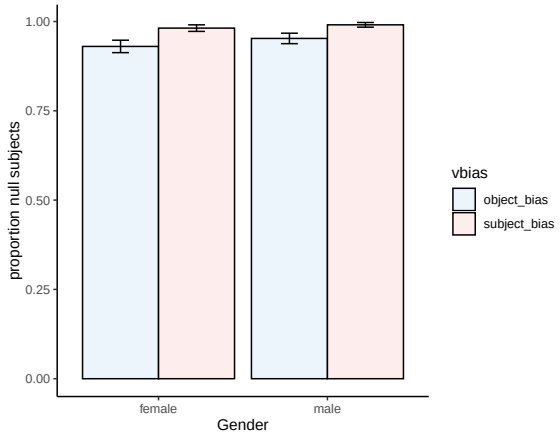

Figure 8: Subject antecedents and verb bias

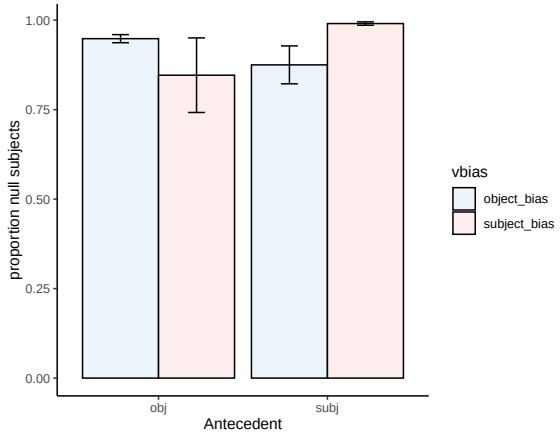

Figure 9: Subject choice and verb bias

be interpreted as is clear evidence against at least a simple version of the *PAH* (Carminati 2002) that stipulates a general preference of null subject pronouns for subject antecedents. While it might be argued that the experimental situation could lead to non-natural productions from the participants, the continuations produced by the participants with object antecedents in the case of object-biased verbs (see 8a and 8b for examples from the experiment) were judged as highly natural by both native speakers of Romanian who annotated them.

(8) a. Laura îl felicită pe Ionuț pentru că
Laura CL.3SG.M.ACC congratulate.PRS.3SG DOM Ionuț because
a luat permisul.
AUX.3SG take.PST license.DEF.M.SG
'Laura congratulates Ionuț because he got his driving license.'

b. Ionuț o felicită pe Laura pentru că
Ionuț CL.3SG.F.ACC congratulate.PRS.3SG DOM Laura because
a câștigat un permiu.
AUX.3SG win.PST a prize
'Ionuț congratulates Laura because she won a prize.'

In an experimental study on pronoun choice and thematic roles, Lindemann et al. (2020) suggest a very similar pattern for Romanian. Their results also show a general preference of null subjects for subject antecedents with no clear preference for pronominal subjects. Interestingly, in their study, thematic roles (goal vs. source) affected the production of referring expressions alongside the grammatical role of the antecedents. Null subjects were more often used to retrieve *goal* referents, i.e. more prominent or predictable referents.

In our experiment, we observe that participants produced pronominal subjects more often when the antecedent was less salient or predictable. However, other cases of pronominal subjects (as in 9a and 9b) included continuations that contained a contrast between antecedents (see Dobrovie-Sorin & Giurgea 2013 and Mayol 2010 for similar suggestions). The role of contrast has more recently also been confirmed in experimental studies by Istrate et al. (2024).

(9) a. Maria îl dezamăgește pe Victor pentru că și el
Maria CL.3SG.M.ACC disappoint.PRS.3SG DOM Victor because also he
a făcut același lucru.
AUX.3SG do.PST same thing
'Maria disappoints Victor because he also did the same thing.'

b. Victor o invidiază pe Maria pentru că ea are note
Victor CL.3SG.F.ACC envy.PRS.3SG DOM Maria because she has grades
mai bune decât el.
better than him
'Victor envies Mary because she has better grades than him.'

With respect to the predictability effect induced by implicit causality verbs, tendencies in Romanian are fairly similar to those suggested by Bott & Solstad

(2023) for German in which the referent predictability was shown to have a strong impact on pronoun production. Moreover, from a crosslinguistic perspective, Romanian seems to align with preferences found for other pro-drop Romance languages (see Contemori & Di Domenico 2021 for Italian and Spanish, Mayol 2018 for Catalan), i.e. null subject pronouns will be favoured for more predictable referents. For European Portuguese, Costa et al. (2004) showed similar preferences for null subjects, but a different pattern in the case of pronominal subjects, which were used more often for object antecedents foregrounded by an object-biased verb. Regarding gender biases, we found a small numeric gender effect (following Ferstl et al. 2011) in our experimental data.

Unlike Bott & Solstad (2023) and Rosa & Arnold (2017), who suggest that predictability effects are stronger with same-gender antecedents, we found that next-mention bias can also play a strong role when using different-gender antecedents in an implicit causality experiment.

4 General discussion

In our corpus study, we found that, while null subjects have a strong preference for subject antecedents as predicted by the *PAH* (Carminati 2002), other more semantic-pragmatic factors also play a role. In particular, prominence enhancing factors such as *voice* or *agentivity* (and potentially *gender*) but also *modality* affect the choice of the referential expression. Moreover, discourse relations seem to play a role in that null and pronominal subjects are equally distributed in causal relations but not in temporal relations.

In our experimental study, we tried to better understand the specific pattern for causal relations. Despite a slight general preference for subject antecedents, null subjects were shown to be strongly preferred as referential form for non-subject antecedents as well when they were predictable enough in the context. More concretely, object antecedents were retrieved mostly by a null subject in the context of causal coherence relations, with an implicit causality verb biased towards the object (e.g., *congratulate*). While null subjects were preferred when the continuations aligned with the verb bias, pronominal subjects were generally used by participants in continuations which go against the verb bias (for example, in contrastive contexts; for similar suggestions see Mayol 2010).

Moreover, putting our corpus study and experimental results together, we contribute to a broader research question which is under significant debate, more specifically, whether predictability influences the choice of referring expressions (cf. Arnold 2001, Fukumura & Van Gompel 2010, Rohde & Kehler 2014, Holler &

Suckow 2016, Modi et al. 2017, Rosa & Arnold 2017 a.o.). Both corpus and experimental evidence in Romanian suggest that higher predictability (Tily & Piantadosi 2009) triggers a clear preference for null subject pronouns. This effect of referent predictability is also in line with previous hypotheses in the literature on the role of salience or accessibility (Givón 1983, Ariel 1994, Grosz et al. 1995, Chafe 1996) or prominence (von Heusinger & Schumacher 2019). As suggested by Demberg et al. (2023), the next mention bias may be triggered by a complex interaction of two semantic-pragmatic factors, i.e. the verb bias and coherence relations.

In general, our data on Romanian replicate results from previous studies (Costa et al. 2004, Mayol 2018, Contemori & Di Domenico 2021) on languages from the Romance family, while they are inconsistent with previous data from Mandarin Chinese (Hwang et al. 2022). More crosslinguistic studies are needed to establish in how far general pro-drop patterns in a language may play a role here.

Data and materials are accessible here: https://osf.io/fmjnq/.

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Chapter 7

Discourse markers are not special (but they can be complicated)

Jacques Jayez
ENS de Lyon & LORIA, CNRS

This chapter discusses the identification and representation of *discourse markers* (DMs), indexical elements which contribute to the organization of discourse, the manifestation of the speaker or the interaction between speaker and addressee(s). I argue that, in spite of their diversity, DMs fall into two broad classes, *connective* DMs, which trigger presuppositions, and *Hic et Nunc Particles*, which trigger conventional implicatures and, like Potts's (2007) expressives, are anchored to the utterance situation. In order to lay the foundations for a representation, I extend the interactional framework of Ginzburg (2012) to incorporate the contribution of DMs in a flexible way.

1 Introduction

This chapter deals with the semantic status of *discourse markers* (DMs) in French. As for instance in Degand (2014: 151), I take them to be words or expressions whose main function is to suggest *discourse relations* (DRs) between semantic objects such as propositions, to refer to epistemic or affective states of the speaker or to her interaction with other conversational agents. Some typical examples in French are DMs which suggest consequence, like *donc* 'therefore', *du coup* 'so', etc., or contrast, like *mais* 'but', *pourtant* 'yet', etc., and DMs like *ah* or *bon* 'well'. DMs have a paradoxical status. On the one hand, they have spawned an abundant literature in many languages. On the other hand, the mosaic of specific meanings and monographic studies makes it difficult to discern a more global image, if any, and relate it to general semantic categories. Although I do not

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deny the obvious fact that specific DMs must be distinguished by fine-grained and sometimes very subtle aspects of meaning, I contend that, as a group, DMs are not special, since they fit pretty closely into a well-known classification of three general semantic kinds, namely modifiers participating in the propositional content, presupposition triggers and conventional implicature triggers.

In Section 2, I present a number of relevant distinctions, starting from the basic ones (Section 2.1) and indicating my position about the identity of DMs (Section 2.2). In Section 3, I show how to type connective DMs (Section 3.1) and present their presuppositional status (Section 3.3) and their representation (Section 3.4). Next, I show in Section 4 how to apply the same kind of analysis to the second major class of DMs, the *Hic et Nunc Particles* (HNPs).

2 Introducing DM

2.1 Basic distinctions

In the 90's, Gisela Redeker and Eve Sweetser independently proposed to classify DM uses by the kind of discourse relations (DRs) or reference types, i.e. the objects they refer to. Redeker (1990) sees DMs as denoting two different types of *coherence* relations (in her terminology): *ideational* or *pragmatic*. Ideational DRs correspond to relations which hold in the real world[1] while pragmatic DRs concern either the beliefs and intentions motivating the related utterances (*rhetorical* DRs) or the management of discourse evolution (*sequential* DRs). Temporal, causal, elaborative, reason and consequence relations are examples of ideational DRs. Concession, justification, and contrast illustrate pragmatic-rhetorical DRs. Topic change, correction and digression illustrate pragmatic-sequential DRs.

For Sweetser (1990), a *domain* is the type of the entity a DM refers to in a given context (a reference type). For instance, in (1), the *parce que* 'because' DM connects two states of affairs. Other examples show that French *parce que*, like its English counterpart *because*, can involve belief states (2) or speech acts (3). Sweetser focuses on what she calls "pragmatic ambiguity", the idea that the same semantic content can concern various reference types, typical examples for English being *because* or *if* (Sweetser 1990, Dancygier 1998). For instance, the same causal relation associates states of affairs in (1) and belief states in (2). The main difference between Redeker's and Sweetser's perspectives is the fact that Redeker is not concerned with reference types, as apparent from her comment on *because* examples parallel to (2) (Redeker 1990: 373).

[1]The term is borrowed from Halliday, see for instance (Halliday 2003: 84).

(1) Paul est en retard parce qu' il a raté son train.
Paul is late because he has missed his train
'Paul is late because he missed his train.'

(2) Paul est chez lui parce que sa voiture est devant la maison.
Paul is at him because his car is in-front the house
'Paul is at home because his car is in front of the house.'

(3) Tu as l' heure? Parce que j' ai oublié ma montre.
you have the time because I have forgotten my watch
'Do you have the time? Because I forgot my watch.'

It is difficult to arbitrate between these two views on general and abstract grounds and I will follow the cautious policy of more recent work in distinguishing domains (reference types) and functions (Crible 2018, Crible & Degand 2019), which essentially amounts to (i) keeping DR types and reference types, and (ii) determining whether these two dimensions are independent on an empirical, non *a priori*, basis.

Another relevant distinction concerns the semantic contribution of DMs. Some DMs contribute to the propositional content (PC)[2] of the utterance whereas others don't. Again, this raises the question of dimension independence: is the contribution dimension of (non-)participation to the PC separated or not from domain and function dimensions? For instance, should we claim that DMs can contribute to the PC only when they express a causal relation between states of affairs (an ideational relation), as in (1)? We will see in the next section that contribution to the PC is indeed limited to the ideational interpretation of DMs.

Finally, there is the question of displaceability, a criterion that Potts (2007) borrowed from Hockett (1960) and applied to expressives like swearwords or evaluative/emotional adjectives in non-predicative constructions (*my stupid neighbor*, etc.). The linguistic tests for displaceability may be sometimes difficult to deploy but they prove useful to isolate the important category of HNPs (Dargnat 2024) in Section 4.

In the next section I address the question of the contribution of DMs to the PC, in relation to the problem of the boundaries of the category "discourse marker".

2.2 DM or not DM?

Many books or papers on DMs start with enumerating a list of features supposed to characterize DMs. Classic references include works by Schiffrin (1987), Brinton

[2]Other labels include *at-issue content*, *main content*, *main point* and *proffered content*.

