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## Editorials

## Articles

# Constructional approaches in formal grammar

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## INTRODUCTION 1

Constructional approaches to language are associated with Construction Grammar, a family of theories whose main analytical concepts can be summarized as follows: a surface-oriented description; the simultaneous presence of form-, meaning- and, sometimes, usage-properties of utterances; non-locality or extended locality of linguistic units; the organization of linguistic knowledge in a hierarchical network (such as a type hierarchy); the rejection of the strict distinction between lexicon and syntax and the assumption of a syntax–lexicon continuum. One concept that is not necessarily associated with Construction Grammar, and is in fact viewed by some as standing in opposition to it, is formal grammar. The goal of the present special issue is to consider how constructional approaches can be used and have been used in formal approaches to grammar.

Given that Construction Grammar comes with a number of different basic assumptions, which are in part shared with other, non-constructional approaches, there is not necessarily a consensus on what counts as *constructional*. In the context of this special issue, we see three basic understandings of this notion. First, "constructional" can be used in the sense of non-local, contrasting with a syntactic and semantic notion of compositionality as incorporated most clearly in Montague Grammar (e.g. Montague 1974). This will be a central issue in Findlay's paper. Second, "constructional" is understood in the

sense of phrasal, as opposed to lexicalist. This means that idiosyncratic properties of complex expressions should not necessarily be reduced to idionsyncratic sub-syntactic elements, and that they can be a property of the complex expression itself. This perspective is argued for in van Eynde's contribution to this special issue. Finally, "constructional" can be used in a more general way, in the sense of holistic, standing in opposition with atomistic. In Melnik's paper, in which  a formalization of a functional analysis is proposed, these two perspectives do not stand in opposition but rather complement each other.

What is essential of these three senses of "constructional" in the context of this special issue is that they are uniformly shared by Construction Grammars, but are typically seen in opposition to the basic analytical concepts of most versions of formal grammar and Mainstream Generative Grammar. To be more precise, formal approaches typically assume (local) compositionality – in contrast to extended locality; they strive at a minimal amount of idiosyncratic phrasal combinations – in contrast to the assumption of an extended phrasal *constructicon*;  and they give preference to atomistic analyses – contrasting with the mentioned holistic view. We think that this has given rise to the impression that *constructional* stands in opposition to *formal*.

Indeed, some approaches within the general framework of Construction Grammar explicitly reject formalization in principle. On the other hand, we find highly formalized and computationally implemented versions of Construction Grammar. This already indicates that the formal vs. non-formal opposition is not necessarily tied to a constructional vs. non-constructional  linguistic analysis. In fact, this debate extends well beyond the domain of Construction Grammar, and is often accompanied by other dichotomies: functionalist vs. formalist, usage based vs. competence based, holistic vs. analytic, theory-driven vs. data-driven, nativism vs. constructivism, or the acceptance vs. rejection of a core–periphery distinction. Arguments against formalization often target Minimalism, as a straw-man case for any criticism towards formal grammar (a point already made in Croft 1999). Furthermore, Newmeyer (2010) finds that formalism and functionalism are complementary, rather than diametrically opposed.

Consequently, the dichotomies that feature in the formal vs. nonformal debate are to a large degree orthogonal to the question of whether a formal account is possible, desirable, or insightful. More-

over, they are not necessarily linked to a constructional vs. non-constructional opposition – under any understanding of *constructional*: There are formal linguistic approaches that deviate from classical context-free phrase structure grammars and which incorporate the empirical motivations and conceptual ideas of construction-size linguistic units. Leading examples are (constructional) Head-driven Phrase Structure Grammar (Sag 1997; Ginzburg and Sag 2000; Müller 2017), Tree Adjoining Grammar (Joshi 1987), proposed constructional extensions of Lexical Functional Grammar (Asudeh *et al.* 2014; Findlay 2017), and Simpler Syntax (Culicover and Jackendoff 2005).

There are, however, issues that legitimately challenge the feasibility or the usefulness of formalization. In particular: (i) due to limitations of the chosen formalism, important aspects of a phenomenon may fall outside of what can be described, which might wrongly suggest that they need not be looked at, (ii) formalization constraints might force a researcher to make analytic decisions that are not directly related to the phenomenon at hand, (iii) the formalization of an analysis may be mistakenly taken as hard evidence for its veracity, and (iv) formalization can analyze structures but usually does not provide an independent explanation or a link to general cognitive or processing principles.

While it is important to keep these caveats in mind, a formal description has a number of advantages: (i) it makes all essential aspects of an analysis explicit, (ii) it makes it possible to check for the compatibility of analyses of different phenomena, (iii) it makes testable and verifiable predictions about possible and impossible utterances, (iv) it clearly separates different aspects of a phenomenon, and (v) it might serve as the basis for an implemented grammar and various NLP software applications.

We conclude that, although some basic views of what is considered *constructional* are not shared by many formal approaches to language, there is no intrinsic or principled correlation between constructional and non-formal. The papers in this special issue do not question the usefulness of a formal approach to the description of language. They demonstrate that our three notions of constructional approaches are instrumental in achieving a comprehensive understanding of linguistic data and in formalizing empirical generalization. At the same time, they discuss to what extent deviations from (local)

compositionality, non-phrasality, and an atomistic analysis are needed and implementable within the chosen framework.

## 2 THE PAPERS IN THE ISSUE

In this section, we will briefly show how each of the contributions addresses the issues raised in this introduction. In particular, the three assumptions of constructional approaches that are usually not shared by formal analyses will play a role, i.e., non-locality of the analysis, idiosyncratic phrases, and holistic characterizations of phenomena.

### 2.1 *Jamie Y. Findlay: Lexical Functional Grammar as a Construction Grammar*

In his contribution, Findlay argues that Lexical Functional Grammar (LFG) can be viewed as a suitable framework for formalizing Construction Grammar analyses. He lays the foundations for his argument by identifying seven meta-theoretical assumptions shared by much research within Construction Grammar frameworks. He then presents LFG and discusses its properties in the light of these assumptions. According to Findlay's presentation, there are two fundamental differences between the two approaches: First, he elaborates on the contrast between a strong morphology–syntax division in LFG (so-called *Lexical Integrity*) and the common assumption in Construction Grammar that there are constructions "all the way down", i.e., that there is no strict boundary between morphology and syntax. Findlay argues in favor of a mid-way position on lexical integrity, showing that LFG might provide means to allow for a morphology–syntax interaction within restricted, well-defined limits.

Second, Findlay points out that the assumption of an *extended domain of locality* in Construction Grammar is incompatible with the syntactic combinatorics of LFG, which is based on a context-free phrase structure grammar. He acknowledges that, while there are more local, more classically compositional analyses of so-called *substantive idioms* (Fillmore *et al.* 1988) such as *spill the beans* and even *kick the*

*bucket*, approaches that assume a single, complex, phrasal syntactic representation associated with a simple semantic representation are more common in Construction Grammar. He then shows that a formally precise, genuinely phrasal description of such idioms is possible within LFG by replacing the phrase structural syntactic combinatorics with a tree grammar, following his own work (see Findlay 2019).

### *Frank van Eynde: The Dutch Anaphoric Possessive Construction*     2.2

Van Eynde provides a detailed discussion of the formal properties of what he calls the *Dutch Anaphoric Possessive Construction* (APC), illustrated in (1) (van Eynde's example), which he contrasts with other possessive constructions in Dutch that are more similar to possessive constructions in English.

(1)   Ik heb  [Tom zijn fiets] verkocht.
     I  have  Tom his  bike  sold
     'I have sold Tom's bike.'

He shows that the construction shares a number of properties with more canonically formed noun phrases, but also has its own, idiosyncratic properties. Since none of the lexical items is construction-specific, van Eynde argues that a phrase-based analysis is well motivated.

This interplay is modeled by a multiple inheritance hierarchy using the framework of *constructional HPSG*. This framework comes with the locality assumption that there are no phrasal units of analysis that go beyond immediate mother–daughter relations (Sag 2010), i.e., there is no extended domain of locality. The APC is a potential challenge for this assumption. As van Eynde shows, in the syntactic structure of the relevant noun phrase, [*Tom$_i$* [*zijn$_i$ fiets*]], the full NP possessor and the co-indexed possessive pronoun are not immediate daughters of the same local tree, nor is there a direct selectional relation between them. However, the combination of feature percolation from the specifier inside the noun phrase *zijn fiets* and the properties of the idiosyncratic construction make it possible to maintain the locality that is inherent to the framework.

## 2.3 *Nurit Melnik: Copy Raising Reconsidered*

Melnik's contribution focuses on a phenomenon that is often referred to as *copy raising*, illustrated in (2a), due to its resemblance to the well-known *subject-to-subject raising* construction, as in (2b).

(2)  a.  Richard$_i$ appears like he$_i$ is in trouble.
     b.  Richard$_i$ appears t$_i$ to be in trouble.

However, as Melnik points out, there is no consensus in the literature regarding its defining characteristics and whether it in fact involves a raised subject and a pronominal copy. This lack of consensus, she claims, reflects an improper taxonomy of the phenomenon. Instead she identifies two distinct functions that perception verbs such as *appear*, *look*, *sound* and *smell* serve: *perceptual depiction* and *perceptual inference*. Moreover, she shows that these functions extend well beyond their particular instantiation in what is referred to as "copy raising".

The analysis that Melnik proposes is twofold: functional and formal. The functional analysis begins with a pre-theoretical examination of the construction and its functions. This perspective sidesteps the syntactic questions that dominate the discussions in the literature regarding copy raising, and in doing so she adopts a more holistic constructional approach, which incorporates aspects of both form and meaning. The formal analysis is couched in the framework of Head-driven Phrase Structure Grammar (HPSG). Strictly speaking, it is a lexicalist analysis; the meanings of the two distinct constructions are ultimately derived from a single lexeme. Nevertheless, the formal analysis captures the essence of the functional account. It does so by employing a lexical type inheritance hierarchy which reflects the shared core meaning of the verbs heading the constructions as well as the extra-lexical meaning components which are associated with each construction.

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# Lexical Functional Grammar as a Construction Grammar

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## ABSTRACT

Lexical Functional Grammar (LFG) is a lexicalist, constraint-based grammatical theory that shares a lot of the basic assumptions of Construction Grammar (CxG), such as a commitment to surface-oriented descriptions (no transformations), and the simultaneous representation of form, meaning, and other grammatical information (no derivations). Nevertheless, LFG is not standardly viewed as a kind of CxG, in particular since its adherence to the principle of Lexical Integrity means that it insists on a strict morphology-syntax distinction where CxG canonically rejects such a divide. However, such a distinction is in fact entirely compatible with CxG assumptions; the actual problem with viewing LFG as a CxG is the difficulty it has in describing the more substantive end of the schematic-substantive spectrum of constructions. I suggest that by replacing the limited context-free grammar base of LFG responsible for this shortcoming with a more expressive formalism (in this case a description-based tree-adjoining grammar), we can obtain a fully constructional LFG, suitable as a formal framework for CxG.

## 1 INTRODUCTION

In grammatical theory, there is an important division between which parts of linguistic competence involve storage/memory and which involve computation. Exactly where the line between these two categories should be drawn is an open, and heavily debated, question.