(1996), Schourup (1999), Aijmer (2002, 2013), Beeching (2016). The general impression is tersely summarized by Brinton (1996: 30): "The definitions of pragmatic particles found in the literature seem to bear little resemblance to one another." More recent works (Crible 2017, Fedriani & Sansò 2017, Heine et al. 2021) tend to take a step back and keep only the most frequently mentioned features or those which are supported by corpus data. A typical example is the list[3] of Heine (2013: 1209), where DMs are presented as in (4):

(4) a. syntactically independent from their environment,
b. typically set off prosodically from the rest of the utterance,
c. non-restrictive in their meaning ("not part of the propositional meaning of a clause"),
d. procedural rather than conceptual-propositional,
e. non-compositional and, as a rule, short.

A simple illustrative example is (5), given by Heine et al. (2021: 3). In (5a), *still* is a constituent of the sentence and contributes to its meaning, whereas the same item does not show these two properties in (5b). Moreover it is much easier to prosodically isolate *still* in (5b) than in (5a).

(5) a. John is still sick.
b. Still, John is sick.

In Heine et al. (2021: 6), the function of DMs is defined as "metatextual, being anchored in the situation of discourse and serving the organization of texts, the attitudes of the speaker, and/or speaker–hearer interaction." Consider (1) in this perspective. The *parce que* 'because' conjunction can contribute to the PC, as evidenced by the usual tests of negation, interrogation and *it*-clefting:[4] *Paul was not late because he missed his train, but for another reason*, etc. Therefore, according to (4c), it does not behave as a DM. This limitation is operative in a number of approaches, in particular cooptation (Heine 2013, Heine et al. 2021) or some versions of Construction Grammars, as illustrated by Traugott's (2018a: 27) definition: "By a DM I mean a metatextual marker that signals some kind of relationship between clauses/utterances." Traugott acknowledges the fact that this is a "restrictive definition".

In other approaches (e.g., Webber et al. 2017), items contributing to the PC are not kept apart from other resources involved in discourse coherence. Given that

[3]For a thorough discussion of various features attributed to DMs, see Brinton (1996: section 2.1).
[4]I use *it*-clefting whenever possible because it is less susceptible to variation in semantic intuition.

(i) such items serve one of the central functions ascribed to DMs, namely structuring discourse, and (ii) in a number of cases, there is an interesting similarity between the PC and non-PC uses, I adopt the liberal view that items relevant to the PC must be included in the family of DMs, and show that a basic semantic function can underlie PC and non-PC contributions via typing constraints.

3 Typing connective DMs

Connective DMs are those DMs which express a discourse relation between two semantic objects. In French, they can be subordinating conjunctions like *parce que* 'because' or *si* 'if' or adverbials like *donc* 'therefore/so' or *après* 'after'. This prompts two questions: what kind of semantic objects can such DMs relate and what kind of contribution to the discourse do they make? I address these questions in turn in the next two sections.

3.1 Unique discourse relation

In this section, I consider the kind of semantic configuration studied by Sweetser (1990), that is, cases where, while there is some variation on the type of semantic objects the DM connects, there is a strong intuition that the connection corresponds in every case to the same discourse relation, for instance causality, consequence or opposition.

In examples (1), (2) and (3), we met the ubiquitous DM *parce que* 'because', which was mentioned by Sweetser (1990) as open to pragmatic ambiguity: one meaning (causal) but several possible reference types. When the DM *parce que* contributes to the PC, it can only relate states of affairs. Using our *it*-cleft test once more, we observe that, when the host clause of *parce que* is in focus, the belief reference type is not possible. So, the following variant of (2) in (6) can only mean that there is some causal, non-epistemic, relation between the location of the car and the presence of Paul. By turning the second sentence into a psychological state of affairs we preserve the causal link (*It's because … that I think that he is at home*).

(6) C'est parce que la voiture de Paul est devant la maison qu' il est
it's because the car of Paul is in-front the house that he is
chez lui.
at him
'It's because Paul's car is in front of the house that he is at home.'

It is not very surprising that contributing to the PC and connecting states of affairs coincide if we assume that the role of the PC is precisely to describe states of affairs, whether physical, psychological, social or mathematical. This is precisely one of the properties that theories which distinguish between, for instance, force and thought (Frege), mood and radical (Stenius), modus and dictum (Meillet), illocutionary force and PC (Searle), try to capture. It does not follow that *not* contributing to the PC disallows reference to states of affairs. Let us consider again the abductive interpretation of *parce que* 'because' illustrated in (2). Given the general structure *A parce que B* 'A because B', there are nine possible denotation choices and as many paraphrases. For instance, the choice of a connection SOA–SOA[5] produces the paraphrase *the fact that Paul's car is in front of the house is the cause of the fact that he is at home*, which, as noted above for (6), is implausible. In fact, there are only four plausible patterns. The <BEL cause SA> and the <BEL cause BEL> ones have paraphrases of the form *the belief that Paul's car is in front of the house is the cause of the belief/assertion that he is at home*. The paraphrases for the patterns <SOA cause BEL> or <SOA cause SA> are *the fact that Paul's car is in front the house is the cause of the belief/assertion that he is at home*. These relations are all enthymematic in some way. For instance, the presence of the car in front of the house can trigger the belief that Paul is at home only if we supplement the relation with the additional premiss that the speaker is aware of the car's location.

The abductive interpretation for (2) sheds light on the nature of the difference between Redeker's and Sweetser's approaches. For Redeker (1990), an abductive interpretation would count as a justification, a non-ideational relation which does not hold in the real world. For Sweetser (1990), there is a general relation of causation, which forms the semantic core of *because* and can be specified in difference domains (reference types). If we accept that cognitive (beliefs) and communicative (speech acts) processes are grounded in the real world, it would probably be more accurate to say that Redeker's ideational relations concern those causal processes which do not involve intentional behavior.[6]

Given the abductive distribution for *parce que*, one may wonder whether the exclusion of <SOA relation SOA> is a general property of non-PC interpretations or a specificity of causation and possibly other relations. A natural follow-up is then to consider other types of relation. The concession relation is *a priori* a good candidate since it has been described as a negative counterpart of causality

[5]SOA is the type of states of affairs, BEL that of belief states and SA that of speech acts.

[6]The intentionality perspective is central to discourse relation models such as *Rhetorical Structure Theory* (Taboada & Mann 2006).

(Verhagen 2005). Concessive DMs like *bien que* 'although', *mais* 'but', *pourtant* 'yet', etc., do not contribute to the PC and have no corresponding verb expressing concession, unlike *because* with its partners *to cause*, *to bring about* or *to trigger*. In order to force the SOA reading, I use perceptual verbs, which prevent the abductive reading, since one cannot infer that one sees (observes, witnesses) something.[7] While the possible reference types for (7a) cannot be determined, (7b) forces the SOA attribution. Examples like (7b) indicate that non-PC-contributing DMs can associate SOA-denoting elements. Adverbial elements like *mais* 'but', *pourtant* 'yet', etc. exhibit the same behavior. Therefore, contributing to the PC and denoting SOA are not equivalent.[8] When a DM contributes to the PC, it must relate SOAs, when it does not, it can also target SOAs.

(7) a. Paul n' est pas chez lui bien que sa voiture soit devant
Paul NEG is not at him although his car be.SBJV.3SG in-front
la maison.
the house
'Paul is not at home although his car is in front of the house.'

b. Je constate que Paul n' est pas chez lui bien que j' aie
I observe that Paul NEG is not at him although I have.SBJV.1SG
vu que sa voiture était devant la maison.
seen that his car was in-front the house
'I observe that Paul is not at home although I saw that his car is in front of the house.'

3.2 Proximity of meaning

There are some items which, like *parce que* 'because', (i) feature more than one of Sweetser's domains (reference types) and can contribute to the PC or not, but which (ii) do not exhibit the same apparent identity of meaning across their uses. In French, this is for instance the case of temporal markers like *après* 'after', *ensuite* 'then', *maintenant* 'now', *en même temps* 'simultaneously' and some conditional markers like *si* 'if' or *au cas où* 'in case'. For example, in the dialogue given in (8), B uses *après* as a concessive marker. The exchange in (8) takes place in the context of a discussion where B complains about her financial limitations.

[7] More precisely, one can infer that what one sees is such or such object, but, under normal circumstances, an agent cannot infer the existence of the seeing event itself.

[8] For similar findings, see Jayez & Rossari (2002) for consequence DM.

Speaker A notes that there are relatively cheap theater seats available. In a probabilistic setting (Jayez 2024, Winterstein 2010) based on the confirmation approach (Crupi & Tentori 2016), A's assertion makes the probability that B books a seat increase whereas B's answer makes it decrease. With a pattern d_1 *après* d_2, where d_1 and d_2 are two discourse chunks, *après* can signal either that an eventuality described by d_2 temporally follows an eventuality described by d_1 (the PC use) or that there is a proposition p such that (i) d_1 can be interpreted as an argument in favor of p, by making its probability rise, and (ii) d_2 makes the probability of p decrease or cancels the raising effect of d_1 (the non-PC use).[9]

(8) A: mais tu peux avoir des places de théâtre […] qui valent
A: but you can have some seats of theater […] which worth
vachement le coup.
really the deal
'But you can get theater seats which are a bloody great deal.'
B: ouais mais après faut voir le truc qu' y a aussi.
B: yeah but after need see.INF the thing that there has also
'Yeah but you have also to see what the program is.'
C: après il y en a beaucoup?
C: after it CL.LOC CL.GEN is many?
'There are many of them?'
(ESLO,
http://eslo.huma-num.fr/CorpusEslo/html/fiche/enregistrement?id=1332)

As noted by a reviewer, *mais* 'but' would also be appropriate in (8). However, the two DMs are not synonymous. One can directly reject p with *mais* whereas the same move would be awkward with *après*, as shown in (9).[10] As proposed by Le Draoulec & Rebeyrolle (2018), I assume that the concessive use of *après* retains something of its temporal anaphoric use. The fact that other DMs can also express concession but not direct rejection – as is the case with *ensuite* 'then' (expressing succession), *en même temps* 'simultaneously' (expressing anaphoric simultaneity) or *maintenant* 'now' (expressing deictic simultaneity) – being thus very similar to *après*, suggests that there is some non-accidental connection be-

[9] In the language of modern argumentation theory, d_2 can either *attack* p or constitute an *undercut*, that is attack the relevance of d_1 or its force of connection with p (see for instance Walton 2013).

[10] The sentence would be much more natural with *il peut se tromper* 'he might be wrong' instead of *il se trompe* 'he is wrong'.

tween the temporal and concessive uses.[11] I have no convincing explanation to offer for the emergence of a concessive value in those cases, but the temporal aspect can explain the difference with *mais*. Concretely, if saying α is an argument for p and saying β counteracts this move, emphasizing a temporal location with a concession makes sense only if we keep the potential conclusions of both moves 'alive'. The marking of temporal organization is used in enumerations to mark the limits between different elements or in contrasts (*on the one hand / on the other hand*, etc.) to mark the balancing elements. It has then in general a demarcating function. The same function serves the presentation of two opposite arguments in concession. If the second move completely neutralized the argumentative impact of the first, there would be no need to give prominence to any kind of temporal demarcation since, with only one effective argument, there would be nothing to distinguish. While there is no temporal succession for *maintenant* 'now' and *en même temps* 'simultaneously', the demarcation function is still salient. To summarize, since all four items introduce a concessive move, the demarcation function associated with their temporal meaning makes direct rejections infelicitous. These items can also introduce a non-assertive speech act, as shown by the alternative answer C in (8), which hints at the possibility that the most advantageous seats are perhaps not so many.[12]

(9) Paul pense que Marie est chez elle, ({mais / ??après / ??maintenant / ??ensuite / ??en même temps}) il se trompe.
Paul thinks that Mary is at her but / after / now / next / simultaneously he REFL.3 is-wrong
'Paul thinks that Mary is at home, but he is wrong.'

[11] See Aijmer (2002: chapter 2) for a detailed analysis of *now* which converges in many respects with the remarks made here and parallel observations for Romanian (Walters 2023). The potential of originally temporal items for marking contrast is pointed out by Kortmann (1997: 189), see *tandis que* and *alors que* 'while/whereas' analyzed in Combettes & Dargnat (2024). However, the type of concession under consideration is not mentioned by Kortmann (1997) nor by Heberlein (2011) for Latin.

[12] The coexistence of a temporal and argumentative function for the DM *après* might correspond to the trajectory described in cooptation from intra-sentential function to discourse function but also to the role assigned to *subjectification* in some semantic approaches (Verhagen 2005). Concerning subjectification, while the existence of a path from external events to internal psychological events seems well-attested, one may wonder why it leads to a concessive and not also to an additive interpretation. For example, why is *après* semantically different from *de plus* 'moreover/in addition/besides', which has very likely followed a similar path? The DM *de plus*, like the cognate expressions *en plus* and *qui plus est*, is used to add an argument in the same direction. This might reflect the Latin comparative origin, the Latin *plus* marking a higher degree on a qualitative or quantitative scale. When shifting to an argumentative interpretation, it is possible that the initial comparative value is transposed as the mention of additional argument, which reinforces the plausibility or relevance of the conclusion.

In some cases, an item does not contribute to the PC but otherwise shows the same type of variation as *après* and similar expressions. A well-studied item of this type is *déjà* 'already' (Mosegaard Hansen 2008, Squartini 2014). Less well-known cases include iterative items, such as *encore une fois* lit. 'again once', *une fois encore* 'once again' or *pour la dernière fois* 'for the last time', and additive ones like *aussi* 'too/also'. In (10), the presupposition trigger *encore une fois* 'once again' is not part of the PC. For instance, in contrast to a temporal adverb, it cannot be clefted. It signals that Paul already failed an exam (perhaps the same type of exam as the current one), exactly like *encore* 'again'. In (11), the same item is preferentially interpreted as meaning that the speaker repeats something which has been said before or paraphrases a belief that has been around. In clause-internal position, *pour la dernière fois* 'for the last time' signals that Paul will not have the possibility to fail the exam again. In clause-initial position, it indicates that the speaker is not willing to repeat what she says. *Aussi* in clause-internal position has the same possible interpretations as *too* in English. In spoken French, in clause-initial or clause-final position, it communicates either that the speaker adds something to the ongoing discourse (like *also* in spoken English) or that she lets the addressee infer from the host sentence that there is some condition which (i) might have prevented some harmful event (generally clear from the context) and (ii) has not or might have not occurred. In (12), A mentions that Paul failed his exam (an adverse event) and B lets A infer that it is possible that Paul did not fulfill a standard precondition for not failing an exam, i.e. studying for it.

(10) Paul a encore une fois échoué à son examen.
Paul has again once failed to his exam
'Paul once again failed his exam.'

(11) Encore une fois, Paul a échoué à son examen
again once Paul has failed to his exam
'Once again, Paul failed his exam.'

(12) A: Paul a encore échoué à son examen.
A: Paul has again failed to his exam
'Paul again failed his exam.'
B: Aussi est-ce qu' il a révisé?
B: also is-this that he has revised
'But did he study for it?'

Heine et al. (2021) give numerous examples of items which begin their life as ideational indicators before extending their scope over discourse units and developing a discourse-oriented meaning. The association of DMs with peripheries is

in fact a very general phenomenon (Van Olmen & Šinkūnienė 2021), which is not limited to items contributing to the PC in some of their uses. Another path of evolution from PC uses to non-PC uses is a categorial change, like when, for instance, a prepositional phrase becomes an adverbial discourse marker (see Fagard & Charolles 2018 for the French *d'ailleurs* 'besides'), or a verb in the imperative loses its complement(s) and can scope over a whole clause which it relates argumentatively to a previous discourse sequence (see Brinton 1996, Traugott 2018b, Dostie 2004 for English *look* and its French counterpart *regarde*).[13] In the next two subsections, I focus on the presuppositional status of certain DMs and its consequences on their representation.

3.3 DMs as presupposition triggers

In this section, I argue that a number of DMs, often called *connectives*, are presupposition (PSP) triggers and I introduce the basic elements of a formal representation. The DMs in question express DRs and connect two objects, with the ability to pick up non-discursive elements of the utterance situation as terms of the relation – at least for some of them. We mentioned in Section 3.2 the case of *encore* 'again', *encore une fois* 'once again' and *aussi* 'also/too', which are parallel to their English counterparts. The idea that connective DMs are PSP triggers was introduced in Jayez (2004) and, subsequently, developed or rediscovered in Dargnat & Jayez (2020), Pavese (2023), Stokke (2017).

There are in fact two possible ways of presupposing for DMs. Trivially, connective DMs need some antecedent to make sense. One uses *afterwards*, *therefore* or *although* with respect to some element of the discourse or utterance situation. This corresponds to the concept of "cohesion" of Halliday & Hasan (1976) and has been explicitly assimilated to anaphora by Berrendonner (1993), whose connection with PSP is well-known (van der Sandt 1992, Geurts 1999). In addition, for some DMs, the relation with the antecedent (= the DR) is itself presupposed. Consider the following example, a variant of Dargnat & Jayez (2020: example 13). Suppose that a company has decided to hire an employee and set up a recruiting committee for this goal. According to the recruiting regulations, any member of the committee who knows a candidate personally is supposed to not participate in the interview. We observe that, like any PSP trigger, DMs like *donc* 'therefore', *du coup* 'so', *alors* 'then', etc., are not affected by negation (13a) or interrogation (13b): the consequence discourse relation holds in the scope of the negative

[13] A similar move is observed for some verbs in the indicative (see Andersen 2007, Brinton 2008 for French *tu sais* and its English counterpart *you know*). However, the resulting DMs are more naturally analyzed as "particles" in the sense of Section 4.

and interrogative operators. The conditionalization test in (13c) makes the consequence relation dependent on the existence of the rule. Moreover, example (14) shows that the DMs have "local effect" (Tonhauser et al. 2013), that is, the consequence relation can be endorsed by Mary. Examples (13)–(14) are different from more usual examples with pronouns or definite descriptions, where the existence of the antecedent is preserved or suspended, like in *The committee member does not know Annie*, which presupposes that there is an identifiable particular committee member or *if a committee is set up they will examine the applications*, where the existence of a committee is not presupposed. In the case at hand, we could manipulate two different PSPs. One is the trivial antecedent, which is the premiss of the rule and the target of the anaphora (= the DM). When this premiss is suspended, the conclusion is also suspended: if Paul does not know Annie X, he may attend her interview.[14] In that case, the rule still takes effect. The other PSP is the rule itself, which is explicitly suspended in (13c). We observe similar effects with concessive DMs like *mais* 'but' or *pourtant* 'yet'.

(13) a. Il n'est pas vrai que Paul connaît personnellement Annie X et ({donc / du coup}) ne peut assister à son audition.
'It is not the case that Paul knows Annie X personally and ({therefore / so}) may not attend her interview.'

b. Est-il vrai que Paul connaît personnellement Annie X et ({donc / du coup}) ne peut assister à son audition?
'Is it the case that Paul knows Annie X personally and ({therefore / so}) may not attend her interview?'

c. Si réellement il y a cette règle sur les membres du comité qui connaissent un(e) candidat(e), Paul ne peut ({donc / du coup / alors}) pas assister à l'audition d'Annie X
'If, really, there is that rule about committee members who know personally a candidate, ({therefore / so / then}) Paul may not attend Annie X's interview.'

(14) Marie pense que Paul ne peut ({donc / du coup / alors}) pas assister à l'audition d'Annie X.
'Mary thinks that ({therefore / so / then}), Paul may not attend Annie X's interview.'

[14]Barring other circumstances, the spontaneous extension from *If Paul knows Annie then he may not attend the interview* to *If he doesn't know her then he may attend the interview* is, of course, an instance of the invalid but natural move known as *conditional perfection*, an enrichment of the consequence relation (see Cariani & Rips 2023 for an evaluation of its robustness).

Consequence and concessive DMs have two main features. They do not contribute to the PC and they suggest some dependence between semantic objects, for instance SOA. Items like *parce que* 'because' can contribute to the PC. When they do, the trivial PSP, that is, the SOA for which *parce que* introduces a cause, is still there: negating (1) gives *Ce n'est pas parce que Paul a raté son train qu'il est en retard* ('It's not because Paul missed his train that he is late'), which presupposes that he is late. For syntactic reasons, things are more complicated for non-PC-contributing uses but we can exploit the conditionalization test of (13c).[15]

In dialogues, another complication is the possibility, for causal and consequence connectives, to target preconditions of or inferences drawn from the speech act of another participant. In (15), B targets a PSP. Other possibilities concern temptative inferences to the cause of the asserted PC (C's answer) or its social legitimacy (D's answer).

(15) A: Paul a encore raté son examen.
A: 'Paul has failed his exam again.'
B: ({Parce qu' / donc}) il l'avait déjà raté ?
B: (lit. 'because / so') 'he had already failed it?'
C: ({Parce qu' / donc}) il n'avait pas révisé?
C: (lit. 'because / so') 'he had not revised?'
D: ({Parce que / donc}) tu crois que ça me regarde?
D: (lit. 'because / so') 'You think it's my business?'

3.4 Representation

The ingredients we need for a basic representation of connective DMs all have to do with the kind of context update that such DMs bring about. The approach in Ginzburg (2012) provides a good starting point for two reasons. It uses the well-understood, visually clear and flexible technique of *records* and *record types*,[16] familiar from computer science, and it gives a central role to the notion of discourse move, intended to capture the dynamic effect of discourse actions. This said, my use of the Ginzburg's framework is opportunistic and there are a number of aspects (in particular, commitment structure and the typing of DM arguments) which have been added to the various record structures, since, in their

[15] A veterinary to an inexperienced assistant: *If they become edgy when you enter their cage, stay away* (SA) *because we risk a problem.*

[16] Records are finite sets of <attribute = value> pairs and record types finite sets of <attribute : type> pairs, where the colon indicates a typing judgment. I will not be concerned here with some technical aspects of records, in particular the stratified type construction detailed in Cooper (2023).

initial form, they were not intended as tools for describing DM. When studying discourse moves, there are a number of general points to take into account.

Firstly, there is the the well-known notion of *Question Under Discussion* (QUD), the current topic of discourse (Roberts 2012). QUD is used in particular to separate elements of the PC from PSP or other non-PC elements (in particular, conventional implicatures). This is crucial for DMs like *parce que* 'because' or *après* 'after' which have PC and non-PC uses.

Secondly, we also need to accommodate the notion of *commitment*, whose importance has been demonstrated by Krifka (2023) and MacFarlane (2011) for assertion, and which is generalized here to other facets of discourse moves. Although there is some debate about the status of commitment and intention in communication (Geurts 2019, Harris 2019), I will adopt the view that expressing certain parameters in terms of commitment is more neutral than using intentions, and that it is always possible to make intentions enter the picture at a later stage if it is deemed useful. For instance, assertions will be minimally associated with a commitment to the truth of the PC, not with an intention to be believed, even though this intention can be attributed to the speaker in most contexts.

Thirdly, the process of updating discourse states may be represented in several ways, but there are two general principles to be observed: (i) respecting the cumulative nature of discourse, that is, the fact that previous discourse moves remain theoretically accessible (discourse information is not lost at every fresh move); (ii) participants can react to various 'aspects' or 'facets' of moves, for instance they can raise an issue about the PC, a PSP, a conventional implicature or the (in)appropriateness of an expression. The QUD records only what the speaker considers as the default trend of discourse, that is, the contents to which participants are supposed to react and which they are supposed to elaborate, in the absence of evidence to the contrary. As shown in Section 3.3, presuppositional DMs display a dependence on previous discourse. By using such a DM, the speaker gets committed to the existence of a possible antecedent and, for non-PC-contributing DMs, to that of an appropriate discourse relation. However, these commitments are not reflected in the QUD, since the speaker does not intend (by default) to propose the presupposed elements to the discussion.

A basic idea in Ginzburg's framework is to develop a library of moves as transitions between *Dialogue Game Boards* (DGBs), which record the state of the conversational agents at some point in discourse. DMs contribute to such transitions in a way which is specified in the DGB representations to follow. In order to illustrate the general architecture of the DGB, I will present a simple case in a stepwise fashion, commenting on (16), which corresponds to a (partial) DGB capturing the transition associated with the PC-use of *parce que*, as in (1). Each

attribute (CMT, for commitment, QUD and MOVES) gets a value which is the result of an update ($\oplus$).

(16)
$$\begin{bmatrix} \text{SPKR} & a \\ \text{ADDR} & b \\ \text{CMT} & sit \vDash pc \wedge \exists x(x : \mathbf{pc} \wedge fant_{\text{pc}}(b, m, pc, parce\ que) = \\ & fant_{\text{pc}}(a, m, pc, parce\ que) = x \wedge cause(pc, x)) \oplus c \\ \text{QUD} & sit \vDash pc \wedge cause(pc, fant_{\mathbf{pc}}(a, m, pc, parce\ que)) \oplus q \\ \text{MOVES} & assert(a, b, cause(pc, fant_{\mathbf{pc}}(a, m, pc, parce\ que)), sit) \oplus \\ & (assert(a, b, pc, sit) \oplus m) \end{bmatrix}$$

Let us start with MOVES. The existing list of moves (m) is updated with a compact form of *IllocProp* object (an element of Ginzburg's ontology), using a pattern *rel*(*spkr*,*addr*,*pc*,*sit*), meaning that a speaker communicates to an addressee that a certain illocutionary force (*rel*) applies to a PC *pc* in the situation *sit*. In the case at hand, the m update is decomposed into two elements: $assert(a, b, pc, sit)$ denotes that the speaker (a) communicates to b an assertion about a certain PC (pc) in the discourse situation (sit). pc is the PC of the sentence introduced by *parce que*, i.e. *il a raté son train* 'he missed his train' in (1). The other element is an assertion by a to b that the same PC is a cause of a certain SOA, the value of the cryptic function *fant*.