The creativity and productivity of human language means that it is untenable to claim that everything is stored; if this were the case, it would be impossible to say anything new – we would only be able to repeat what we had already heard and memorised. This is the aspect of human language emphasised by work in mainstream generative grammar (MGG),[1] and claims about the 'discrete infinity' of human language are commonly seen in the opening pages of textbooks which introduce students to natural language syntax from this perspective. On the other hand, the arbitrariness in human language means that we cannot claim that everything is computed, either: some form-meaning pairings are the way they are for no other reason than convention, and conventions must be learned. This is the Saussurean observation about the arbitrariness of the linguistic sign: there is no more reason for *dog* to be used to refer to the domestic canine than any other sequence of sounds, which is precisely why languages vary in this respect (e.g. the German word for the same concept is *Hund*, the French *chien*, etc.). This arbitrariness also exists above the level of the word (see below), and it is this aspect of human language which is emphasised by work in the tradition of Construction Grammar (CxG).[2]

A traditional view in MGG is that the things which are stored are words, collected in the LEXICON, and that objects larger than the word – phrases, clauses, etc. – are arrived at by the application of general and abstract rules of syntactic composition to these lexical atoms. One problem with this view is that the arbitrariness of natural language does not stop at the word level: there are a variety of phrasal objects which do not behave as we would expect from the normal syntactic processes of the language in question, and whose meanings (and sometimes forms) therefore apparently have to be memorised. The most striking examples are idioms, whose meanings are often wholly

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[1] This term is borrowed from Culicover and Jackendoff (2005), and is used to refer to work in the Chomskyan tradition, i.e. that strand of theoretical thinking that begins with *Syntactic structures* (Chomsky 1957) and continues to the present day with work in the Minimalist Program (Chomsky 1993, 1995).

[2] CxG refers to a family of theories which originated in the work of Charles Fillmore and colleagues in the 1980s (Fillmore 1985, 1988; Fillmore *et al.* 1988; Kay and Fillmore 1999), and that recognise the construction, a pairing of form and meaning of arbitrary size and varying abstraction, as the basic unit of analysis in grammatical theory. More details will be given about CxG below.

unpredictable given the meaning of their parts in other contexts (if they even exist outside the idiom), and whose syntactic structures are often anomalous or archaic:

(1)     Holden **pulled a rabbit out of the hat**.
        ≈ 'Holden found an unexpected solution to the problem.'
        (Anomalous semantics: no rabbits or hats need be involved.)

(2)     The thieves have **flown the coop**.
        ≈ 'The thieves have escaped.'
        (Anomalous semantics: no coops or flying need be involved.
        Anomalous syntax: *fly* does not normally take a Source direct
        object in contemporary English.)

(3)     We've tried **every which way** to solve this problem, and there's
        just no solution.
        ≈ 'We've tried every possible means of solving this problem,
        and there's just no solution.'
        (Anomalous syntax; not possible with other quantifiers, for ex-
        ample: *\*each which way*.)

(4)     We've let these pirates **run amok** for too long.
        ≈ 'We've let these pirates cause chaos for too long.'
        (Anomalous lexical content: *amok* does not exist outside of this
        expression.)

But there are more schematic phrasal configurations which also bear unpredictable meanings, illustrated in (5)–(7):

(5)     The more you tighten your grip, Tarkin, the more star systems
        will slip through your fingers.
        ≈ 'As you tighten your grip, the number of star systems slip-
        ping through your fingers will correspondingly increase.'
        (The comparative correlative/*the X-er the Y-er* construction;
        Fillmore 1987; Culicover and Jackendoff 1999.)

(6)     What's a nice girl like you doing in a place like this?
        ≈ 'How come a nice girl like you is in a place like this?'
        (The *what's X doing Y/WXDY* construction; Kay and Fillmore
        1999.)

(7)     Bill belched his way out of the restaurant.
        ≈ 'Bill left the restaurant while belching.'
        (The *way*-construction; Jackendoff 1992.)

Fillmore *et al.* (1988, 505–506) call these FORMAL IDIOMS, in contrast to the SUBSTANTIVE IDIOMS in (1)–(4). Formal idioms have more open slots which can be filled in with any appropriate word or phrase, whereas substantive idioms require specific words for their idiomatic meaning to come off. In fact, idioms exist on a spectrum from more substantive to more formal (or schematic).

Because of the existence of these larger-than-single-word expressions whose meaning and/or form cannot be computed on-line, CxG takes a different view from MGG: the building blocks of phrasal syntax are not words, but CONSTRUCTIONS, pairings of form and meaning of *any* size. Word-internal syntax is also often understood to fall under this umbrella, so that constructions extend both above and below the level of the word, with the distinction between phrasal syntax and the lexicon therefore breaking down. Instead, the grammar is simply a repository of constructions – the CONSTRUCTICON (Jurafsky 1992) – and some means of combining them (often unification, since constructions are often represented as feature structures).

There is quite some diversity in how this insight is cashed out, leading to an array of sometimes quite disparate theories all bearing the moniker 'Construction Grammar', e.g. Berkeley Construction Grammar (Fillmore 1985, 1988; Kay and Fillmore 1999), Embodied Construction Grammar (Bergen and Chang 2005), Fluid Construction Grammar (Steels 2011; Steels and van Trijp 2011), Sign-Based Construction Grammar (Sag 2010; Boas and Sag 2012; Michaelis 2015), Cognitive Construction Grammar (Lakoff 1987; Goldberg 1995, 2006), and Radical Construction Grammar (Croft 2001). Nonetheless, there are certain overriding meta-theoretical assumptions that basically all CxGs have in common, which are identified below:

1. WYSIWYG: Linguistic descriptions are surface oriented, or 'WYSIWYG' ('What You See Is What You Get') in nature – that is, no phonologically empty elements are assumed, and there is no abstract 'underlying' form which must be transformed to reach the surface representation.

2. PARALLEL-REPRESENTATION: All levels of linguistic analysis, both in terms of form and meaning, are present in parallel – that is, no level of representation is derived from another (e.g. meaning is not derived from form, nor *vice versa*).

3. EDL: Linguistic description has an 'extended domain of locality' – that is, the notion of the Saussurean sign extends above the level of the word, and form-meaning pairings can exist which necessitate dependencies between structurally distant parts of a sentence.

4. CONSTRUCTIONS-ALL-THE-WAY-DOWN: Since the notion of sign also extends *below* the level of the word, a corollary of EDL is that there is no absolute/discrete distinction between morphology and syntax, since words and phrases are built out of the same things: "it's constructions all the way down" (Goldberg 2006, 18).

5. HIERARCHY: Linguistic knowledge is structured, and organised in a hierarchical fashion – often in some kind of inheritance network or type hierarchy, of the sort also assumed to structure non-linguistic knowledge.

6. CROSS-LX-VARIETY: There is a greater emphasis on cross-linguistic variety, on 'unusual' constructions, and on subtle connections of form and meaning than is found in MGG, for instance, where the focus is much more on 'core' constructions and cross-linguistic similarity.

7. USAGE-BASED: Knowledge of language is based on usage – that is, there is no strict competence-performance distinction, and we store both linguistic generalisations and specific episodic memories of linguistic events.

Within these assumptions, we can draw a dividing line between the first five, which are more about the architecture of the grammar, and the final two, which are about what you do with that grammar – i.e. what kinds of questions linguists should be asking, and where they should look for their explanations.

In this paper, I want to argue that Lexical Functional Grammar (LFG: Kaplan and Bresnan 1982; Bresnan *et al.* 2016; Dalrymple *et al.* 2019), a constraint-based, declarative grammatical theory, can be seen as another kind of Construction Grammar – or, more precisely, that it can be viewed as a suitable framework for formalising CxG ideas and analyses.[3] For this reason, I will be focussing on the first five

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[3] Cf. Lichte and Kallmeyer (2017) and Müller (2021), who undertake a similar exercise for Tree-Adjoining Grammar (TAG) and Head-Driven Phrase Structure Grammar (HPSG), respectively.

assumptions above, since my interest is in the formal properties of LFG as a system, rather than to what ends researchers make use of the framework.[4]

I begin in Section 2 with an introduction to LFG, highlighting its key features and pointing out to what extent these allow it to satisfy assumptions 1–5 above. It will be seen that it already satisfies all of them to some extent, with the notable exception of CONSTRUCTIONS-ALL-THE-WAY-DOWN: LFG self-avowedly adheres to the principle of LEXICAL INTEGRITY (LI), which means that it rejects the claim that there is no distinction between morphology and syntax.

In Section 3, however, I argue that *some* version of LI should be adopted by CxG (and already is in frameworks like SBCG), and therefore that the assumption of CONSTRUCTIONS-ALL-THE-WAY-DOWN ought not to be a *sine qua non* of CxG. On the other hand, I also argue that LFG should (and sometimes already does, albeit often implicitly) loosen the absolute distinction between morphology and syntax, since some apparent LI violations do seem to be genuine.

In fact, the problem with viewing LFG as a formalisation of CxG lies not with LI, but with its inability to handle substantive idioms satisfactorily, owing to the difficulty of describing multiword stretches in the lexicon. Section 4 examines how LFG handles some constructional phenomena, showing that existing machinery allows it to analyse many formal idioms well, but that it falls short when it comes to substantive idioms. I discuss some existing inadequate proposals, and conclude that Findlay's (2019; to appear) proposal to replace the context-free grammar backbone of LFG with a tree-adjoining grammar would give the appropriate level of descriptive freedom to enable LFG to capture substantive idioms. With this move, LFG's notion of 'extended domain of locality' is expanded to include phrase struc-

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[4] In its guise as a research paradigm rather than a formalism, LFG has tended to be split on assumptions 6 and 7. Cross-linguistic variety has been a major focus, especially of the Parallel Grammar project (ParGram; Butt *et al.* 2002), and non-configurationality has provided an important motivation for LFG's modular architecture (see e.g. Bresnan *et al.* 2016, ch. 1). In keeping with its generative roots, however, LFG researchers tend to treat the competence/performance distinction as a given – although see work in LFG-DOP (Bod and Kaplan 1998) for a more usage-based approach.

ture, meaning that lexical entries become nothing more or less than a declarative description of every level of linguistic structure in parallel – exactly what we would expect from a Construction Grammar.

## LEXICAL FUNCTIONAL GRAMMAR 2

LFG is a declarative/constraint-based (i.e. non-transformational) grammatical theory, an off-shoot of MGG stemming from a desire in the late 1970s and early 1980s to develop a more psychologically plausible and computationally tractable theory (Kaplan and Bresnan 1982, 173–174; Dalrymple and Findlay 2019, 123).[5] In this section, I introduce some of its key machinery while considering how well it adheres to the assumptions of CxG identified in Section 1.[6] We will see that LFG in its canonical form already shares many of them. Assumption 5, HIERARCHY, is not met by LFG 'out of the box', but is easily accommodated with the addition of TEMPLATES, a tool already common in computational work in LFG, and now gaining ground in theoretical work (to be introduced in Section 2.3). The status of EDL and its supposed corrolary CONSTRUCTIONS-ALL-THE-WAY-DOWN is more challenging: we will see in Section 2.1 that LFG has very powerful tools for describing non-local relationships; however, LFG's adherence to Lexical Integrity means that it assumes a strict and categorical distinction between lexicon and

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[5] Although the focus on psychology has not been sustained in contemporary work, LFG does still play a role in psycholinguistic work – for instance, some of its insights underpin the influential Bock-Levelt model of language production (Bock and Levelt 1994). There has been a far bigger focus on computational implementation, most notably through the Xerox Linguistic Environment (XLE: Kaplan and Newman 1997; Crouch *et al.* 2017), in which grammars for a very large number of different languages have been written as part of the Parallel Grammar (ParGram) project (Butt *et al.* 2002).

[6] Of course, this will by necessity be a fairly superficial introduction. For further details, the reader is directed to the relevant parts of Dalrymple *et al.* 2019, and to Dalrymple forthcoming. For an article-length overview of LFG, see Asudeh and Toivonen 2015, and for textbook-style introductions, see Bresnan *et al.* 2016 and Börjars *et al.* 2019.

grammar, contrary to CONSTRUCTIONS-ALL-THE-WAY-DOWN (Section 3), and the format of LFG's lexical entries hamstrings its commitment to EDL by making it impossible to handle certain kinds of constructions, especially substantive idioms, in a satisfactory way (Section 4.3).

2.1                                   *Two levels of syntactic structure*

What is generally called 'syntax' refers both to more imminent, 'surfacey' phenomena such as word order (which vary widely across the world's languages) and to more abstract, 'deeper' phenomena such as subjecthood (which exhibit many more commonalities cross-linguistically). LFG formalises this distinction by positing two distinct levels of syntactic structure, C(ONSTITUENT)-STRUCTURE and F(UNCTIONAL)-STRUCTURE, which encode the different kinds of information in different data structures, and which are related by correspondence (not by derivation). C-structure is a phrase-structure tree, and represents constituency, part-of-speech categories, and word order. F-structure is a feature structure/attribute-value matrix (AVM), and represents abstract relational information about grammatical functions, agreement, long-distance dependencies, etc. The two are connected by a PROJECTION FUNCTION, $\phi$, which maps c-structure nodes onto their corresponding f-structure ($\phi$ is a function, so more than one c-structure node can be mapped to the same f-structure, but each c-structure node only maps to a single f-structure). Figure 1 gives the c- and f-structures for the sentence *Jadzia loves them* by way of illustration.[7]

   C-structure is loosely based on X-bar theory (Chomsky 1970; Jackendoff 1977), but makes a number of simplifying assumptions:[8]

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[7] Figure 1 only represents the $\phi$ function on the three c-structure nodes which correspond to maximal functional projections (and which map to the three f-structures), so as to avoid visual clutter (see Dalrymple and Findlay 2019, 137–138). This does not conceal any information, since daughter nodes in each of these three projections will be annotated to indicate that they share the same f-structure as their mother, with the effect that their functional information is 'passed up' the tree – see below for explanation of annotations on c-structure.

[8] For a fuller account of the formal details of c-structure, see Dalrymple *et al.* 2019, ch. 3.
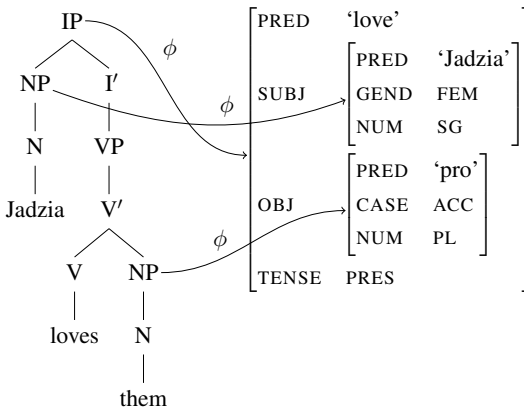
Figure 1:
C- and f-structures
for *Jadzia loves them*,
with correspondences

1. All right-hand elements of phrase-structure rules are optional, so that there can be headless phrases (VPs without Vs, IPs without Is, etc.) – this avoids positing empty heads where no overt material fills the slot (e.g. in the analysis of English, an I node is only assumed when there is an auxiliary or modal that fills it, otherwise it is simply omitted).

2. Some categories are NON-PROJECTING (Toivonen 2003), indicated by a circumflex accent over the category label: e.g. a P̂ is a non-projecting P. This means that they do not project a phrase.

3. We assume there is always a rule XP → X, for any category X, which omits extraneous bar levels (this is part of a general principle called ECONOMY OF EXPRESSION; see Dalrymple *et al.* 2015).

In addition, no phonologically empty elements are assumed.[9] All of this makes LFG c-structures a much more direct representation of

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[9] Some versions of LFG violate this by employing traces. This was common in earlier incarnations of the theory, including Kaplan and Bresnan 1982, along with e.g. Bresnan 1995, 1998; but since the introduction of functional uncertainty (Kaplan *et al.* 1987; see below), it is not normally seen as part of the mainstream theory. Various handbook and textbook presentations of LFG, such as Dalrymple 2001, Börjars *et al.* 2019, and Dalrymple *et al.* 2019, do not employ traces, for example. Awkwardly, one prominent textbook, Bresnan *et al.* 2016, *does* make use of empty categories, albeit only in a heavily restricted set of cases (such as crossover phenomena – see Bresnan *et al.* 2016, ch. 9). However, others have convincingly argued for alternative analyses of these phenomena which remove the need for traces and empty categories in LFG altogether: see Dalrymple *et al.* 2001, 2007, Dalrymple and King 2013, and Nadathur 2013.

surface syntactic structure than trees in other frameworks where the phrase-structure tree is overloaded and expected to encode functional information as well as constituent structure. LFG takes the view that different kinds of information require different kinds of data structure to represent: syntactic trees are very good at encoding constituency and linear order, but much less good at representing dependency relations between constituents (which may involve re-entrancy, cyclicity, etc.), for which a feature structure is much better suited. By omitting abstract functional information from the tree, we therefore obtain a much more WYSIWYG c-structure: assumption 1 of CxG described above.[10]

Formally, an LFG grammar is a context-free grammar where the phrase-structure rules bear annotations that describe how f-structure is projected from the c-structure. Annotations are written using the following abbreviations:

(8)     a.   $*$ := the current node (the node bearing the annotation)
        b.   $\hat{*}$ := the current node's mother

(9)     a.   $\downarrow$ := $\phi(*)$ (the f-structure of the current node)
        b.   $\uparrow$ := $\phi(\hat{*})$ (the f-structure of the current node's mother)

We can indicate that a node and its mother share the same f-structure by writing $\uparrow = \downarrow$:

(10)    NP → 　 N
        　　　　　 $\uparrow = \downarrow$

And we can indicate that a phrase bears some particular grammatical function by using paths through f-structure in our annotations. The rule in (11), for example, says that the f-structure of the NP in the specifier of IP is the SUBJect of the f-structure corresponding to the IP:[11]

(11)    IP → 　　 NP 　　　　 I′
        　　　　 $(\uparrow \text{SUBJ}) = \downarrow$ 　 $\uparrow = \downarrow$

---

[10] Zaenen (1989) makes this explicit in a 'WYSIWYG Principle'.

[11] For reasons of space, I will not motivate or list the grammatical functions and features usually assumed at f-structure. For a full treatment, see Dalrymple *et al.* 2019, ch. 2.

In words, the annotation below the NP says that the f-structure corresponding to its mother node, IP ("↑"), has a subject attribute ("SUBJ"), whose value is the NP's f-structure ("↓").

It is important to recognise that although we say that f-structure is *projected* from c-structure, this does not mean that f-structure is *derived* from c-structure in any sense. Rather, the two structures are both simultaneously present, and constrain each other *mutually*. (This is an important component in LFG's adherence to PARALLEL-REPRESENTATION, which we return to in Section 2.2, where I introduce the wider LFG projection architecture.) The directionality inherent in the projection function is related to information flow rather than derivation: owing to the functional nature of $\phi$, structure present at c-structure can be lost at f-structure (many nodes can correspond to a single f-structure), and cannot then be recovered in reverse (in the same way that mergers are irreversible in sound change).

Lexical entries in LFG are formally just phrase-structure rules, as in (12):

(12)  N →      Jadzia
              (↑ PRED) = 'Jadzia'
               (↑ NUM) = SG
              (↑ GEND) = FEM

But they are usually written in a different format, shown in (13):

(13)   Jadzia   N   (↑ PRED) = 'Jadzia'
                    (↑ NUM) = SG
                    (↑ GEND) = FEM

The feature PRED was originally used to indicate the semantic predicate of an f-structure, but given developments in the LFG approach to semantics (see Section 2.4), its role is now really just to uniquely identify lexical items (see Andrews 2008 and Findlay 2019, 152–154 for some discussion) – cf. the role of the LID feature in SBCG (Sag 2012, 84). Lexical entries therefore almost always contain a statement identifying their PRED value at a minimum.

Annotations, whether in lexical entries or other phrase-structure rules, can refer to non-local parts of f-structure. We have seen how annotations can include paths through f-structure; in principle there is no

limit to the length of these paths. Therefore as well as simple annotations like ($\uparrow$ SUBJ) = $\downarrow$, or ($\uparrow$ NUM) = SG, which describe relationships between the f-structures of a c-structure node and its mother, or simply ascribe values to attributes within a lexical item's own f-structure, we can also express more distant relationships, such as FUNCTIONAL CONTROL, illustrated in the second line of this lexical entry for the raising verb *seem*:

(14)      seem      V      ($\uparrow$ PRED) = 'seem'
                             ($\uparrow$ SUBJ) = ($\uparrow$ XCOMP SUBJ)

The second constraint here identifies the subject of *seem* with the subject of its open complement clause (e.g. connecting *Jadzia* and *leave* in *Jadzia seemed to leave*), i.e. it expresses a cross-clausal dependency.

LFG also permits these paths to be expressed as regular expressions over grammatical functions, meaning that they can be *arbitrarily* long. Such FUNCTIONAL UNCERTAINTY (Kaplan *et al.* 1987) is useful in describing long-distance dependencies, for instance. Example (15) shows this employed in a (simplified) phrase-structure rule for a fronted *wh*-phrase in English constituent questions:

(15)      CP $\rightarrow$                    XP                         C$'$
                                   ($\uparrow$ FOCUS) = $\downarrow$            $\uparrow$ = $\downarrow$
                           ($\uparrow$ FOCUS) = ($\uparrow$ COMP* GF)

The first annotation under XP identifies its f-structure with the 'grammaticized discourse function' FOCUS (Bresnan and Mchombo 1987; Dalrymple 2001, 182–183) – this is the special function assumed to be assigned to questioned material. But displaced constituents must also play a grammatical role at the 'gap' where they are interpreted; this is what the second annotation ensures. It says that the FOCUS also bears some grammatical function (GF), which may be in the same clause or may be embedded in any number of COMPlement clauses – the '*' following COMP is a Kleene star, indicating zero or more occurences of COMP on this path.

With the use of functional uncertainty, it is obviously possible to describe extremely non-local dependencies between elements. Additional tools, such as OFF-PATH CONSTRAINTS (Dalrymple *et al.* 2019, ch. 6.6), have also been developed to allow further constraints to be imposed on the paths described by such expressions, which enables

very precise specifications of very detailed and complex long-distance relationships through the f-structure. Thus, the description language of LFG allows constraints to be placed on dependencies that extend way beyond a word and its immediate sisters or dependents, which clearly affords LFG some version of EDL, assumption 3 of CxG described above.