To clarify what *fant* is supposed to mean, I return to the issue of presuppositional DMs. One might require that PSPs be recorded in FACTS (a standard attribute of DGBs). However, the situation of DMs is more subtle. Debaisieux (2004) shows that, in natural conversation, the antecedent of *parce que* is constructed through a fast inferential process and is not necessarily available before the DM occurrence nor accommodated out of cooperativeness. Even in more simple cases, where the DR is relatively transparent, it is perhaps not as salient as an object picked up by a pronoun or a definite description. So, I use a more flexible constraint than the presence inside FACTS, specifically a commitment of the speaker to the possibility for the addressee to identify *some* plausible referent (weak version) or the same referent as the speaker's chosen one (strong version). For space reasons, I will only mention the strong version here. The $fant_{type}$ function (for 'fetch antecedent of type *type*') function provides a black box for general antecedent recovery procedures. It denotes the result of extracting an antecedent of type *type* from the previous moves (so from m) and has four parameters: the agent (speaker or hearer in general) looking for an antecedent, the list of moves to explore (m), the PC and the DM on which the exploration is based. As a result, the $assert(a, b, cause(pc, fant_{\text{pc}}(a, m, pc, parce\ que, sit)))$ stands for an assertion by a to b that the PC is a cause of whatever propositional antecedent a recovers

from *m* in *sit*. Note that the antecedent must be a PC, the basic ingredient of a SOA, because we want the causal link to connect two PCs. However, the fact that the utterance situation satisfies the PC is not declared in MOVES but in QUD, since MOVES contains only speech acts.

The QUD update material is quite simple: the discourse situation satisfies the PC ($sit \vDash pc$) and the causal relation asserted in the update of *m*. Finally, the CMT attribute is updated with the fact that *sit* satisfies the PC (as for the QUD) and also the existence of a suitable antecedent *x*, shared by *a* and *b* and such that the PC is a cause of *x*. In the simplest case of an *A parce que B* structure, the antecedent is just the PC of *A*, to be recovered from the last element of *m*.

In (17) and in an abductive configuration (17a), the causal relation is not in the PC, which gives us two presupposed elements: the antecedent (like in (16)) and the causation. The type of the *fant* function is changed to BEL in order to take into account the fact that the antecedent should be a belief. The same configuration is used for a speech act antecedent when *parce que* introduces an explanation/justification of the speech act (17b). (17c) corresponds to example (15) and *a*'s move consists in asking *b* to confirm the truth of a felicity condition of a previous move by *b*.

(17) a.
$$\left[\begin{array}{ll} \textbf{belief} & \\ \text{CMT} & sit \vDash pc \wedge \exists x(x : \textbf{pc} \wedge fant_{\textbf{bel}}(b, m, pc, parce\ que) = \\ & fant_{\textbf{bel}}(a, m, pc, parce\ que) = x \wedge cause(pc, x)) \oplus c \\ \text{QUD} & sit \vDash pc \oplus q \\ \text{MOVES} & assert(a, b, pc, sit) \oplus m \end{array}\right]$$

b.
$$\left[\begin{array}{ll} \textbf{sp. act} & \\ \text{CMT} & sit \vDash pc \wedge \exists x(x : \textbf{pc} \wedge fant_{\textbf{sa}}(b, m, pc, parce\ que) = \\ & fant_{\textbf{sa}}(a, m, pc, parce\ que) = x \wedge cause(pc, x)) \oplus c \\ \text{QUD} & sit \vDash pc \oplus q \\ \text{MOVES} & assert(a, b, pc, sit) \oplus m \end{array}\right]$$

c.
$$\left[\begin{array}{ll} \textbf{sp. act} & \\ \text{CMT} & \exists x(x : \textbf{pc} \wedge fant_{\textbf{sa}}(b, m, pc, parce\ que) = \\ & fant_{\textbf{sa}}(a, m, pc, parce\ que) = x \wedge precond(pc, x)) \oplus c \\ \text{QUD} & sit \vDash pc \oplus q \\ \text{MOVES} & question(a, b, pc, sit) \oplus m \end{array}\right]$$

In Section 3.1, we saw that *bien que* 'although' can connect SOA. However, the connection between SOAs is not necessarily a sort of inverted causation: communicating that *A although B* does not imply that *B* normally *prevents A* from happening. In an abductive example like (2), it is unclear whether there is a causal link between the two SOAs. I use a more neutral relation of being counter to expectation: *cntr-expect*(x,y) means that *x* being true should not normally lead us

to observe or think that y is also true. The record for *bien que* 'although' would then be as in (18).

(18)
$$\begin{bmatrix} \textsc{cmt} & sit \vDash pc \wedge \exists x(x : \mathbf{soa} \wedge fant_{\mathbf{soa}}(b, m, pc, \textit{bien que}) = \\ & fant_{\mathbf{soa}}(a, m, pc, \textit{bien que}) = x \wedge \textit{cntr-expect}(pc, x)) \oplus c \\ \textsc{qud} & sit \vDash pc \oplus q \\ \textsc{moves} & assert(a, b, pc, sit) \oplus m \end{bmatrix}$$

As a final illustration, I turn to the temporal vs. concessive uses of *après* 'after', defined in (19). The temporal use defined in (19a) parallels (16) for *parce que*, with a temporal relation instead of a causal one. The concessive move defined in (19b) is different in two respects. First, the concession relation is presupposed and put in the commitment store. Second, the last assertive move, corresponding to the host sentence, is declared in CMT as temporally following the initial value of MOVES (m). The *after-dem* predicate corresponds to the demarcation function introduced in Section 3.2 in the analysis of example (8).

(19) a.
$$\begin{bmatrix} \mathbf{temporal} & \\ \textsc{cmt} & sit \vDash pc \wedge \exists x(x : \mathbf{pc} \wedge fant_{\mathbf{pc}}(b, m, pc, \textit{après}) = \\ & fant_{\mathbf{pc}}(a, m, pc, \textit{après}) = x \wedge \textit{after}(pc, x)) \oplus c \\ \textsc{qud} & sit \vDash pc \wedge \textit{after}(pc, fant_{\mathbf{pc}}(a, m, pc, \textit{après})) \oplus q \\ \textsc{moves} & assert(a, b, pc, sit) \oplus \\ & (assert(a, b, \textit{after}(pc, fant_{\mathbf{pc}}(a, pc, m, \textit{après})), sit) \oplus m) \end{bmatrix}$$

b.
$$\begin{bmatrix} \mathbf{concessive} & \\ \textsc{cmt} & sit \vDash pc \wedge \exists x(x : \mathbf{pc} \wedge fant_{\mathbf{sa}}(b, m, pc, \textit{après}) = \\ & fant_{\mathbf{sa}}(a, m, pc, \textit{après}) = \\ & x \wedge \textit{concession}(pc, x)) \wedge \textit{after-dem}(assert(a, b, pc, sit), m) \oplus c \\ \textsc{qud} & sit \vDash pc \oplus q \\ \textsc{moves} & assert(a, b, pc, sit) \oplus m \end{bmatrix}$$

4 Hic et Nunc Particles

4.1 Description

Hic et Nunc particles (HNPs) have been recently examined in Dargnat & Jayez (2020), Dargnat (2024). They represent an extension of the traditional grammatical category of "interjections". Their central property is that, like presuppositional DMs, they remain outside the PC, but, unlike them and like Potts's (2007) expressives, they are anchored to the utterance situation. This is most easily seen in a local effect context like in (20). It is not possible to attribute the HNP to Mary, unless a direct quotation interpretation is forced (*Mary thought: "heck! Paul missed his train"*).

(20) Marie pense que ({zut / merde / bon / tiens}) Paul a raté son train.
'Mary thinks that ({heck / shit / well / look}) Paul missed his train.'

Three points have to be clarified at the outset. Firstly, not all HNPs are expressives. Many of them are, hence the frequent confusion with interjections, which are often assimilated to emotional expressions. Items like *bon* 'good/well', *hein* 'right?' or *quoi* 'what' are not intrinsically expressives. Of course they can be colored by intonation, but this is the case with other parts of speech as well.

Secondly, HNPs are more radically anchored to the utterance situation than some expressives. Consider the contrast in (21). (21c) is a bit strange out of context. It would be natural in a situation where I happen to remember that I had broken the vase, for instance if I just bought some flowers, was looking to put them in the vase and realized too late that the vase does not exist anymore. In that case, *oops* would point to my present disappointment. In (21b), *fucking* also indexes my present irritation but this feeling is not overtly caused by elements of the utterance situation, such as an external or internal event. Maybe I just dislike the vase in general, not because of *hic et nunc* circumstances.

(21) a. Oops! I dropped the vase.
b. I dropped the fucking vase yesterday.
c. #Oops I dropped the vase yesterday.

Thirdly, there is the question of ineffability or inscrutability. One can easily develop the impression that HNPs are more difficult to analyze than other DMs, in particular the connective DMs I have briefly described in Section 3.3. This feeling is probably justified in part, because, even though many connectives remain outside the PC, they have a propositional content, i.e. a content which can be described in a propositional language, by saying, for instance, that two semantic objects are related by a consequence or concession relation. However, this is not the case for every connective. For instance, *en fait* 'in fact/actually' or *de toute façon, en tout cas* 'anyway' involve more complex constraints (Rossari et al. 2018).

Lastly, it has been repeatedly proposed that interjections occupy intermediate positions in a continuum, whose exact nature varies (e.g., a degree of conventionalization or a showing-meaning[17] scale, see Wharton 2009: chapter 4). Although quite plausible, this possibility should not hide the fact that HNPs share

[17]The intuition that Wharton's expression intends to capture is that of a contrast between two extreme points: displaying some internal state by one's behavior ('showing') vs. articulating the same fact by means of linguistic expressions. He calls the second scenario 'saying'. He relates this distinction to the problem of effability in chapter 4 of his book.

two common basic features: (i) they are indexical elements whose reference is restricted to aspects of the utterance situation, and (ii) these aspects fall into two broad classes: internal events (emotional, attentional or cognitive variations) and speaker-hearer interaction. HNPs can be very vague, and their reference type can depend on context. For instance, many HNPs which index emotional states, like *ah*, *oh*, *putain* 'damn', can correspond to surprise, admiration, anger, relief, etc., depending on context and intonation. Their common function is to signal a rise or decrease along some emotional dimension, as proposed by Potts (2007) for expressives. HNPs like *tiens* 'look', *ah* or *eh bien* can signal that the speaker has focused her attention on some particular event or object. The speaker-hearer interaction is apparent in items like *écoute* 'listen', *tu sais* 'you know' or *tu parles* 'you bet'.

4.2 Representation

It seems that the HNP information should be located in the commitment store. However, if I am to follow this route, I will have to explain why a sentence like *Ah, I am really suprised* is not redundant. If we insert (i) the effect of the assertion that the speaker is surprised (a SOA) in QUD, and (ii) whatever conveys the same information in CMT, we will end up storing in CMT the effect of the assertion (copied from QUD) and the same information (independently added to CMT). One might suggest that the explicit phrasing *I am really surprised* allows the speaker to resolve the potential ambiguity of *ah* for the hearer, but I doubt that this would explain away examples like *Ouch! it hurts*, in particular if the hearer observes a situation where the speaker hits or cuts herself. Another option would be to get rid of the idea of a commitment but then it would be hard to explain why responses such as *Oh come on, you just fake it* make perfect sense.

Intuitively, HNPs are manifestations of events (emotions, attention focusing, etc.). They are linguistic signs indicating that something is happening at the moment of the utterance. The speaker is committed to letting the addressee believe that a plausible associate of the sign is happening, but she does not declare that this associate is occurring. The proximity of interjections to involuntary reactions is often noted in the literature and suggests that they are perceived as reactions to stimuli. Intuitive as this view might be, it tends to mix up two different things, the event that causes a certain reaction and the reaction indexed by the HNP: HNPs are not directly about external events but about the internal events that are elicited by them. Moreover, HNPs can be used even if there is no corresponding external event, for instance if I say *ah!* because I happen to remember something totally unrelated to the current situation. HNPs which have to do with

interactions are not reactive in the sense that many interjections are supposed to be. They index an intention to act on the hearer, in general by orienting her attention in a certain direction or by emphasizing for her the epistemic status of some piece of information, as is typically done by *tu sais* 'you know', which suggests that the host sentence conveys something which is not obvious to the hearer. In contrast to connective DMs, HNPs do not necessarily make use of the content of the host clause (if any), which aligns with the fact that they can function as holophrases, even under non-exclamative interpretations.

The basic structure for HNPs is shown in (23a), the commitment is the existence of an event (i) whose spatio-temporal trace, given by the *loc* function, coincides with the current situation and (ii) which has properties appropriate to the HNP which indexes it (the dummy X) and is used in the MOVES update. (23b) illustrates the case of *tu sais*. The generic intended effect of *tu sais* is, as with a number of other HNPs, to raise the degree of attention of the hearer to something, specifically, with *tu sais*, the PC of the host sentence. CMT is also updated with the proposition that the speaker has no evidence that the hearer already believes what the host sentence conveys, a proposition which reflects the fact that it would be odd to use *tu sais* when confirming what another speaker has just declared (22).