### *The parallel projection architecture* 2.2

Although the original formulation of LFG in Kaplan and Bresnan 1982 includes only c-structure and f-structure, subsequent developments have expanded the number of different levels of representation, i.e. the different 'structures', which are assumed. A contemporary view of the so-called (PARALLEL) PROJECTION ARCHITECTURE is given in Figure 2, showing the different structures and correspondence functions which map between them. All of these different structures are taken to have "their own primitives and organizing principles, and therefore
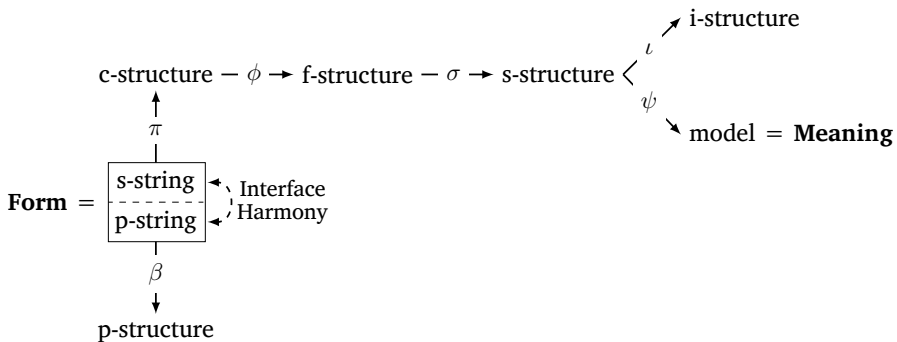
Figure 2: The parallel projection architecture (Findlay 2021, 344). On the division of the string into the s-string and p-string, see Dalrymple and Mycock 2011 and Mycock and Lowe 2013. The other structures shown here are p(rosodic)-structure (Mycock and Lowe 2013), s(emantic)-structure (Dalrymple 1999; Lowe 2014; Findlay 2021), and i(nformation)-structure (Dalrymple and Nikolaeva 2011). Not shown are a(rgument)-structure, which appears between c-structure and f-structure in some conceptions of the architecture (Butt *et al.* 1997), but which other approaches have omitted entirely (Asudeh and Giorgolo 2012; Findlay 2016); and m(orphosyntactic)-structure (Butt *et al.* 1996; Frank and Zaenen 2004), which has likewise been dispensed with in modern treatments (Dalrymple 2015)

their own internal structure and formal representation" (Dalrymple *et al.* 2019, 265 – although in practice almost all are represented as AVMs like f-structure), meaning that LFG takes a highly modular view of the grammar. Crucially, meaning is also included in this extended view of the LFG architecture, as well as information-structure, so that all kinds of form *and* function are, at least in principle, brought within the scope of the framework. This shows that LFG shares assumption 2 of CxG, PARALLEL-REPRESENTATION: all levels of linguistic analysis, both form and function, are represented simultaneously.

What is more, although each of these structures represents a different plane of linguistic analysis, they are not derived from one another; instead they are present in parallel, and are mutually constraining. Just as phrase-structure rules can be annotated to describe f-structure, they can also bear annotations referring to any level, e.g. a person's name like *Jadzia* might specify that the ANIMate feature in its s-structure has the feature +:

(16)      Jadzia     N     $(\uparrow \text{PRED}) =$ 'Jadzia'
                           $(\uparrow_\sigma \text{ANIM}) = +$

The subscript convention here is used to make such annotations more readable. $\uparrow_\sigma$ is equivalent to $\sigma(\uparrow)$, and, more generally, for any structure $s$ and any projection function $\omega$, $s_\omega := \omega(s)$. Such subscripts can also be iterated, so that, for instance $\downarrow_{\sigma\iota}$ is equivalent to $\iota(\sigma(\downarrow))$, or, in other words, this node's i-structure.

Thus, descriptions (on both phrase-structure rules and in lexical entries) can constrain all levels of representation simultaneously – or, rather, all levels except c-structure. For, since the annotations appear on phrase-structure rules in a context-free grammar, the scope of c-structure constraints remains within a single generation (a mother node and its daughters). We will return to this problem in Section 4.3.

2.3                          *Templates*

It is common in programming languages to use *macros* of some kind to abbreviate chunks of code when they will be repeated. This has the pragmatic benefit of saving typing time, but it also makes maintaining code much easier: if something has to be changed in the chunk of code

in question, it need only be changed in one place, where the macro is defined, rather than having to be changed at every instance of its use. This saves time too, but, more importantly, it also avoids errors being introduced when some instances are inevitably missed.

The computational implementation of LFG, the Xerox Linguistic Environment (XLE: Kaplan and Newman 1997; Crouch *et al.* 2017), also provides a means of writing macros – in this case they are called TEMPLATES. In addition to their practical uses, there has, over the past two decades, been a growing interest in the *theoretical* applications of templates in LFG, as a means of expressing generalisations across different lexical entries or parts of the grammar (Dalrymple *et al.* 2004; Asudeh *et al.* 2014; Findlay 2020, 132–133). Since templates are just abbreviations, a grammar with templates is extensionally equivalent to one without, but the former will be able to express generalisations that the latter cannot.

One area where templates can capture generalisations is in abbreviating annotations that frequently co-occur. For instance, any distinctively third-person singular verb in English will share the second and third lines of this lexical entry for *loves*:[12]

(17)     loves     V     ($\uparrow$ PRED) = 'love'
                              ($\uparrow$ SUBJ PERS) = 3
                              ($\uparrow$ SUBJ NUM) = SG

We can therefore define a template 3SG-SUBJECT that abbreviates this information:

(18)     3SG-SUBJECT :=
                ($\uparrow$ SUBJ PERS) = 3
                ($\uparrow$ SUBJ NUM) = SG

Now we can rewrite the lexical entry for *loves* by 'calling' this template, indicated by prefixing the template name with an '@' symbol:

---

[12] These annotations illustrate how agreement works in LFG: an agreeing subject (e.g. *Jadzia loves …*) will provide the same values for these features as the verb does, meaning the specifications are compatible; by contrast, a non-agreeing subject (e.g. \**We loves …*) will cause a feature clash in its f-structure, since it will specify different values for its PERSON and NUMBER features (e.g. 1 and PL in this case).

(19)     loves     V     $(\uparrow \text{PRED}) = $ 'love'
                              @3SG-SUBJECT

Templates can be parametrised, as in (20), so that they take one or more arguments, allowing even more flexibility:
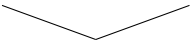
(20)     TENSE($t$) :=
              $(\uparrow \text{TENSE}) = t$

Notably, templates can also be nested, as shown in (21) and (22):

(21)     a.    3-SUBJECT :=
                        $(\uparrow \text{SUBJ PERS}) = 3$
          b.    SG-SUBJECT :=
                        $(\uparrow \text{SUBJ NUM}) = \text{SG}$

(22)     3SG-SUBJECT :=
              @3-SUBJECT
              @SG-SUBJECT

That is, a template can call one or several other templates in its definition. This nesting creates an implicit hierarchy between templates:

(23)     3-SUBJECT     SG-SUBJECT

                   3SG-SUBJECT

Such a hierarchy is different from a typical inheritance hierarchy – it is an *inclusion* hierarchy instead (Asudeh *et al.* 2013, 17–19). This is because templates, in common with LFG descriptions generally, allow the use of Boolean operators like negation or disjunction. For example, alongside the 3SG present tense form *loves*, we have the complemetary form *love*, used for all other person/number combinations in the present tense. We can describe this distribution by simply negating the 3SG-SUBJECT template:

(24)     love     V     $(\uparrow \text{PRED}) = $ 'love'
                              ¬@3SG-SUBJECT

But now both *love* and *loves* will be daughters of 3SG-SUBJECT in the template hierarchy, since both *include* the template, even though in one case this is only under negation:

(25)    3SG-SUBJECT

```
        /‾‾‾‾‾‾\
     love      loves
```
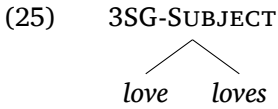
In principle, all functional annotations in a grammar could be abbreviated in templates and appropriately related to one another. This would provide LFG with a hierarchical organisation of linguistic knowledge, bringing it in line with assumption 5 of CxG, HIERAR-CHY.[13] In practice, however, theoretical work in LFG has not pursued this endeavour in a thoroughgoing way (though see Asudeh *et al.* 2013 and Przepiórkowski 2017 for case studies), and so the framework does not yet live up to the claim by Goldberg that in CxG "the network of constructions captures our grammatical knowledge of language *in toto*" (Goldberg 2006, 18) – although only for contingent rather than principled reasons.

<div align="center">

*Meaning in LFG*                                    2.4

</div>

Any theory which purports to explain human language needs to have an account of meaning. In particular, it needs to explain how meanings can be arrived at compositionally, allowing us to express new ideas with existing, limited, resources. LFG remains wholly agnostic about how meanings *per se* should be represented – in keeping with its modular approach, this is not a question for the framework overall, but for the particular module which deals with semantics. What is crucial, though, is how this module connects to the rest of the grammar: in other words, the syntax-semantics interface. There has been some variation over the years in how this has been conceptualised within LFG, and in particular about the necessity and/or role of s-structure in this (on which see Findlay 2021, especially §3), but the *de facto* standard approach to the syntax-semantics interface in contemporary LFG is GLUE SEMANTICS (Glue: Dalrymple *et al.* 1993; Dalrymple 1999).

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[13] Work in CxG generally makes use of *inheritance* hierarchies, and therefore LFG's template inclusion hierarchies may not seem like such a good fit. It remains an open question, however, what exactly the hierarchical structure of the grammar should look like, and further work is needed to determine the theoretical implications of choosing an inclusion rather than an inheritance hierarchy.

For our purposes, most of the details of this theory are not relevant, but it will nonetheless be useful to have some tools to describe how LFG handles the pairing of form and meaning, and so in this section I give a brief introduction to Glue for LFG. For a fuller introduction to the theory, the reader is directed to Asudeh 2012, ch. 4 or Dalrymple *et al.* 2019, ch. 8.

Meaning contributions in Glue are handled by so-called MEANING CONSTRUCTORS, which pair an expression in some meaning language (here a simple predicate calculus) with a logical expression that both gives the type of that meaning and connects it to the syntax – this logical expression is called the glue term, since it bonds the semantics to the syntax. Semantic composition is logical deduction: parsing a sentence gives us a collection of meaning constructors, and we use their glue terms to construct a proof terminating in the type of the sentence itself.

Glue Semantics uses LINEAR LOGIC (Girard 1987) as the logical language for the second part of a meaning constructor. Since it lacks the structural rules of weakening and contraction, this logic has the property of RESOURCE SENSITIVITY, meaning that premises are 'used up' in deriving a conclusion. This has the – desirable – consequence that meanings cannot be re-used or discarded in the process of composition. For example, *Jadzia loves Worf* cannot mean **love**(**jadzia**, **jadzia**) ('Jadzia loves herself'), where we use the meaning of *Jadzia* twice and ignore the meaning of *Worf*.[14]

A simple meaning constructor is given in (26):

(26)    **jadzia** : $e_\uparrow$

The meaning language side introduces a constant **jadzia**, while the linear logic side says that this is of type $e$ and is associated with $\uparrow$: in a lexical entry this means the pre-terminal node's f-structure, i.e. the lexical item's own f-structure.[15]

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[14] On the more widespread relevance of resource sensitivity to linguistic theory, see Asudeh 2012, ch. 5.

[15] In much of the Glue Semantics literature, types are associated with s-structures rather than f-structures, but for our purposes f-structures are sufficient, and avoid us being drawn into unresolved disputes about the exact content

A more complex meaning constructor appears in (27):

(27)     $\lambda x.\lambda y.\mathbf{love}(x, y) : e_{(\uparrow \text{SUBJ})} \multimap e_{(\uparrow \text{OBJ})} \multimap t_{\uparrow}$

This has a two-argument function on the left-hand side, and on the right-hand side a linear logic expression with two implications. This second part shows the $\langle e, \langle e, t \rangle \rangle$ type of the function on the left ('$\multimap$' is right-associative), and also links its first argument to its f-structure subject and its second to its f-structure object. Read as an implication, the glue term can be thought of as saying the following: "If I am provided with something of type $e$ corresponding to my subject, and if I am then provided with something of type $e$ corresponding to my object, I will provide something of type $t$ corresponding to my own f-structure (i.e. the f-structure of the clause)".

Of course, combining types means nothing if we don't also combine meanings. Glue achieves this by appealing to the CURRY-HOWARD CORRESPONDENCE (Curry and Feys 1958; Howard 1980): proof steps in a constructive logic (like linear logic) correspond to specific operations in the lambda calculus. Most notably, implication elimination (i.e. *modus ponens*) corresponds to functional application, while implication introduction (i.e. hypothetical reasoning) corresponds to lambda abstraction. This means that as we compose the types on the right-hand side of a meaning constructor, the left-hand meanings are also combined appropriately. Let us see how this works with an example.

Meaning constructors are included in lexical entries just like other annotations. For the sentence *Jadzia loves Worf*, we can assume the (very simplified) lexical entries in (28)–(30):

(28)     Jadzia     N     $(\uparrow \text{PRED}) = $ 'Jadzia'
                              $\mathbf{jadzia} : e_{\uparrow}$

---

of s-structure (on which see Findlay 2021, §3). I also make use of so-called FIRST-ORDER GLUE here (Kokkonidis 2008), where the atomic expressions in the linear logic are type constructors that take structures in the projection architecture (here f-structures) as arguments (here represented as subscripts), rather than the more common approach which takes the atoms to be the structures themselves (appropriately typed). This is mostly for the sake of clarity, since it makes the role of the linear logic in driving composition based on types more explicit (see also discussion in Kokkonidis 2008 and Findlay 2019, 181–183).

(29)    Worf    N    $(\uparrow \text{PRED}) = \text{‘Worf’}$
        **worf** : $e_\uparrow$

(30)    loves    V    $(\uparrow \text{PRED}) = \text{‘love’}$
        $\lambda x.\lambda y.\textbf{love}(x, y) : e_{(\uparrow \text{SUBJ})} \multimap e_{(\uparrow \text{OBJ})} \multimap t_\uparrow$

The (abbreviated) f-structure for the sentence is shown in (31). The different structures have been labelled to allow us to refer to them directly.

(31)
$$l \begin{bmatrix} \text{PRED} & \text{‘love’} \\ \text{SUBJ} & j\begin{bmatrix} \text{PRED} & \text{‘Jadzia’} \end{bmatrix} \\ \text{OBJ} & w\begin{bmatrix} \text{PRED} & \text{‘Worf’} \end{bmatrix} \end{bmatrix}$$

We can now obtain a set of INSTANTIATED meaning constructors from the lexically contributed meaning constructors in (28)–(30) by replacing the descriptions on the linear logic side with the names of the f-structures they describe in (31):

(32)    **jadzia** : $e_j$
        **worf** : $e_w$
        $\lambda x.\lambda y.\textbf{love}(x, y) : e_j \multimap e_w \multimap t_l$

Finally, we can use these to construct the proof in Figure 3, where each step corresponds to an instance of *modus ponens*/function application. As we can see, we arrive at the correct meaning for the sentence, namely **love(jadzia, worf)**.

Figure 3:
Glue proof for
*Jadzia loves Worf*

$$\cfrac{\cfrac{\textbf{jadzia} : e_j \qquad \lambda x.\lambda y.\textbf{love}(x, y) : e_j \multimap e_w \multimap t_l}{\lambda y.\textbf{love}(\textbf{jadzia}, y) : e_w \multimap t_l} \qquad \textbf{worf} : e_w}{\textbf{love}(\textbf{jadzia}, \textbf{worf}) : t_l}$$

2.5                          *Summary*

We have now seen briefly some key components of LFG, and I believe this has illustrated how many of the core assumptions of CxG it already shares. Its surface-oriented syntax, represented at c-structure, means

that it adheres to WYSIWYG. The parallel projection architecture gives us PARALLEL-REPRESENTATION: all levels of linguistic structure exist in parallel, mutually constraining one another. The existence of tools like functional uncertainty gives us an important degree of EDL; although c-structure remains problematic, something we will explore more fully in Section 4, it is clear that overall LFG is perfectly capable of expressing a variety of complex constraints across arbitrary distances. Lastly, HIERARCHY can be achieved through the use of templates to organise and modularise linguistic description, even though this approach has not been followed through to completion in theoretical work in LFG.

One problem arises, however, when it comes to CONSTRUCTIONS-ALL-THE-WAY-DOWN. LFG professes to adhere to the principle of Lexical Integrity (LI), whereby syntax and morphology are strictly separated, and the morphological structure of words is invisible to the syntax. Crucially, the LI claim that "words are built out of different structural elements and by different principles of composition than syntactic phrases" (Bresnan and Mchombo 1995, 181) would appear to be at odds with the CxG credo that "no strict division is assumed between the lexicon and syntax" (Goldberg 1995, 7). Since "LFG assumes a strict version of the Lexical Integrity Principle" (Dalrymple *et al.* 2019, §3.3), this would seem to be a serious obstacle to viewing LFG as a CxG. In the next section, we will examine LI and see that it may not prove as great an obstacle as appearances would suggest.

## LEXICAL INTEGRITY                                  3

The principle of Lexical Integrity claims that the smallest items the (phrasal) syntactic component of the grammar can 'see' are words. That is, word-internal morphological structure is not accessible to the syntax, and so there is an important division between the syntax on the one hand and the lexicon on the other, which may also be taken as an important division between the computational system underlying syntax and that underlying morphology.

Building on the proposals of Chomsky (1970), the principle of Lexical Integrity was first formulated by Lapointe (1980, 8) as the Generalized Lexicalist Hypothesis:

(33)    **Generalized Lexicalist Hypothesis:**
        No syntactic rule may refer to elements of morphological structure.

In the forty plus years since this original formulation, many different versions have been proposed, but all make the same basic claim: there is some kind of 'firewall' between syntax and the lexicon, with the latter feeding the former, but not *vice versa*. Perhaps the most succinct specification of this is given by Anderson (1992, 84):

(34)    **Principle of Lexical Integrity:**
        The syntax neither manipulates nor has access to the internal structure of words.

A whole paradigm of linguistic theories exist, called LEXICALIST theories, which are defined by their adherence to the principle of Lexical Integrity – LFG is one such theory. LI has featured explicitly in LFG analyses from the very start (Bresnan 1982; Simpson 1983), and appears in textbook/handbook presentations of the theory (Falk 2001, 26; Bresnan *et al.* 2016, 92; Börjars *et al.* 2019, 28; Dalrymple *et al.* 2019, 135–136). And there are good *prima facie* reasons to believe that LI is valid: many phenomena that it predicts to be impossible are indeed so. For example, gapping can be applied to words but not sub-lexical elements (examples from Simpson 1991, 51):

(35)    a.    John liked the play, and Mary, the movie.
              (gapping of *liked* permitted)
        b.    *John liked the play, and Mary dis- it.
              (gapping of *-liked* not permitted)

And sub-parts of words cannot be modified independently of the whole (examples from Williams 2007, 354):

(36)    a.    How complete are your results?
        b.    *[How complete]-ness do you admire?

Although *how* can modify *complete* in (36a), it cannot do so when *complete* is part of a larger word, *completeness*, as in (36b). Note that the deviancy of (36b) is not because its meaning is incoherent: its meaning is perfectly grammatically expressed by (37a). And it is entirely possible for *how* to modify *complete* inside a nominal expression, provided that nominal expression is phrasal, as shown in (37b) (Williams 2007, 354):

(37)    a.    What degree of completeness do you admire?
          b.    How complete a record do you admire?

These data notwithstanding, CxG is often understood as rejecting a strict separation of morphology and syntax – this is the assumption I called CONSTRUCTIONS-ALL-THE-WAY-DOWN above. Since constructions are pairings of form and meaning, and morphemes also fit this description, there is therefore no fundamental distinction between morphemes and words. Rather, all constructions exist on a lexicon-syntax spectrum, varying in particular in terms of SCHEMATICITY, i.e. how much the phonological form is specified by the construction. At the more lexical end of the spectrum, we have words and morphemes, which are fully specified for phonological form (e.g. *cat* has the form /kæt/, at least in British English); at the more syntactic end, we have abstract phrasal constructions, which are radically under-specified for phonological form (e.g. the so-called N-P-N construction, exemplified in phrases like *hour by hour*, *cheek to cheek*, and *attack after attack*, which has a non-compositional semantics and imposes various restrictions on its parts – the nouns must be count nouns, cannot have a determiner, etc. – but is compatible with a wide variety of nouns and (a more limited variety of) prepositions: see Jackedoff 2008).

Taken naïvely, therefore, the LFG and CxG positions are clearly incompatible, and so LFG would be unsuitable as a formalisation of CxG. But whether or not LI is valid is an empirical question, not (just) a matter of formalism. And answering it would resolve the rift between LFG and CxG one way or the other. If it is valid, then CxG should abandon CONSTRUCTIONS-ALL-THE-WAY-DOWN in its strictest interpretation and move closer to LFG. Alternatively, if it is not, then LFG should abandon LI and move closer to CxG. So, what are the facts?

Alongside the putative evidence in favour of LI presented above, there is also apparently equally clear counterevidence. For instance, phrases and even entire clauses can host derivational and inflectional suffixes in English:

(38)   a.   His general [ok-with-less-than-we-should-aim-for]-ness makes him an undesirable candidate.   (Bruening 2018, 6)
       b.   He [I-don't-care]-d his way out of the room.
                                                         (Carnie 2000, 91)

This seems to be a clear example of syntax being 'visible' to morphology, since phrasal material can be used as input to a morphological process (suffixation).

   Another apparent counter-example is the possibility of coordinating certain prefixes:

(39)   a.   [pre- and even to some extent post]-war (economics)
       b.   [pro- as opposed to anti]-war
       c.   [hypo- but not hyper]-glycaemic        (Spencer 2005b, 82)

(40)   a.   [mono- and tri]-syllabic
       b.   [pro- and en]-clitics
       c.   [socio- and politico]-economic
                                    (Siegel 1974, 147, cited in Strauss 1982, 43)

In German, this also extends to verbal prefixes, leading to gapping constructions similar to (35):[16]

(41)      Peter be- und Maria ent-lud    den LKW.
          *Peter* BE- *and Maria un-loaded the  truck*
          'Peter loaded and Maria unloaded the truck.'

In all these cases, it seems that morphology is visible to syntax, since coordination is an operation in the phrasal syntax but here it is being applied to parts smaller than words.

   Some have seen evidence such as this as damning. Marantz (1997, 207), for example, declares that "[l]exicalism is dead, deceased, demised, no more, passed on …". All the same, more than

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[16] My thanks to an anonymous reviewer for this example.

20 years later, Bruening has to again declare the lexicalist hypothesis "both wrong and superfluous" (the subtitle of Bruening 2018); apparently, earlier reports of lexicalism's death were greatly exaggerated (to – further – misquote Mark Twain). In fact, the empirical situation is fraught, and none of the data presented in this section are unproblematic. For instance, Bruening (2018, 23–29) purports to explain the sub-lexical gapping and modification data in (35) and (36) in syntactic terms which make no reference to the notion of word, thus rendering LI superfluous. At the same time, the phenomenon of sub-lexical coordination illustrated in (39)–(40) is not at all as thoroughgoing as we might expect were morphology and syntax truly underpinned by exactly the same combinatory sytem. For although some English prefixes can be coordinated, others emphatically cannot:[17]

(42)    a.  *[un- or re]-tie
        b.  *[i{n|m}- or ex]-port          (Spencer 2005b, 82)
        c.  *[ex- and se]-cretions          (Siegel 1974, 147)

And it does not seem to be possible at all with suffixes:

(43)    a.  *fear-[some and -less]
        b.  *thought-[ful and -less]
        c.  *interest-[ed and -ing]          (Strauss 1982, 43)

Lieber and Scalise (2007, 3) therefore express a sort of compromise position, admitting that LI cannot be valid in a strict sense, but viewing it as a kind of default or strong tendency: "we know that

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[17] The distinction appears to be between what Siegel (1974) calls Class I and Class II prefixes. Class I prefixes are both morphologically and functionally 'closer' to the stem: they always appear nearer to the stem than Class II prefixes, for example, and unlike their Class II counterparts they can affect lexical stress assignment. It is perhaps unsurprising then that the prefixes in (42) that resist coordination are Class I – their closeness to the stem is reflected in their inability to be separated from it by a syntactic process like coordination. Note that the same class of prefixes can behave differently in different languages, however: the German *Im- und Export*, for example, is apparently impeccable. (One can also find hits online for *im- and export* in English, but many of these seem to be in forum posts written by German speakers: see, for example, `https://adobe.ly/3PoQKpo` or `https://bit.ly/42U4o75` [accessed June 22nd 2023].)

morphology and syntax interact, and that this interaction is not a one way affair: morphology sees syntax and syntax sees morphology. Nevertheless this two way interaction is highly constrained". This is echoed more recently by Cappelle (2022, 204), who points out that "[a]ny randomly selected stretch of discourse is likely to prove that morphologically complex words stay together as undivided units and that they tend not to include any above-word-level components".