(22) A: Marie doit être chez elle. B: Oui, ??tu sais, elle est chez elle.
A: Mary must be at her B: yes you know she is at her
'A: Mary must be at home. B: Yes, she is at home.'

For *bon*, the indexed event in (23c) is considered by the speaker to be the final element in a sequence of events. This is the basic 'termination effect' of *bon* (CMT1), which is frequently used to mark some stage in a process or to signal an attempt to interrupt the addressee. When *bon* has a conversational import and is used to mark a major or minor speaking turn change or an attempt to interrupt, the list s which the speaker considers to be ended by *bon* is a sublist of the list of moves m (CMT2). The $s \sqsubseteq_{<} m$ notation indicates that s respects the ordering of m.

(23) a.
$$\begin{bmatrix} \textbf{HNP skeleton} & \\ \text{CMT} & \exists e(loc(e) = sit \wedge index(hnp, e) \wedge X(e)) \\ \text{QUD} & \ldots \\ \text{MOVES} & use(hnp, sit) \oplus m \end{bmatrix}$$

b.
$$\begin{bmatrix} \textbf{\textit{tu sais}} & \\ \text{CMT} & \exists e(loc(e) = sit \wedge index(hnp, e) \wedge e = \\ & intend(a, raise\text{-}att(b, pc))) \wedge \neg Bel(a, Bel(b, sit \vDash pc)) \oplus c \\ \text{QUD} & sit \vDash pc \oplus q \\ \text{MOVES} & use(tu\ sais, sit) \oplus (assert(a, b, pc, sit) \oplus m) \end{bmatrix}$$

c.
$$\begin{bmatrix} \textbf{\textit{bon}} & \\ \textsc{cmt1} & \exists e(loc(e) = sit \wedge index(hnp, e) \wedge \\ & \exists s(s : \textbf{list of events} \wedge Bel(a, e = last(s))) \oplus c \\ \textsc{cmt2} & \exists e(loc(e) = sit \wedge index(hnp, e) \wedge \\ & \exists s(s : \textbf{list of events} \wedge s \sqsubseteq_{<} m \wedge Bel(a, e = last(s))) \oplus c \\ \textsc{qud} & \ldots \\ \textsc{moves} & use(bon, sit) \oplus m \end{bmatrix}$$

5 Conclusion

In this paper, I have shown that, in spite of their individual variability, already apparent from the few examples I presented, DMs are not semantically special, since they are members of the PC, trigger PSPs or behave like conventional implicatures. That said, although I offered a number of guidelines for their description and representation, I barely scratched the surface of certain problems or set them aside. I will briefly discuss two of them. First, concerning the PSP triggers, I did not discuss the (im)possibility of organizing their records into a hierarchical network, as is done in HPSG (Davis & Koenig 2021) or Construction Grammars (Diessel 2023). In particular, the diachronic motivations offered in many cases invite us to examine whether we can construct a coherent and large scale picture of these derivations and the resulting meaning similarities (see Kortmann 1997 for an enterprise of this kind). For HNPs, it is desirable to describe not only what would count as their core meaning, which I illustrated here, but also the interactional scenarios in which they occur (Aijmer 2002), which is particularly appropriate in a framework like Ginzburg's (2012).

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Chapter 8

On the (im-)possibility of reflexive binding into the subject of German experiencer-object verbs

Simon Masloch[a], Johanna M. Poppek[a] & Tibor Kiss[a]
[a]Ruhr-University Bochum

This paper presents an acceptability rating study on the possibility of reflexive binding into the subject of German experiencer-object psych verbs. Experiencer-object verbs are claimed to license exceptional binding patterns in many languages, but analyses differ in whether they relate this behaviour to a peculiar syntactic structure of the verbs or independently available logophoric binding. An explanation in terms of logophoricity is not viable in German, since the German reflexive *sich* does not allow a logophoric interpretation. The study shows that reflexive binding into the subject of German experiencer-object verbs is only possible in the midfield if the antecedent precedes the reflexive in linear order and – given the binary-branching structure of the midfield – thus c-commands it. The pattern observed poses a problem for predicate-based theories of binding and it is only explainable if sentence-level constituents in German are base-generated in their surface positions or scrambling does not reconstruct for binding.

1 Introduction

There is a long-standing debate about so-called "backward binding" into the subject of experiencer-object (EO) verbs, i.e. psych-verbs whose experiencer is realised as an object, (see i.a. Belletti & Rizzi 1988, Pollard & Sag 1992, Pesetsky 1995, Landau 2010, Cheung & Larson 2015). In Belletti & Rizzi's (1988) Italian examples in (1), only in the example containing an EO verb (1a) may the anaphor be bound although it is (superficially) not c-commanded by its antecedent.

Simon Masloch, Johanna M. Poppek & Tibor Kiss. 2025. On the (im-)possibility of reflexive binding into the subject of German experiencer-object verbs. In Gabriela Bîlbîie & Gerhard Schaden (eds.), *Empirical issues in syntax and semantics: Selected papers from CSSP 2023*, 197–222. Berlin: Language Science Press. DOI: 10.5281/zenodo.15450442

(1) Italian (Belletti & Rizzi 1988: 312)

a. Questi pettegolezzi su di sé preoccupano Gianni più di
these rumours about REFL worry Gianni more than
ogni altra cosa.
every other matter
'These gossips about himself worry Gianni more than anything else.'

b. * Questi pettegolezzi su di sé descrivono Gianni meglio di
these rumours about REFL describe Gianni better than
ogni biografia ufficiale.
every biography official
'These gossips about himself describe Gianni better than any official biography.'

Some authors take such examples to provide evidence for the unaccusativity of (certain classes of) EO verbs (e.g. Belletti & Rizzi 1988, Cheung & Larson 2015). Accordingly, the subject/nominative originates in a position below the object, such that c-command does hold at some point during the derivation. Others claim that such cases represent instances of logophoric or point-of-view-based binding, a phenomenon that extends beyond the domain of psych verbs (e.g. Pollard & Sag 1992, Bouchard 1995).

In this paper, we will present evidence from an acceptability judgment study that binding into the subject of EO verbs in the German midfield is possible only if the object precedes (and given the binary-branching structure of the midfield thus c-commands) the subject in surface order. In this regard, German is of special interest for multiple reasons: First, the overall grammaticality of examples analogous to (1a) is disputed (cf. Kiss 2012, Platzack 2012, Fischer 2015, Temme & Verhoeven 2017), with Fischer (2015) claiming that there is an effect of linear order. Secondly, despite the widespread assumption that scrambling disables binding possibilities in German (and enables new ones, see e.g. Haider 2017), Temme & Verhoeven (2017) claim to have found experimental evidence for backward binding with EO verbs in German using examples involving quantificational binding. Thirdly, German does not license logophoric binding (Kiss 2012), so if backward binding *is* possible, a logophoric interpretation of the reflexive cannot account for it. In the absence of an explanation relying on logophoricity, unaccusativity may be suggested to account for backward-binding patterns. However, what we find is that binding into the subject of an EO verb is possible in German only if it is *not* backward. The patterns observed can be explained by assuming that surface orders of the type A B imply that A asymmetrically

c-commands B and that the German reflexive *sich* requires a c-commanding antecedent. There is thus no need to return to unaccusativity, nor does an analysis suggest itself that is based on the concept of (lexical) predicates.

The structure of this paper is as follows: We will introduce some necessary background on German clause structure and linearisation as well as on binding peculiarities with EO verbs in Section 2. This will lead us to expectations about the acceptability of reflexive binding into the subjects of German EO verbs. Section 3 describes the experimental study, the results of which are discussed in Section 4. Section 5 concludes the paper.

2 Background

We will now briefly discuss some relevant aspects of German syntax and provide some background about "backward binding" with EO verbs.

2.1 German clause structure and the unmarked argument order with experiencer-object verbs

German is a verb-second language. The finite verb is placed after the first constituent in matrix clauses, but a verb-final order can be observed in embedded clauses. Placing a constituent in the pre-field (the area in front of the verb in verb-second clauses) may have interpretational effects (Frey 2006). Thus, in an experimental study all constituents of relevance should – if possible – be placed in the so-called midfield, i.e. the area between C (the position of the finite verb in verb-second clauses) and the verbal complex at the end of the clause.

Usually different linearisations of constituents in the midfield are grammatical, but there is a normal (information-structure-wise most neutral, see Höhle 1982/2019) order that is at least partially dependent on the predicate (we will use the terms *normal* and *unmarked* interchangeably). Deviations from the normal order outside a licensing context may influence acceptability judgments independently of binding constraints, making it necessary to consider their effects here. One prominent approach to German clause structure takes the unmarked order(s) to be base-generated while other orders are derived via scrambling (viewed as movement; see i.a. Frey 1993, Haider 2017). Other approaches favour base-generation of the different orders (i.a. Fanselow 2001) or assume a fixed base-generated order and movement, but do not equate it with the unmarked order (i.a. Müller 1999).

In the spirit of Belletti & Rizzi (1988), the literature on unmarked word order with EO verbs in German usually draws a distinction between those with an

accusative object and those with a dative object. Although the unmarked order with EO verbs is debated in the literature (cf. i.a. Lenerz 1977, Scheepers et al. 2000, Haider & Rosengren 2003, Ellsiepen & Bader 2018), recent experimental evidence points to a preference for object before subject with (most) dative-object EO verbs and a preference for subject before object with (most) accusative-object EO verbs if subjects are inanimate and all other factors potentially influencing linear order are controlled for (Temme & Verhoeven 2016, Masloch et al. 2024).

Masloch et al. (2024) assume base generation of sentence-level constituents and violable linear precedence constraints to account for their linearisation data. They treat linear precedence constraints as weighted constraints within Maximum Entropy Grammar (Goldwater & Johnson 2003), a probabilistic variant of Optimality Theory. There is much research on the factors influencing the linear order of elements in the German midfield (see i.a. Lenerz 1977, Uszkoreit 1987, Hoberg 1997, Keller 2000, Ellsiepen & Bader 2018). As Masloch et al. (2024) argue, most accusative-object EO verbs have a causer subject, while this is not the case for most dative-object EO verbs (their subject being an object of emotion in Pesetsky's 1995 terms). They do not assume constraints making reference to case or grammatical function, but (among others) a constraint CAUSER $\prec$ NON-CAUSER, which places causers before non-causers and has more weight than the constraint ANIMATE $\prec$ INANIMATE. Because in our experimental setting subjects will be inanimate but objects animate, these two constraints will lead to a preference for a subject before object linearisation with accusative-object EO verbs and a preference for object before subject with dative-object EO verbs. Since the constraints are violable, these preferences are not absolute and the reverse order is strictly speaking syntactically well-formed, although it may be less acceptable. We will follow this account. Furthermore, we follow Haider (2010) in assuming a binary-branching structure and the absence of functional projections between V and C. Thus, the schematic structure in Figure 1 emerges.

We will abstract away from certain phenomena, which are orthogonal to our analysis, such as the fronting of (reflexive) pronouns, the possibility to place constituents in the prefield, exceptional scope and binding options under a rise-fall intonation, and extraposition. Then, a phrase α dependent on a verbal head precedes another phrase β dependent on the same head in linear order iff α asymmetrically c-commands β. All orders of dependents of a verbal head are strictly speaking syntactically well-formed (unless they violate some other constraint, of course), but not all of them are equally acceptable in every context.

We will base the predictions for our experiment on this view of German clause structure. An approach assuming a fixed base order plus scrambling conceived

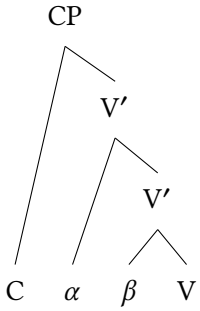

Figure 1: (Simplified) structural schema of German clauses

as movement to the left (as e.g. in Haider 2017) will produce the same predictions as long as binding constraints are evaluated at the target position only, i.e., i) scrambling does not reconstruct for reflexive binding; and ii) it is not the case that binding constraints can apply at any point.

2.2 Experiencer-object verbs and "backward binding"

It has been observed for many languages that an anaphor contained in the subject of an EO verb may precede its experiencer-object antecedent (see, among many others, for Italian Belletti & Rizzi 1988, for English Pesetsky 1995, for Chinese Cheung & Larson 2015). Examples like (1a), repeated here, pose a problem for theories of binding that require an anaphor to be c-commanded by its antecedent.

(1a) Italian (Belletti & Rizzi 1988: 312)
Questi pettegolezzi su di sé preoccupano Gianni più di ogni
these rumours about REFL worry Gianni more than every
altra cosa.
other matter
'These gossips about himself worry Gianni more than anything else.'