Ultimately, a large part of the problem is this: deciding whether one or another piece of linguistic data is a LI violation depends hugely on one's other theoretical assumptions (Desjardins 2023, 19–20), and so the enterprise of proving or disproving LI by looking for supportive or problematic constructions in the world's languages is a largely hopeless one. There are, however, systematic differences between morphology and syntax at a higher level of abstraction that plead for a principled separation between the two.

Firstly, morphology applies strict ordering constraints on morphemes, even in languages where the syntax imposes no ordering constraints. For example, case markers and verbal inflection in Latin always follow the stem, even though any of the six permutations of the three *words* in (44) is grammatical:

(44)    a.   mil-es      coqu-um  laud-at.
              *soldier*-NOM *cook*-ACC *praise-3*SG.PRES.INDIC
              'The soldier praises the cook.'

        b.  *es-mil coqu-um laud-at

        c.  *mil-es um-coqu laud-at.

        d.  *mil-es coqu-um at-laud.

And, of course, morphemes from different words cannot be interleaved, even though discontinuous *constituents* are permitted (Snijders 2012, 2015, 211–212). That is, so-called 'free word order' languages are *not* 'free morpheme order' languages.

Secondly, and perhaps more foundationally, there are important differences in the computational complexities of morphology and syntax (Asudeh *et al.* 2013, 4–5). Morphology falls almost entirely within the class of finite-state languages (Roark and Sproat 2007, ch. 2),

with the sole exception being unbounded reduplication (Culy 1985).[18]
Syntax, on the other hand, falls almost entirely within the class of
context-free languages,[19] with the sole exception being cross-serial de-
pendencies (Shieber 1985).[20] Assuming there is no formal difference
between morphology and syntax, as CONSTRUCTIONS-ALL-THE-WAY-
DOWN would have it, then this contrast is puzzling. As Asudeh *et al.*
(2013, 5) put it:

> [i]f morphology has the full power of syntax, why are
> there no clear morphological equivalents of unbounded or
> nested dependencies? […] Similarly, why do we fail to find
> reduplication in the syntax, if there is no important formal
> distinction between morphology and syntax?

Note that the claim here is not merely that morphology is less powerful
than syntax, but that the two systems are in fact *disjoint*: there are syn-
tactic phenomena, like unbounded or nested dependencies, which we
do not observe in morphology, and there are morphological phenom-
ena, like reduplication or root-and-pattern, which we do not observe
in syntax.[21]

I am not aware of any arguments in the literature which have
addressed these concerns, and they seem to strongly suggest that we
need to be able to distinguish between processes happening above the
level of the word and processes below. Any framework that makes this

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[18] See Wang and Hunter 2023 for a minimal extension to the class of regular
languages designed to account for just this kind of pattern.

[19] See Partee *et al.* 1990, 480–482 for a proof that English is not a finite-state
language, and see Gazdar *et al.* 1985 for a comprehensive syntactic theory which
is nonetheless self-avowedly context free.

[20] Even though Shieber's findings show that the human language faculty must
in general be capable of learning languages which are at least mildly context-
sensitive in their strong generative capacity, further evidence of the necessity of
greater-than-context-free power has not been abundantly forthcoming. It seems
entirely plausible, as Pullum and Rawlins (2007, 285) opine, that languages sim-
ply vary in this respect. Perhaps non-context-freeness is a typological corner case,
and designing our formalisms around it is merely generalising to the worst case.

[21] Contrastive Reduplication in English (*Do you LIKE HIM-like him?*) offers
a potential counter-example to the idea that reduplication is not found in the
syntax, since it has been claimed to obey (morpho)syntactic rather than purely
prosodic constraints (Ghomeshi *et al.* 2004).

*impossible* ought to be treated with a degree of suspicion, therefore. So, is CxG such a framework?

In fact, the CxG position may have been overstated by its critics (or, depending on your point of view, the CxG position may be thought of as unclear/non-committal). On the same page that Goldberg (1995, 7) makes her oft-cited claim that "[i]n Construction Grammar, no strict division is assumed between the lexicon and syntax", she goes on to clarify that "[i]t is not the case, however, that in rejecting a strict division, Construction Grammar denies the existence of any distinctly morphological or syntactic constraints (or constructions)". It would seem our choice is not, therefore, between two extreme positions – on the one hand, a strict version of LI where syntax and morphology are computationally distinct processes, and, on the other, the obliteration of LI and total collapse of the syntax-morphology boundary. Rather, a third way is possible (and indeed espoused by Goldberg), where syntax and morphology operate under the same computational system, but where a formal distinction is drawn between morphemes, words, and phrases, meaning that linguistic processes can be sensitive to these contrasts (see Ackema and Neeleman 2004 for a similar approach outside of CxG).

This approach is readily embodied by any type-driven framework. For example, a standard HPSG type signature includes the sub-section shown in (45) (Przepiórkowski and Kupść 2006, §3.3):

(45)

$$
\begin{bmatrix}
\textit{sign} \\
\text{PHON} & \textit{phon} \\
\text{SYNSEM} & \textit{synsem}
\end{bmatrix}
$$

$\textit{word}$ $\quad$ $\begin{bmatrix} \textit{phrase} \\ \text{DTRS} & \textit{list} \end{bmatrix}$
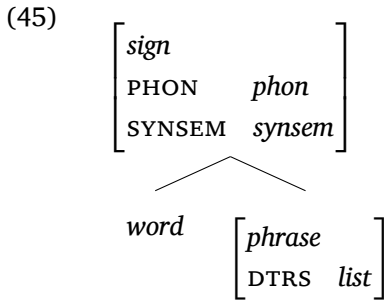
Here we see that words and phrases are both sub-types of *sign*, and that what defines a sign is the pairing of PHONological form with syntactic and semantic information (SYNSEM). That is, "both lexical and syntactic constructions are essentially the same type of declaratively represented data structure: both pair form with meaning" (Goldberg

1995, 7). But since *word* and *phrase* are still distinct types, it remains possible for certain constructions to be more restrictive: for example, 'morphological' constructions can be defined as those which require their mother to be specifically of type *word* (while 'syntactic' constructions require that their daughters (DTRS) merely be of type *sign*). I have illustrated this point with HPSG since it makes the cut so clearly and succinctly, but the same point could be made with HPSG's explicitly constructionist cousin, Sign-Based Construction Grammar (SBCG: Boas and Sag 2012; Michaelis 2015),[22] which likewise recognises an early cleavage between lexical constructs and phrasal constructs (cf. Sag 2010, 499). In other words, even existing implementations of CxG do not take rejection of LI as a *sine qua non*.

CxG can therefore be made to fit with Lieber and Scalise's (2007, 18) conclusion "that the interaction between word formation and syntax goes both ways, but that nevertheless it is quite restricted": there are formalisms for CxG which do not in themselves preclude syntax-morphology interactions, but do give a means of restricting it and/or only permitting it on a construction-by-construction basis. What of LFG, then? LI must be weakened, it seems; but how easy is this to do?

As it happens, LFG already sanctions a weaker than strict interpretation of LI. In one common LFG formulation of LI, its scope is limited to c-structure:

(46)   **Lexical Integrity:**
       Morphologically complete words are leaves of the c-structure tree, and each leaf corresponds to one and only one c-structure node.

                                                    (Bresnan *et al.* 2016, 92)

That is, words are syntactic atoms when it comes to phrasal constituency, but when it comes to functional information, the internal morphological features of a word may very well be visible to syntax.

This view is well motivated, since there are numerous instances where what is expressed analytically in one language is expressed syn-

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[22] Sag (2007, 403, 2010, 486) is explicit about SBCG being simply a variant of HPSG. In fact, HPSG is itself fundamentally constructionist, even though it does not bear the 'construction grammar' name (Sag 1997; Müller 2021).

thetically in another (Asudeh *et al.* 2013, 7–9). For instance, future tense in Romance languages can be expressed via verbal inflection, whereas English uses an auxiliary (Asudeh *et al.* 2013, 7):

(47)   a.   Il   arriver-a.        (French)
           *He arrive*-3SG.FUT
           'He will arrive'
       b.   He will arrive.

While the c-structures of these sentences will differ, since the French tree has two terminal nodes and the English three, their f-structures will be identical:

(48)   a.

$$
\begin{array}{c}
\text{IP} \\
\diagup \quad \diagdown \\
\text{NP} \qquad \text{I}' \\
\mid \qquad\quad \mid \\
\text{N} \qquad\quad \text{I} \\
\mid \qquad\quad \mid \\
\text{il} \qquad \text{arrivera}
\end{array}
\qquad
\begin{bmatrix}
\text{PRED} & \text{'arrive'} \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'pro'} \\ \text{GEND} & \text{MASC} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{bmatrix} \\
\text{TENSE} & \text{FUT}
\end{bmatrix}
$$

   b.

$$
\begin{array}{c}
\text{IP} \\
\diagup \quad \diagdown \\
\text{NP} \qquad \text{I}' \\
\mid \qquad \diagup \diagdown \\
\text{N} \quad\; \text{I} \quad \text{VP} \\
\mid \qquad \mid \qquad \mid \\
\text{he} \quad \text{will} \quad \text{V} \\
\qquad\qquad\quad \mid \\
\qquad\qquad \text{arrive}
\end{array}
\qquad
\begin{bmatrix}
\text{PRED} & \text{'arrive'} \\
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'pro'} \\ \text{GEND} & \text{MASC} \\ \text{NUM} & \text{SG} \\ \text{PERS} & 3 \end{bmatrix} \\
\text{TENSE} & \text{FUT}
\end{bmatrix}
$$
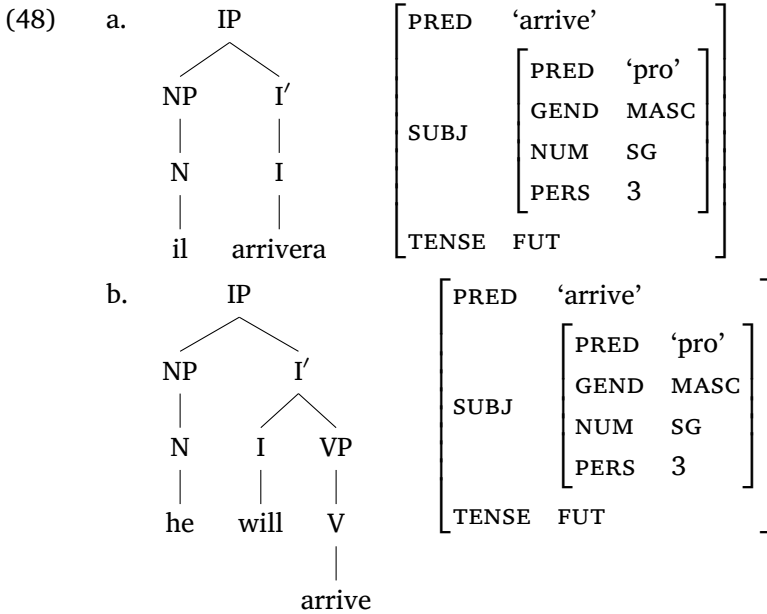
In English, the attribute-value pair ⟨TENSE, FUT⟩ is contributed by syntax, whereas in French, it is contributed by morphology.[23] In the latter case, the syntax, in the form of f-structure, can clearly 'see' the morphological features of words, even though c-structure is blind to morphological structure. That is, the syntax sees that *arrivera* contributes a

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[23] An instance of the cross-linguistic phenomenon whereby, to use the LFG slogan, "morphology competes with syntax" (Bresnan 1998).

future tense feature, but it does not see that it is specifically the suffix -*a* which does so.