The solutions proposed in the literature can be divided into two broader classes: Those that take the backward binding pattern to relate to a peculiar syntactic structure of EO verbs (and possibly some wider class, e.g. Belletti & Rizzi 1988, Pesetsky 1995, Cheung & Larson 2015) and those that relate it to logophoric or point-of-view-based binding, which is available more generally (e.g. Pollard & Sag 1992, Bouchard 1995). On Belletti & Rizzi's (1988) account of the syntax of psych verbs, the nominative argument of EO verbs is not an external argument but originates in a position where it is c-commanded by the experiencer. It is then

assumed that Principle A can be satisfied before the stimulus moves to a position above the experiencer. While analyses that take the (surface) subject to originate in a position below the object are still widely assumed for dative-object EO verbs and sometimes for accusative-object EO verbs (see the overview in Rozwadowska et al. 2020), using backward binding to argue for it has somewhat fallen out of fashion (see, e.g. Landau 2010, Hirsch 2018). This is so because various authors have shown that backward binding can be licit even if it is impossible to establish a c-command relationship between the antecedent and the putative anaphor at any given syntactic level (see e.g. Pollard & Sag 1992, Bouchard 1995, Cançado & Franchi 1999). (2) is an illustrative example. Logophoric binding can account for such cases, so one needs to assume it anyway.

(2) Brazilian Portuguese (Cançado & Franchi 1999: 140)
Rumores sobre si explicam a insegurança mostrada por João.
rumors about himself explain the insecurity shown by John

Logophoric binding or exemption from Principle A, however, is not attested with the German reflexive *sich* (Kiss 2012). Picture-NPs do neither allow intersentential (3a), nor non-c-commanding (3b), nor split antecedents of embedded reflexives (3c), unlike in English (Pollard & Sag 1994: 245). The examples in (3) are not only somewhat degraded but grossly unacceptable on the coindexations given.

(3) (Kiss 2012: 158)

a. * Ulrich$_i$ war sauer. Ein Bild von sich$_i$ war beschädigt worden.
Ulrich was upset a picture of REFL had damaged been
'Ulrich was upset. A picture of himself had been damaged.'

b. * [Schumachers$_i$ Reklamevertrag] verlangte eine
Schumacher.GEN promotion.contract required a
Nacktaufnahme von sich$_i$.
nude.photo of REFL
'Schumacher's promotion contract required that nude photos of himself be taken.'

c. * Ulrich$_i$ zeigte Klaus$_j$ einige Bilder von sich$_{i+j}$.
Ulrich showed Klaus some pictures of REFL
'Ulrich showed Klaus some pictures of themselves.'

If backward binding with EO verbs is possible only due to exemption, it should thus *not* be possible in German. If it *is* possible, one could use this fact as an

argument for unaccusativity: On the assumption that scrambling reconstructs for binding or that a c-command requirement can be fulfilled at an early point or at any point in a derivation (as assumed by i.a. Grewendorf & Sabel 1999, Müller 1999), the experiencer could c-command the reflexive before the latter moves across it. If (dative) EO verbs have an unaccusative structure, binding into their subject should be possible irrespective of the linear order of the arguments. By contrast, only the orders in which the object precedes the subject containing the reflexive should be grammatical if there is a c-command requirement and all orders are base-generated as we assume here, or scrambling as movement destroys binding possibilities and creates new ones (as is frequently assumed, see e.g. Haider 2017).

The acceptability of German examples analogous to (1a) is disputed in the literature (cf. Kiss 2012, Platzack 2012, Fischer 2015, Temme & Verhoeven 2017). Fischer (2015) claims that there is an effect of linear order. According to her, binding into the subject of an EO verb is possible if the antecedent object-experiencer precedes it, and (4b) is acceptable to her.

(4) (Kiss 2012: 161, b. acceptable according to Fischer 2015: 1390)

a. * Ich glaube, dass die Bilder von sich den
I believe that the.NOM pictures.NOM of REFL the.DAT
Kindern gefielen.
children.DAT appealed.to

b. */✓ Ich glaube, dass den Kindern die Bilder von
I believe that the.DAT children.DAT the.NOM pictures.NOM of
sich gefielen.
REFL appealed.to
'I believe that the children liked the pictures of themselves.'

While Kiss (2012) judges (4b) as unacceptable, it is grammatical on his theory if his assumption that the subject must be the last argument to combine with the verbal projection is dropped and the linear order of constituents translates to c-command in the way we assume here (see Section 4.2).

The only experimental study on backward binding with EO verbs in German known to us is Temme & Verhoeven's (2017) and it claims that backward binding is more acceptable with EO than with action verbs. For reasons to be discussed below, the authors chose a configuration that does not involve reflexive, but quantificational binding. They report the results of two experiments (one for accusative-object verbs, one for dative-object verbs), in which they compared

the acceptability of backward binding into the subjects of EO verbs and agentive verbs in two conditions: particular and generic. Since they argue that apparent binding possibilities on the latter reading are only illusory, we will focus on the former. Participants were asked to provide binary acceptability judgments. In both experiments, Temme and Verhoeven found a significant (and non-negligible) effect of verb class to the extent that backward binding was more acceptable with EO verbs. However, the overall acceptability within the EO conditions was still not high (30 % for accusative-object, 40 % for dative-object EO verbs, which compare to an average acceptability of around 20 % for Principle-C violations and ca. 83 % for backward coreference across their experiments). Temme & Verhoeven (2017) rightfully argue that it is the observed difference between the conditions in the controlled experiment that counts and that the relatively low acceptance rate does not imply ungrammaticality. They propose that it may be due to processing difficulties that arise with quantificational binding and the backward dependency as well as the fact that the reading of the stimuli they asked their participants to evaluate is not the most prominent one. Ultimately, they take their findings to show that backward binding is a peculiar property of psych verbs in German after all. Yet, we take it to be possible that other factors are responsible for the effect. In particular, Webelhuth (2022) recently showed in a corpus study that quantificational binding in German is possible *without* c-command. He concludes that "[t]he overall picture that emerges from the corpus evidence is thus that topicality motivates wide scope and scope rather than c-command licenses […] bound pronouns" (Webelhuth 2022: 387). In an article about argument linearisation, Temme & Verhoeven (2016) argue that experiencers are more likely to be aboutness-topics than patients. Thus, it may be the case that Temme & Verhoeven's (2017) results are due to the experiencer being more likely to be interpreted as the topic than a patient and taking wide scope in turn, which licenses quantificational binding. Since Webelhuth (2022) does not claim reflexive binding to be licensed by topicality, we consider it preferable to rely on reflexive binding to test for the availability of backward binding in German.

To sum up: The data on the possibility of backward binding in German is murky. The acceptability of pertinent examples is disputed in the literature and the only experimental study finds an effect, but it is weaker than one may expect and may be caused by an independent factor. Logophoricity is not a factor in German. The possibility of binding into a subject preceding the object could be explained by assuming unaccusativity and a c-command condition that either allows reconstruction or may be fulfilled at any or an early point. Both examples in (4) should be grammatical then. If arguments are base-generated in their sur-

face positions or scrambling does not reconstruct for binding, only (4b) should be grammatical. Masloch et al. (2024) argue that the latter view explains the linearisation preferences they observe with German EO verbs less naturally.

A potential problem for an experimental investigation into the possibility of reflexive backward binding in German pointed out by Temme & Verhoeven (2017: 286) concerns the subjects themselves: Since German lacks a genitive reflexive, a reflexive can only be embedded in the subject within a PP. However, the usage of such a PP can be functionally overshadowed by a considerably more frequent construction involving a possessive, as in (5).

(5) (based on an in-text example by Temme & Verhoeven 2017: 286)
Er betrachtete seine Möbel / ??die Möbel von sich.
he beheld his furniture the furniture of REFL
'He looked at his furniture.'

Such overshadowing may lead to reduced acceptability of the stimuli in an experimental setting and should thus be avoided. However, not all [N [P REFL]] structures are equally unacceptable: e.g. *Bilder von sich* 'pictures of REFL' as in (4) is not generally unacceptable as shown by sentences like *Warum hat Claude Cahun$_i$ die Bilder von sich$_i$ zurückgehalten?* 'Why has Claude Cahun withheld the pictures of herself?' (Kiss 2012: 156). In this sentence, *ihre Bilder* 'her pictures' would mean something like 'pictures she made/owns' rather than 'pictures of herself / pictures depicting herself': It is one of the cases often noted in the literature on possessives (see e.g. Barker 2019) where the exact relation holding between the possessor and the possessed is provided by context (Claude could e.g. own the pictures or it could be pictures she has taken). *Bilder* 'pictures' being a relational noun, the question arises why the interpretation 'pictures depicting her' is not salient (or perhaps unavailable) for *ihre Bilder*. We will tentatively assume that the preposition *von* 'of' is not devoid of meaning and that NPs containing such PPs compete with NPs containing a possessive. Which variant is preferred for a given meaning will then depend on the exact literal meaning of the candidates, the factors involved in the competition and general pragmatic principles. For the purposes of experiments on reflexive binding, the exact analysis of this phenomenon does not matter as long as there is a way to ensure that the [N [P REFL]] structures are not overshadowed by [POSS N] structures (but see Section 4).

3 Experimental Study

We aimed to answer the question if reflexive binding into the subject of EO verbs is possible in German by conducting an acceptability rating study. The study has been preregistered with OSF (https://doi.org/10.17605/OSF.IO/EV7MA). All scripts and materials are available via https://doi.org/10.17605/OSF.IO/VNWFQ.

3.1 Design

The design reflects the two factors ORDER (*subject before object*, *SO* or *object before subject*, *OS*) and CASE (of the object, *accusative* or *dative*). While CASE is tested between items (since there is no synchronic object-case alternation with EO verbs having a subject in German), each item is presented in both ordering conditions. Participants only see each item in one ordering condition, but each of them rates the same number of *SO* and *OS* sentences. Answers are provided on a 5-point scale ranging from *vollkommen unnatürlich* 'completely unnatural' to *vollkommen natürlich* 'completely natural'. All points had a natural language name.

3.2 Materials

Test items were constructed according to examples (6–7), presented here without any acceptability judgment:

(6) Accusative object

a. Subject before object:
Es ist offensichtlich, dass das Gerücht über sich den
it is obvious that the.NOM rumour.NOM about REFL the.ACC
Professor genervt hat.
professor.ACC annoyed has

b. Object before subject:
Es ist offensichtlich, dass den Professor das Gerücht
it is obvious that the.ACC professor.ACC the.NOM rumour.NOM
über sich genervt hat.
about REFL annoyed has
'It is obvious that the rumour about himself annoyed the professor.'

(7) Dative object

a. Subject before object:
Es ist allgemein bekannt, dass die Meldung über sich
it is commonly known that the.NOM report.NOM about REFL
dem Opernsänger gefallen hat.
the.DAT opera.singer.DAT appealed.to has

b. Object before subject:
Es ist allgemein bekannt, dass dem Opernsänger die
it is commonly known that the.DAT opera.singer.DAT the.NOM
Meldung über sich gefallen hat.
report.NOM about REFL appealed.to has
'It is commonly known that the opera singer liked the report about himself.'

Test items contained the clause of interest embedded in a matrix clause to ensure a verb-final sentence. In total, we used eight test items containing an accusative-object EO verb and eight test items containing a dative-object EO verb, each of them in both ORDER variants.[1] We created two lists so that each participant rated only one ordering variant per item. In addition to the test items, the questionnaires contained 64 filler items, so that each participant judged 80 sentences (plus one sentence in the instructions). Among the fillers, there were six unannounced calibration items included to familiarise participants with the task and the scale, sixteen control items used to identify uncooperative or distracted participants, and five attention items used to detect inattentive participants. Filler items varied in expected acceptability so that participants would see roughly the same number of clearly acceptable, clearly unacceptable, and somewhat degraded sentences. Within each subcategory, half of the filler items were related to the test items either by containing *sich*, by containing a noun-preposition-noun structure, or by containing a psych verb, while the other half was unrelated. All items were presented in pseudo-randomised order subject to some constraints.[2]

[1]A complete list of all items used in the study can be found in the OSF directory. Dative-object verbs: *auffallen* 'to strike', *behagen* 'to please', *einleuchten* 'to be evident', *gefallen* 'to appeal to', *imponieren* 'to impress', *missfallen* 'to displease', *nahegehen* 'to afflict', *widerstreben* 'to have an aversion against'; accusative-object verbs: *anekeln* 'to sicken', *ärgern* 'to anger', *ängstigen* 'to frighten', *beeindrucken* 'to impress', *befremden* 'to alienate', *faszinieren* 'to fascinate', *nerven* 'to bother', *verärgern* 'to annoy'.

[2]The presentation of items was constrained as follows: calibration items had to come first, test and control item had to be separated by fillers, controls had to occur in the last 66 % of the questionnaire, and the last item had to be a filler.

The verbs used in the test items were chosen based on their syntactic behaviour in corpus data – essentially following the procedure of and using the materials from Masloch et al. (2024) – so that a preference for inanimate subjects, the frequency of non-psych readings and other potential confounding factors were taken into account. In all test items, the subject was an NP containing an embedded PP whose internal argument was the third person reflexive *sich*, while the embedded verbs' object was the only possible antecedent for the reflexive. The noun-preposition sequences are frequent collocates and we ensured that the use of the PP is not overshadowed by a possessive construction (as in 5). In order to do so, nouns that frequently have a preposition as their right neighbour were extracted from DeReKo (Kupietz et al. 2010) using KorAP (Diewald et al. 2016). From these, 327 nouns were manually chosen. We then calculated collocation scores with 81 prepositions (as direct right neighbours) and possessive pronouns (maximally three words to the left of the noun) for each of them and chose noun-preposition combinations from the pairs with a high logDice (an association score defined by Rychlý 2008). Afterwards we manually checked whether the use of an embedded reflexive is overshadowed by a possessive construction (cf. Section 2.2). The noun-preposition-reflexive combinations used in the items were chosen such that there is no overshadowing in our judgment. Additionally we avoided psych nouns for potential confounding effects.

3.3 Participants and Procedure

Participants (monolingual native speakers of German, residents of Germany, Austria, or Switzerland) were recruited via *Prolific* (prolific.com). 79 participants completed the questionnaire and received a compensation of £ 3.5. A typical run lasted ca. 15 minutes. The experiment was conducted using a web-based infrastructure using jsPsych (de Leeuw 2015) and JATOS (Lange et al. 2015) on a university server – where participants' individual reaction times were automatically measured. Taking the control- and attention checks specified in the preregistration as well as possible topic awareness (checked with an open question at the end of the survey) into account, data from 48 participants was included in the analysis.[3] After giving their informed consent to participate in the experiment, participants read written instructions asking them to rate how natural the

[3] A version of the analysis script where all participants are included is available via the OSF directory and the results are interpretation-wise the same as the ones presented here. The reason for the comparatively large number of participants whose data did not enter the analysis were the rather strict predefined exclusion criteria, namely: 1. the participant guessed the topic of the study correctly or displayed significant linguistic knowledge (we asked participants to guess the topic), 2. the participant did not complete the questionnaire, 3. the participant

sentences sound to them as sentences of their mother tongue. They saw an example item on the instructions page. The experiment started with the six unannounced calibration items. Each item was presented on its own page together with the answer options. There was no time limit for providing an answer.

3.4 Hypotheses and predictions

As discussed in Section 2.1, we follow Masloch et al.'s (2024) account of argument linearisation in the midfield for German EO verbs, which takes surface-order at face value: A constituent α in the midfield is taken to c-command a constituent β if and only if α precedes β in linear order. Combined with the assumption that the German reflexive *sich* must be c-commanded by its antecedent, it follows that sentences in which the subject precedes the object are ungrammatical (because the reflexive cannot be c-commanded by its antecedent).[4]

(8) Main hypothesis
In the German midfield, the object of an experiencer-object verb cannot bind a reflexive embedded in a subject preceding it.

Thus, an item is ungrammatical if the subject precedes the object in the target clause. As mentioned in Section 2.2, theories of German clausal syntax that take scrambling not to reconstruct for reflexive binding will share this hypothesis irrespective of the base structure assumed. Sentences in which the object precedes the subject are strictly speaking grammatical but may violate linear precedence constraints, possibly leading to different degrees of acceptability. An OS linearisation will violate CAUSER $\prec$ NON-CAUSER with (most) accusative-, but

did not judge at least 80 % of the attention items correctly, 4. the participant did not judge at least 80 % of the related control items correctly, 5. the participant did not judge at least 80 % of the unrelated control items correctly, 6. the participant had unusually long or short answering times as determined by Pieper et al.'s (2025) method, 7. the participant self-reported residing in a country or area where German is not the official language. The OSF directory contains the script that was used in the exclusion process, where all exclusions are discussed. We slightly deviated from Pieper et al.'s (2025) criteria for reaction times, which appeared to be too strict given the overall very fast reaction times. Overall, these criteria are quite strict because participants have to fulfill all of them. We think that this is a desirable property because participants recruited via web-based participant recruitment platforms tend to rush through studies and the decisive manipulation was rather small and could easily be overlooked.

[4] As mentioned in Section 2.1, we do not aim at covering pronoun fronting, which is a different mechanism than the word order freedom we look at here (Haider 2017). We assume that *sich* is fronted in many apparent counterexamples to a c-command condition. For our purposes, the precise mechanism behind such cases is irrelevant since in our items the reflexive is embedded.

Table 1: Predicted acceptability of the test items within the different conditions (see main text for qualification)

	dative	accusative
OS	high	medium
SO	low/medium	low

not with (most) dative-object EO verbs (see Section 2.1). An SO linearisation violates ANIMATE ≺ INANIMATE, which is outweighed by CAUSER ≺ NON-CAUSER with accusative-object verbs, but not with dative-object verbs. Thus, without any violations of binding constraints OS should be more acceptable with dative-object verbs, SO with accusative-object verbs.

Based on these prerequisites, we expect dative-object verbs to receive high ratings in OS linearisation while the same order is marked with accusative-object verbs, which should result in lower ratings. In SO order, the reflexive is not c-commanded by its antecedent and the order is marked for dative-object verbs. However, we may hypothesise that some participants, especially when they try to behave like cooperative discourse-participants (remember that we asked participants to rate how natural the sentences sound to them) or parse the sentences only superficially, will correct the ungrammatical sentence. Since the resulting OS order is unmarked with dative EO verbs, participants may rate the items containing them higher than one would expect based on their theoretical grammaticality status. In contrast, since SO already is the unmarked order with accusative-object verbs, this effect is not possible for them. Consequently, sentences in this condition should be rated as unnatural. This state of affairs is summarised in Table 1.

Given the model we will use for the analysis (see Section 3.5), our assumptions lead to the following expected effects:[5]

(9) Expectations fixed effects:
- CASE: Mildly positive
- ORDER: Medium/strong positive
- CASE × ORDER: marginal or non-existent

[5]This is *not* the model mentioned in the pre-registration. A reviewer for CSSP suggested that a sum-coded model may be easier to understand than the dummy-coded one we were using originally. We think that they are right and only discuss the sum-coded model here. The dummy-coded model is still available in the analysis script on the OSF directory.

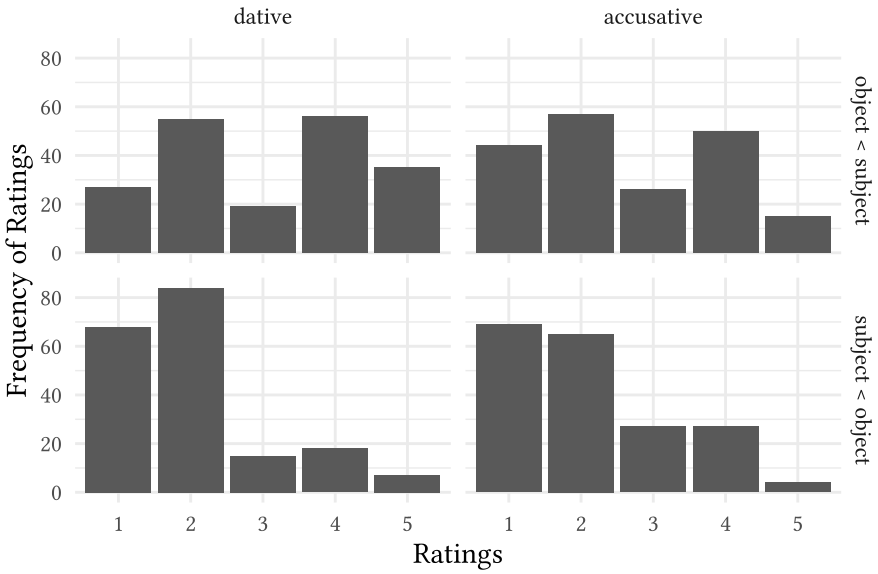

Figure 2: Empirical distribution of ratings. "5" stands for "completely natural", "1" for "completely unnatural". All choice options were presented to the participants with a natural language label.

3.5 Results

Figure 2 displays the empirical distribution of ratings in all four conditions. We see that sentences in which the subject containing the reflexive precedes the object (condition *SO*) received very low ratings, although ratings (unexpectedly) improve slightly with accusative-object verbs. In the *OS* condition, in which the reflexive is preceded by its antecedent, sentences receive overall better judgments, although there is still a large number of lower ratings. Ratings are higher with dative-object verbs there. These descriptive results speak in favour of the main hypothesis (8).

To model the data and test our hypotheses, we fitted a Bayesian cumulative logit generalised linear mixed model with flexible thresholds using the `brms` package (Bürkner 2017) in R (R Core Team 2023). Cumulative models are a type of model that can be used to analyse ordinal data (see Bürkner & Vuorre 2019 for an introduction): Since one cannot assume that the intervals between response options of Likert items have equal size, it is not appropriate to use a metric model (see i.a. Liddell & Kruschke 2018). Both factors were sum-coded with *dative* and *OS* coded 1 and *accusative* and *SO* coded −1. The model includes fixed effects

for CASE, ORDER, and their interaction, varying intercepts for participants and items, a varying slope for ORDER for items, and varying slopes for CASE, ORDER, and their interaction for participants, as well as all possible correlation parameters between them.[6] In Bayesian models, parameters are random variables, so one can talk about the credibility of different values (an introduction aimed at a linguistic readership is provided by Nicenboim et al. 2024). One starts off with a prior distribution across the parameters, which reflects one's prior knowledge, and updates it using the data to receive a posterior distribution, which reflects the uncertainty about the parameter values. Given the lack of previous comparable studies and quantitative predictions for the effect sizes, we use mildly informative, theory-neutral regularising priors.[7] For hypothesis testing, we will use Bayes factors: The Bayes factor (BF) is the ratio of the marginal likelihoods of two models and tells us under which of them the data are more likely. We will compare the model we report here against a model in which the effect of interest is set to 0. According to Jeffreys (1939, cited after Nicenboim et al. 2024), a BF of 3 indicates moderate evidence in favour of the first model, a BF of 10 strong evidence and a BF of 100 extreme evidence. 1 is the neutral value, ⅓ indicates moderate evidence in favour of the second model etc.[8]

There is an effect of ORDER in the expected direction ($\hat{\beta} = 0.79$, 95 % credible interval (CrI) = $[0.47, 1.12]$)[9], which is, however, not quite as strong as expected as it roughly corresponds to the difference between two levels of the ordered response variable.[10] Nevertheless, the Bayes factor shows that there is extreme evidence for this effect (Bayes factor computed as Savage-Dickey density ratio

[6]The analysis script on the OSF directory contains several additional models as well as a comparison between them. We will focus on this model here.

[7]We performed prior predictive checks and additionally fitted models with different (and more informative) priors, which can be found in the analysis script on the OSF directory. The results are interpretation-wise the same.

[8]The Bayes factor depends on the prior. The analysis script contains a sensitivity analysis for the Bayes factors as well as a detailed look at the posterior distributions of different models (including models with more informative priors). For our theoretical purposes, the results are similar.

[9]We use hats (ˆ) to indicate estimates. When describing the marginal posterior distribution of a parameter in Bayesian models, we use the mean as the measure of central tendency (estimate) and the standard deviation for variability (CrIs).

[10]Due to the sum-coding used, the distance between *OS* and *SO* would be $0.79 \times 2 = 1.58$, which is smaller than the distance between the first and the second or between the third and the fourth threshold, but larger than the distance between the second and the third on the latent variable within the model, see the full model summary in the analysis script on the OSF. In a cumulative model, the response is taken to relate to a latent variable – in our case: perceived naturalness – that can be modelled as linear and is partitioned into ordered bins corresponding to the response options via thresholds that are estimated in the model.

between the model and a model where β is set to 0; $BF_{10} = 126.7$). Changing from *SO* to *OS* leads to an increased naturalness. The point estimate for the effect of CASE ($\hat{\beta} = 0.17$, CrI = $[-0.24, 0.57]$, $BF_{10} = 0.074$) is slightly positive, but we do not have enough evidence to postulate its existence. Indeed, the Bayes factor shows that one may do better without it. In any case, the effect is only small. The reason we expected a mildly positive effect of CASE was that OS is unmarked for dative-object EO verbs, but not for the accusative-object ones. While descriptively sentences are rated higher in *dative OS* than in *accusative OS*, they are rated lower in *dative SO* than in *accusative SO*. Judments of naturalness may correspond to normal order in a more straightforward way, such that a sentence perceives higher ratings irrespective of binding constraints if it is normally ordered (this may be a caused by performance mistakes). The interaction effect would capture such a pattern: a positive value of it would correspond to a preference for the normal order irrespective of the other factors including binding constraints because – given the encoding chosen – *dative SO* and *accusative OS* get the value -1 and *dative OS* and *accusative SO* get the value 1. Although the posterior distribution hints at a small positive effect ($\hat{\beta} = 0.23$, CrI = $[-0.06, 0.52]$), the Bayes factor indicates that the data provide evidence against it ($BF_{10} = 0.138$).