Thus, it is not true that morphology is wholly isolated from syntax in LFG, but it remains true that morphological *structure* is. In fact, this view is quite in keeping with one formulation of LI, that of Di Sciullo and Williams (1987, 49), whereby "words have 'features', or properties, but these features have no structure, and the relation of these features to the internal composition of the word cannot be relevant in syntax – this is the thesis of the atomicity of words, or the lexical integrity hypothesis, or the strong lexicalist hypothesis". Falk's (2001, 26) suggestion that "[l]exical integrity as understood by LFG […] is a limited sort of lexical integrity" is thus perhaps a little premature, but does highlight that LI in LFG is limited to c-structure; by contrast, the contribution of a single word can be spread throughout f-structure, giving the impression of undermining said word's atomicity. The orthodox view in LFG is therefore perhaps more in line with Cappelle's (2022, 196) conclusion that LI should be reformulated "as a principle forbidding the manipulation of words, rather than access to word-internal structure" – 'manipulation' of words would correspond to splitting them up at c-structure.

As such, however, even this weakened version of LI would disallow the coordination of affixes seen in (39)–(40), and certainly the phrases hosting affixes seen in (38). So it may well be that LFG has to accept even greater concessions. There is some lurking awareness of this in the LFG literature. Analyses occasionally make use of 'sublexical' entries; that is, lexical entries for morphemes, written as if they were leaves in the c-structure tree, in clear violation of LI (e.g. King 1995; Nordlinger 1998; Marcotte 2009; Bresnan *et al.* 2016). Usually, it is implied (though often not stated explicitly) that these have no formal status, and should instead be viewed as descriptions of generalisations over lexical entries (of the sort that would nowadays be captured by templates), but sometimes suggestions are made to incorporate actual sub-lexical phrasal syntax (Marcotte and Kent 2010). Recent work in the LFG variant Lexical-Realizational Functional Grammar (L$_R$FG: Melchin *et al.* 2020; Asudeh *et al.* 2021; Asudeh and Siddiqi 2022, to appear) takes this as its starting point, and assumes a rich sub-lexical syntactic structure, inspired by Distributional Morphology (Halle and Marantz 1993), thus rejecting LI wholesale. As

argued above, however, this may be throwing the baby out with the bathwater. Mainstream LFG has tended to adopt a halfway-house solution, using non-projecting categories (Toivonen 2003), which can be adjoined at the $X^0$ level, to represent the kinds of elements that exist somewhere between word and morpheme. This treats LI as the default position, but allows a controlled relaxation of it in certain circumstances – such an approach has been used in the analysis of case (Spencer 2005a) and compounding (Lowe 2015), for example.

To sum up: the abolition of the distinction between word and phrase or morphology and syntax implied by a strict reading of CONSTRUCTIONS-ALL-THE-WAY-DOWN is not a necessary (or indeed empirically justified) tenet of CxG; at the same time, the *absolute* separation of the two implied by a strict reading of LI is not a necessary (or indeed empirically justified) tenet of LFG either. There is therefore ample room for common ground between the approaches, and we need not see the conflict between CONSTRUCTIONS-ALL-THE-WAY-DOWN and LI as a reason to dismiss LFG as a formalisation of CxG. But we are not home and dry yet! The proof of the pudding is in the eating, and the best way to validate a theoretical claim is to see it implemented. In the following section, therefore, I will demonstrate how LFG handles constructions. We will see that many formal idioms, including argument structure constructions, can be handled comfortably, and that the formalism actually accommodates divergent theoretical perspectives. However, when it comes to substantive idioms, we run into problems, and a change to the framework is needed.

## 4             CONSTRUCTIONS IN LFG

So far, although I have argued that LFG has potential as a formal framework for CxG, we have not seen any examples of LFG analyses of constructional phenomena. This section will provide just that. We begin in Section 4.1 with Goldberg-style argument structure constructions, and show that LFG is compatible with either a lexical or constructional view of argument structure. Section 4.2 then shows how LFG can handle (some kinds of) formal idiom, but concludes that the presence of arbitrary phonological material (i.e. words) that

does not (appear to) contribute compositionally to the meaning of the construction causes problems: the more lexically filled a construction is, the more difficult it is for LFG to accommodate it. This is clearly most problematic for substantive idioms, which are the subject of Section 4.3.

### *Argument structure constructions* 4.1

Recent work in LFG+Glue has treated argument structure not as a separate level of the projection architecture (as in e.g. Butt *et al.* 1997; Kibort 2007) but as a phenomenon at the syntax-semantics interface (Asudeh and Giorgolo 2012; Asudeh *et al.* 2014; Findlay 2016, 2020; Przepiórkowski 2017; *i.a.*). This research adopts a neo-Davidsonian event semantics (Parsons 1990), whereby the meaning contribution of a verb is not a predicate of or relation between individuals, but rather a predicate of eventualities (events or states) conjoined with a number of semantic role predicates that relate participants to that eventuality. For example, rather than the traditional meaning in (49), a verb like *sneezes* would have the meaning in (50):

(49)    $\lambda x.\textbf{sneeze}(x)$

(50)    $\lambda x.\lambda e.\textbf{sneeze}(e) \wedge \textbf{agent}(e, x)$

This opens up the possibility of splitting the valency information apart from the lexically-specified eventuality predicate, as in (51):

(51)    a.    $\lambda e.\textbf{sneeze}(e)$
        b.    $\lambda P.\lambda x.\lambda e.P(e) \wedge \textbf{agent}(e, x)$

The result of applying (51b) to (51a) is (50), but by factoring out these two components of meaning we have separated out the core lexical meaning from what would be seen in CxG as the constructionally-provided argument structure meaning (Goldberg 1995). This means that the same core lexical meaning can be used across diathesis alternations (Asudeh and Giorgolo 2012) or other argument structure frames (Asudeh *et al.* 2014).

Of course, in Glue Semantics these meaning terms are paired with a linear logic type which anchors them in the syntax:

(52)　　a.　$\lambda e.\textbf{sneeze}(e) : v_\uparrow \multimap t_\uparrow$
　　　　b.　$\lambda P.\lambda x.\lambda e.P(e) \wedge \textbf{agent}(e,x) :$
　　　　　　　$(v_\uparrow \multimap t_\uparrow) \multimap e_{(\uparrow\text{SUBJ})} \multimap v_\uparrow \multimap t_\uparrow$

Using $v$ as the type of events, we can see that the meaning constructor in (52b) consumes the meaning constructor in (52a) to produce a dependency on the verb's subject.

　　We can combine the core meaning with other valency templates to produce other constructional meanings. For instance, we can represent the English caused-motion construction (Goldberg 1995, ch. 7), exemplified in (53), with the meaning constructor in (54):[24]

(53)　　Frank sneezed the tissue off the table.

(54)　　$\lambda P.\lambda x.\lambda y.\lambda Q.\lambda e.P(e) \wedge \textbf{agent}(e,x) \wedge \textbf{theme}(e,y) \wedge \textbf{goal}(e,Q) :$
　　　　　　$(v_\uparrow \multimap t_\uparrow) \multimap$
　　　　　　　　$e_{(\uparrow\text{SUBJ})} \multimap e_{(\uparrow\text{OBJ})} \multimap (e_{(\uparrow\text{OBL})} \multimap t_{(\uparrow\text{OBL})}) \multimap v_\uparrow \multimap t_\uparrow$

This will require that the verb be accompanied by an OBJect and an OBLique in the syntax. If these dependents are not present, this meaning constructor will be unusable, since there will be no meaning constructors which match the types required. (We return to this point momentarily.)

　　For the sake of brevity, let us name our two argument structure frames using templates:

(55)　　AGENT-FRAME :=
　　　　　$\lambda P.\lambda x.\lambda e.P(e) \wedge \textbf{agent}(e,x) :$
　　　　　　$(v_\uparrow \multimap t_\uparrow) \multimap e_{(\uparrow\text{SUBJ})} \multimap v_\uparrow \multimap t_\uparrow$

(56)　　CAUSED-MOTION-FRAME :=
　　　　　$\lambda P.\lambda x.\lambda y.\lambda Q.\lambda e.P(e) \wedge \textbf{agent}(e,x) \wedge \textbf{theme}(e,y) \wedge \textbf{goal}(e,Q) :$
　　　　　　$(v_\uparrow \multimap t_\uparrow) \multimap$
　　　　　　　$e_{(\uparrow\text{SUBJ})} \multimap e_{(\uparrow\text{OBJ})} \multimap (e_{(\uparrow\text{OBL})} \multimap t_{(\uparrow\text{OBL})}) \multimap v_\uparrow \multimap t_\uparrow$

One possibility is to associate these with the verb *sneezes* in the lexicon, as shown in (57). This represents what Müller and Wechsler

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[24] I assume the second argument of the **goal** predicate is a relation expressing a location, e.g. $\lambda x.\textbf{off}(x, \iota y[\textbf{table}(y)])$ in this case, and therefore has a functional type in the linear logic.

(2014) call a lexical approach to argument structure, as opposed to the phrasal, or constructional, approach of e.g. Goldberg (1995), and which we discuss below.

(57)      sneezes   V   $(\uparrow \text{PRED}) = $ 'sneeze'
                  $\lambda e.\textbf{sneeze}(e) : v_\uparrow \multimap t_\uparrow$
                  $\{@\text{AGENT-FRAME} \mid$
                      $@\text{CAUSED-MOTION-FRAME} \mid \ldots\}$

The third clause in (57) expresses a disjunction, and is intended to include all the other potential argument structure constructions that a verb like *sneezes* might enter into. Such disjunctions can themselves be encoded in templates which name different types of verb, for example, thus allowing generalisations to be captured (of the type that would be captured by lexical rules in other approaches, or indeed in earlier LFG analyses).

Recall that if we choose the CAUSED-MOTION-FRAME, the verb must be accompanied by an object and an oblique argument. If these dependents are not present in the syntax, we will have a situation of RESOURCE DEFICIT in the semantics (Asudeh 2012) – there will be too few meaning constructors for the valency frame constructor to consume, and so no valid proof for the sentence. This results in ungrammaticality. The effect of this is that the various argument structure constructions are only licensed when the verb is in the correct syntactic environment, but this is achieved without actually placing any constraints on the syntax: the constraints are instead on the syntax-semantics interface.

In addition to the lexical approach, LFG is also compatible with the alternative, constructional view, whereby the argument structure frames are associated not with the lexical entries of verbs, but with particular phrasal configurations, as illustrated in (58) and (59). This is because LFG annotations can be added to phrase-structure rules just as well as to lexical entries (since formally lexical entries just *are* phrase-structure rules).