The model assumes a comparatively large standard deviation of the participants' varying intercepts ($\hat{SD} = 1.57$, CrI = $[1.22, 2]$), so there is variability between participants. The standard deviation of the participants varying slope for ORDER is considerable ($\hat{SD} = 0.5$, CrI = $[0.26, 0.75]$), while the ones for CASE ($\hat{SD} = 0.16$, CrI = $[0.01, 0.39]$) and for the interaction ($\hat{SD} = 0.22$, CrI = $[0.01, 0.48]$) are not. There is variation between items ($\hat{SD} = 0.74$, CrI = $[0.45, 1.18]$), also for the varying slope for ORDER ($\hat{SD} = 0.47$, CrI = $[0.23, 0.81]$). The estimated correlations between varying effects are rather unremarkable.

An exploratory look into the responses of individual participants shows that twelve out of the 48 participants whose responses entered the analysis assign low scores across conditions. Additionally, three of the test items received almost only low scores in both ordering conditions. Taken together, these observations may explain the overall lower level of acceptability (and hence the surprisingly small effect size of ORDER) and in part also the variation among participants and items. If the relevant items and participants are excluded, accusative-object EO verbs receive mixed judgments in the *OS* condition, dative-object EO verbs rather good ones.

4 Discussion

4.1 General discussion

We take these results to support our main prediction: Reflexive binding into the subject of German EO verbs is licit only if it is *not* backward.[11] This holds for dative-object as well as for accusative-object EO verbs. As discussed in Section 2.2, this is expected on different accounts of German clausal syntax and the syntax of EO verbs, but it is *not* expected on an account that i) takes (dative) EO verbs to be unaccusative (which should translate into an OS base order); and ii) takes scrambling to reconstruct for reflexive binding. Indeed, the results are incompatible with the idea that scrambling reconstructs for binding because if it did so, there should be no difference between the ordering conditions. Thus, our data do not speak against the unaccusativity hypothesis (taken to imply an OS base order) directly because the base order does not matter for reflexive binding if scrambling does not reconstruct for it; but they also do not speak for it. Both a base-generation approach as described in Section 2.1 and a scrambling-as-movement account without reconstruction for reflexive binding are compatible with the data.

We expected a mildly positive effect of CASE, which seems to be inexistent. The reason we expected this effect was that we assumed that participants may rate a sentence better if the binding condition is fulfilled in the unmarked order. This does not seem to be the case.

Two remarkable aspects are the unexpectedly low level of acceptability (also in comparison to filler and control items categorised as acceptable a priori, which received high ratings, see the analysis script on the OSF directory) and the substantial individual variation. We do not have a full explanation for this at the moment, but regarding both, one has to consider that the test items were complex sentences that had to fulfill highly specific criteria and contained a relatively infrequent phenomenon, namely the PPs containing reflexives discussed in Section 2.2. The overshadowing process mentioned there presumably involves competition between a PP containing the reflexive and the possessive, but a PP containing a personal pronoun will be involved as well. We suspect that there are

[11] For a discussion of the surprisingly low overall acceptability in the OS condition, see below. One may object that both orderings could be ungrammatical and that enhanced acceptability of the OS order is due to priming effects: Since participants see the experiencer object first, they are already familiar with the possible antecedent and will be able to correct the grammar violations instantly, whereas this is not the case in the SO variant. An account along such lines is not tenable since the examples in (3), where the possible antecedent precedes the reflexive, too, are clearly unacceptable.

differences both between and within speakers (varieties, register) with respect to the weighting of the factors involved. These will influence how natural the noun-preposition-reflexive combinations sound to them in the given setting because (as one may assume) the losing candidate in a competition will be judged as less natural. Items may differ in which factors involved in the competition are relevant. To the best of our knowledge, there is no in-depth investigation of the phenomenon yet.[12] The fact that the standard deviation of the participants' varying slope for ORDER is not as low as one may expect may be due to the participants who rate all test items as unnatural. Something similar may happen with the standard deviation of the items' varying slope for ORDER since there are some test items that received low ratings across conditions. A radical alternative explanation for the rather low overall acceptability and the individual variation would be lectal variation in binding domains such that for some speakers the reflexive has to be bound only at clause level while for others the binding domain is narrower, so that the reflexive needs an antecedent within the NP or PP. However, given the availability of a plausible alternative, we do not want to pursue this path.

A reviewer asks us to disentangle the effects of linear order, c-command and topicality, which all seem to make the same prediction here. While we only looked at the midfield, where linear order and c-command (largely) correspond to each other, a constituent situated in the prefield linearly precedes the midfield. It is widely assumed that the prefield constituent moves there from the midfield. It may thus (at some point) be c-commanded by a constituent that follows it in surface order. (10) is acceptable even though the reflexive precedes its antecedent.

(10) [Bilder von sich$_i$ veröffentlicht]$_1$ hat [Claude$_i$ [fast nie t_1]].
pictures of REFL published has Claude almost never
'Claude almost never published pictures of herself.'

In (11), the reflexive in the accusative object may be bound by the subject or the dative object, although only the subject is topical.

(11) *Was ist mit der Fotografin?* 'What about the photographer?'
Die Fotografin$_i$ zeigte einem Kunden$_j$
the.NOM female.photographer.NOM showed a.DAT customer.DAT

[12] The EISS reviewers asked for baselines involving PPs containing full NPs or personal pronouns. We did not include items containing such NPs to keep the number of conditions low and because we did not expect the overall rather low acceptability. On our explanation of the latter, such items could not function as real baselines (because they either stand in competition with the variant we used or lack a competing candidate) but would be very interesting for further investigation.

Bilder von sich$_{i/j}$.
pictures.ACC of REFL
'The photographer showed a customer pictures of herself/himself.'

Both linear order and topicality are thus unlikely to be the decisive factor for licensing reflexive binding by themselves.

4.2 Theories of binding

So far, we assumed that the German reflexive *sich* has to be c-commanded by its antecedent, which aligns with Principle A of classical binding theory. Theories that try to capture binding data using tree-configurational notions such as c-command are rivaled by predicate-based theories of binding (i.a. Pollard & Sag 1992, Reinhart & Reuland 1993), in which co-argumenthood is decisive. On Reinhart & Reuland's (1993) account, only heads with an external argument count as syntactic predicates. According to their condition A, reflexive syntactic predicates (i.e., predicates that have two co-indexed arguments) need to be reflexive marked, which can either happen lexically or via a SELF-anaphor. German *sich* can be a SELF-anaphor according to Reuland & Reinhart (1995). Pollard & Sag (1992) define binding conditions in terms of relative obliqueness. In their analysis of English anaphora, an anaphor has to be co-indexed with a less oblique co-argument if there is one. In our test items, the predicate relevant to determining co-argumenthood is the noun or the preposition. In both cases, there is no co-argument/subject. Thus, it is not a syntactic predicate for Reinhart & Reuland (1993) and condition A does not apply. Thus, the anaphor does not have a less oblique co-argument so that Pollard & Sag's (1992) Principle A does not apply. As a result, the reflexive should be licensed without being bound.[13] Even if there were some further principle requiring *sich* to have a co-argument or if one were to assume that there is an unpronounced external argument of the noun or preposition, one could not capture our data, since it is the positioning of the whole syntactic predicate (the NP/PP) that makes the difference. Hence some structural condition must be at play.[14]

[13] Pollard & Sag (1992) do not claim their theory to be applicable to languages other than English. Thus, our data do not speak against their theory directly, they only show that it cannot trivially be extended to German.

[14] According to Reuland & Reinhart (1995) and Reuland (2011), *sich* may also be a SE-anaphor, in which case it would not mark the predicate as reflexive. However, it should not be possible to stress SE-*sich* (see Reuland & Reinhart 1995: 249 sqq., Reuland 2011: 275 sqq.), but in our judgment stressed *sich* is perfectly fine in examples like (4b). In order to be interpreted as bound, SE-*sich* would have to be in a chain with its antecedent. This cannot be the case (if only

This structural condition need not be a universal principle: On Kiss' (2012) account of reflexive binding, anaphoric dependencies are introduced in syntax. A reflexive pronoun will receive a feature **D**(*n*), where *n* is an index, if it is an argument of a head with an articulated argument structure (≈ having an external argument, see Kiss 2012), which will bear the feature +ARG-S. **D**(*n*) is projected upwards until *n* is identified with the index of a sister of a phrase bearing the feature. In German, a feature **Đ**(*n*) representing an inactive dependency is introduced if the head does not have an articulated argument structure (−ARG-S), and projected in the same way until it is activated (= leads to the phrase having the feature **D**(*n*)) when meeting a +ARG-S head.[15] A local resolution condition requires dependencies to be resolved within the clause. In effect, this means that German *sich* has to be co-indexed with a c-commanding phrase within the same clause.[16] Figure 3 illustrates how this works for (4b). Since P and N do not have an articulated argument structure there, the **Đ**(*n*) introduced with *sich* becomes active only once $_2$NPbecomes a daughter of the verbal projection, i.e. $_2$NP bears **D**(*n*). **D**(*n*) is projected upwards to $_1$V′, where *n* can then be identified with the index of $_1$NP. Indeed, it must do so in order for the local resolution condition to be fulfilled. By contrast, local resolution cannot be fulfilled if the NP containing the reflexive is the last one to combine with the verbal projection as in (4a) and our SO items, leading to ungrammaticality.

5 Summary

Our study shows that reflexive binding into the subject of experiencer-object verbs is licensed in the German midfield only if the subject is preceded – and thus c-commanded – by the antecedent in surface structure. The results are in principle compatible with both free base-generation and movement-based accounts of linearisation in the midfield, but with the latter only if scrambling is taken not to reconstruct for binding. Analysing German EO verbs as unaccusative is not necessary to explain their reflexive binding patterns (although they are not

because Reuland (2011: 167 sqq.) takes D to block the attraction process that would be necessary on his account). If SE-*sich* cannot enter a chain, one may expect a logophoric interpretation to occur, but 1. German *sich* does not have a logophoric interpretation as shown in Section 2.2 and 2. one would get the same problems as mentioned for SELF-*sich* in the main text then.

[15] English is taken to lack inactive dependencies, so something like a predicate-based binding theory emerges.

[16] Note that on Kiss' (2012) theory there may also be differences between different lexical items within a language, so our results for *sich* may not be directly transferable to reciprocal *einander* 'each other'.

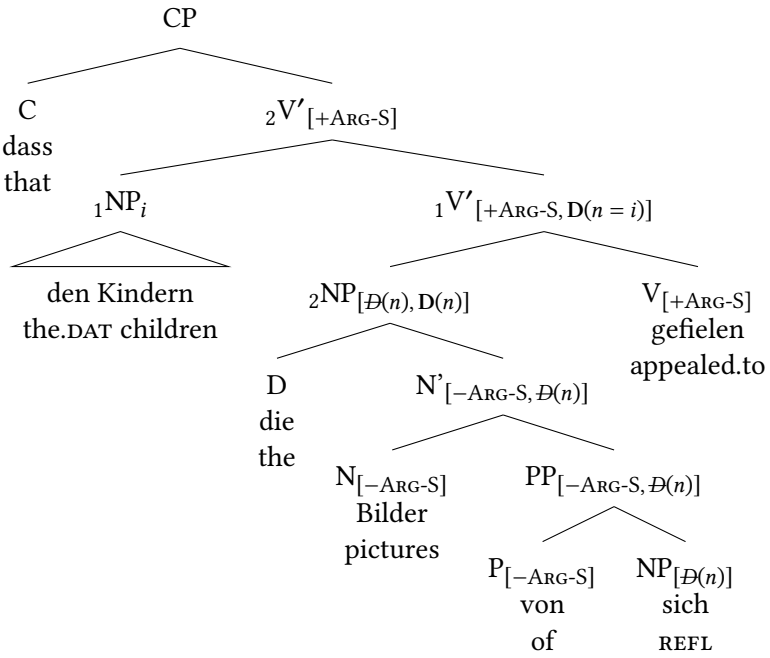

Figure 3: Analysis for (4b). Numbers are used to distinguish nodes in the tree, small letters for indices

incompatible with unaccusativity). Because the positioning of the constituent containing the embedded reflexive influences acceptability, the results are problematic for predicate-based binding theories.

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Abbreviations

BF	Bayes factor	SO	subject before object
CrI	95 % credible interval	OS	object before subject
EO	experiencer-object		

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Subject index

Empirical issues in syntax and semantics

The present volume in the series *Empirical Issues in Syntax and Semantics* collects a curated selection of papers from the 2023 *Colloque de Syntax et Sémantique à Paris* (CSSP 2023), held on December 7-8, 2023, at the École Normale Supérieure in Paris. The result aims to be a snapshot of contemporary linguistic research in the areas of syntax and semantics.

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