(58)    IP $\rightarrow$      NP                          I′
                    $(\uparrow \text{SUBJ}) = \downarrow$                $\uparrow = \downarrow$
                                    $\{@\text{AGENT-FRAME} \mid \ldots\}$

(59)  VP →  V′

     ↑ = ↓

  {@Caused-Motion-Frame | … }

Notice that we are still underspecifying the phrase structure associated with these templates; for example, Caused-Motion-Frame will still be present on a V′ node even when it does not have the correct number of daughters, *viz.* an object and oblique alongside the verb. This is possible because of the disjunctive approach, which relies on resource sensitivity to select only the appropriate meaning constructor(s). But of course nothing stops us associating the constructional meaning with more specific phrase-structure rules either, if this is preferred for theoretical reasons:

(60)  V′ →       V             NP           PP

        ↑ = ↓        (↑ OBJ) = ↓ (↑ OBL) = ↓

  {@Caused-Motion-Frame | … }

Much ink has been spilled on the question of whether argument structure is best analysed as a lexical or constructional/phrasal phenomenon (see, among others, Goldberg 1995, 2006, 2013; Müller 2002, 2006, 2018; Tomasello 2003; Goldberg and Jackendoff 2004; Müller and Wechsler 2014). In particular, Müller (2018) provides a detailed critique of exactly the phrasal LFG approach sketched above, highlighting numerous empirical problems. It may well be the case that argument structure should be handled lexically, therefore; but it is also true that at present most CxG approaches do not do this, and instead take the phrasal view, following Goldberg (1995). LFG as a formalism is thus capable of expressing the canonical CxG view, even though we might ultimately reject such a view on empirical grounds. At the same time, though, LFG also provides for the possibility of a lexical analysis (or, in fact, what Goldberg 2013, 447–448 calls a "derivational verb template" analysis). The main point of this section is therefore that the *formalism* of LFG offers the analytical flexibility to make the choice about argument structure either way, depending on which *theoretical* stance one takes. Indeed, and in keeping with the CxG focus on diversity and variety in linguistic phenomena, the LFG formalism in fact allows us to allocate argument structure meanings lexically or constructionally *on a case by case basis*, thus offering a more

empirically responsive, and perhaps less ideologically driven, kind of theorising.

<div align="center">*Formal idioms*</div> <div align="right">4.2</div>

These same techniques can be applied quite liberally to all manner of constructional meanings. For example, Asudeh *et al.* (2013) give a very detailed analysis of related 'traversal' constructions in Swedish, English, and Dutch, illustrated in (61) by the English *way*-construction:

(61)  a.  Sarah elbowed her way through the crowd.
      b.  Sarah whistled her way across the room.

<div align="right">(Asudeh *et al.* 2013, 12)</div>

This has the special meaning that Sarah traversed the crowd/room, and that either the means (as in (61a)) or the manner (as in (61b)) of this traversal was the activity described by the main verb. None of the words in (61) normally conveys this meaning alone, so it seems to emerge from the construction itself.

However, Asudeh *et al.* (2013) argue that the constructional meaning need not be hosted by a phrasal configuration, since in English there is nothing special about the syntax of the *way*-construction. As in (61), it employs a standard [V NP PP] configuration, which is witnessed by many other constructions. Rather, what is special about the *way*-construction is the obligatory presence of the word *way* – Asudeh *et al.* (2013, 30) therefore choose the lexical entry for this word as the host of the constructional meaning (highlighted here with a box):[25]

(62)      way      N    $(\uparrow \text{PRED}) = \text{'way'}$
                        $\lambda x.\textbf{way}(x) : e_\uparrow \multimap t_\uparrow$
                        $\boxed{(@\textsc{English-Way})}$

---

[25] When reproducing formal analyses from Asudeh *et al.* 2013, I omit some detail to avoid unnecessary exposition, and modify some expressions to bring them into conformity with the choices made in this paper. This does not affect any of the arguments made here, but the reader should be aware of the discrepancies, and should consult Asudeh *et al.* 2013 for the formal details.

This is the normal lexical entry for run-of-the-mill *way*, with the addition of an optional constructional meaning constructor (optionality is indicated by surrounding a piece of description in parentheses), abbreviated by the template ENGLISH-WAY. I will not unpack this meaning here, since the higher-level principle can be grasped without going into the details of the analysis, but it adds the additional traversal meaning to the clause, and makes the verb of which *way* is the object either the means or the manner of this traversal event. Note that the normal meaning of *way* is not optional in (62), and therefore survives in the constructional use too; in fact, it is equated with the **path** through which the traversal event proceeds (Asudeh *et al.* 2013, 30–31), enabling a straightforward analysis of instances where *way* is modified or possessed by something other than the subject (Asudeh *et al.* 2013, 13):

(63)  a.  As ambassador, Chesterfield negotiated [Britain's way] into the Treaty of Vienna in 1731.
      b.  In these last twenty years Richard Strauss has flamed [his meteoric way] into our ken – and out of it.

The Swedish traversal construction analysed by Asudeh *et al.* (2013), called the directed motion construction (DMC) by Toivonen (2002), is illustrated in (64):

(64)  a.  Sarah armbågade sig   genom mängden.
          *Sarah elbowed   SELF through crowd.DEF*
          ≈'Sarah elbowed her way through the crowd.'
                                                (Asudeh *et al.* 2013, 13)
      b.  Han ljög sig   ut  ur armén.
          *he   lied SELF out of army.DEF*
          ≈'He lied his way out of the army.'   (Toivonen 2002, 315)

This differs from the English construction in that it only has a means (not a manner) interpretation, and that there is no equivalent of *way*, i.e. a fixed word which is always present. Although the presence of the (simplex) reflexive, here illustrated by *sig*, is obligatory, its form will change depending on the person and number of the subject, with which it agrees (e.g. it will be *mig* for a 1SG subject, *dig* for 2SG, etc. – see Toivonen 2002, 322). Asudeh *et al.* (2013) therefore suggest that

the constructional meaning here *should* be associated with a particular phrasal schema (Asudeh *et al.* 2013, 22):

(65)   V′ →   V                    NP                        PP
              ↑ = ↓              (↑ OBJ) = ↓            (↑ OBL) = ↓
                          (↓ PRONTYPE) = SIMPLEX-REFL
                              $\boxed{\text{@SWEDISH-DMC}}$

Once again, note that all of the normal meanings for the words involved in the DMC persist in the constructional meaning. The construction introduces additional meaning, in the form of a new traversal event etc., but does not replace any existing meanings.

Just as we saw above with argument structure constructions, the approach of Asudeh *et al.* (2013) illustrates the analytical flexibility that LFG affords researchers: constructions, in the theory-neutral sense, can be given either a lexical or phrasal analysis, depending on (i) the details of the construction itself and/or (ii) broader theoretical concerns (or preferences). For instance, it would be wholly possible to associate the ENGLISH-WAY template, and its constructional meaning, with a special phrase-structure rule just like in Swedish, rather than hosting it in the lexical entry for *way*. The only substantial change would be the addition of a requirement that the NP the template annotates have the PRED value 'way', since, unlike Swedish, there is a specific lexical element which is obligatory in the English construction. This would arguably be a less direct way of encoding such a requirement, but the important point is that the formalism leaves one free to make such decisions on theoretical grounds alone – no choice is imposed by the framework.

So far so good, then! We have seen that LFG has tools at its disposal which enable it to handle constructional phenomena. However, what these constructions all have in common is that they involve *extra* meaning being added on top of the standard, literal meanings of their parts. Sometimes meanings are also 'realigned', e.g. the main verb of the *way*-construction is relegated from expressing the main predicate of the clause to merely expressing the means or manner of the traversal event, but none are discarded. Indeed, the resource sensitivity of Glue Semantics makes this quite difficult to do. But plenty of constructions have meanings that do not merely make unconven-

tional use of the meanings of their parts, but actually override or ignore them.

For example, in the *WXDY* construction, illustrated in (66), both *what* and *doing* do not contribute their usual semantic content: the construction is not asking for the identity of an activity being undertaken – indeed, there need not be any 'doing' happening at all (this is especially clear when the subject is inanimate, as in (66b) and (66c)).

(66)  a.  What are your children doing playing in my garden?
      b.  What do you think your name is doing in my book?
      c.  I wonder what the salesman will say this house is doing without a kitchen.
      d.  What's a nice girl like you doing in a place like this?

<div align="right">(Kay and Fillmore 1999, 3, 5)</div>

It seems the only way to give a satisfactory LFG analysis of this construction would be to have special versions of *what* and *doing* which either contribute no meaning or contribute some part of the overall constructional meaning instead of their usual semantic content.[26] Such a move may be empirically adequate, but it rather flies in the face of CxG assumptions, since now the construction is distributed through the lexicon and grammar rather than being represented in one place: even if the whole constructional meaning can be encoded in a single template on a special phrase-structure rule, we still need to have two new lexical entries for the special versions of *what* and *doing*.

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[26] Equivalently, one could stick to a single lexical entry for each word, but give a disjunctive specification of its meaning, with the 'empty' or construction-specific meaning as one of the disjuncts (see also footnote 30 below). Alternatively, one might imagine keeping the regular lexical entries but using specially-designed, construction-specific meaning constructors to 'throw away' the literal meanings (cf. the MANAGER RESOURCES of Asudeh 2012, 128–134) – this is the approach proposed by Arnold (2015) for idioms like *kick the bucket*. However, such a strategy is ultimately untenable, since it makes radically incorrect predictions about modification (specifically, that it should be possible to vacuously modify words whose meanings are removed in this way – e.g. *What's a nice girl like you doing carefully in a place like this?* ought to have the same meaning as (66d)); see Findlay 2017, 228–229 for more details.

And this will only multiply as more constructions are considered. (See Section 4.3.2 for further discussion.)

So, we can conclude that LFG is well suited to handle highly schematic idioms, since these involve overlaying additional meaning on existing lexical resources, but that as constructions become less schematic and more substantive, problems begin to arise. In the next section, I examine some attempts to confront these challenges, and suggest a different solution.

<div align="center">

*Substantive idioms*        4.3

</div>

Alongside intermediate constructions like *WXDY*, there are fully substantive idioms like the following:

(67)    a.    Don't worry; we still have our **ace in the hole**.
            (*ace in the hole* ≈ '(hidden) resource or advantage')

      b.    Chrisjen likes to be kept **in the loop**.
            (*in the loop* ≈ 'informed (about a particular matter)')

      c.    **Pull yourself together**, man! We're not giving up that easily!
            (*pull oneself together* ≈ 'calm down/compose oneself')

      d.    These new import regulations really **take the biscuit**.
            (*take the biscuit* ≈ 'be especially egregious/shocking/annoying')

      e.    If you **let the cat out of the bag** too early there will be trouble.
            (*let the cat out of the bag* ≈ 'reveal the secret')

In these kinds of idioms, the literal meanings of the words involved simply do not appear – they are replaced wholesale by different, idiomatic meanings. This is a major problem for the approach of Asudeh *et al.* (2013). *Taking the biscuit*, for instance, involves no taking event and no contextually salient biscuit, but unless we do something to prevent it, precisely these meanings will be introduced by the standard lexical entries for *take*, *the* and *biscuit*. So even if we also introduce a meaning for 'be especially egregious' via some constructional template (associated with a phrase-structure rule or with one or more of the words themselves), we still need to do something with the 'left

over' literal meanings – that is, we find ourselves in a state of RE-SOURCE SURPLUS: there will be no way to successfully incorporate these meanings into the linear logic proof, and so the sentence will be ruled out by the grammar.

There is also the secondary challenge of ensuring the idiomatic meaning only arises when all of the required words appear in the correct configuration. This is precisely what makes these idioms substantive: their parts cannot be switched out, even for semantically very similar constituents. E.g. *in the ring* does not have the idiomatic meaning of *in the loop*, nor *yank oneself together* the idiomatic meaning of *pull oneself together*.[27]

The fundamental problem is that the only level at which phonological form is paired with meaning in LFG is in the lexicon, and the lexicon contains only words.[28] As we saw in the previous section, abstract phrasal configurations can also be paired with meanings, and words can be associated with complex meanings that reference structurally distant parts of the phrase, both of which give LFG the appearance of licensing phrasal constructions more generally. But there is no way of assigning specific meanings to structurally complex *multiword* units, and this is why substantive idioms are challenging. In this section, I will present two potential solutions to this problem, before advocating for a third way, more in keeping with the intuitions of CxG.

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[27] There are, however, cases where substantive idioms are distorted for communicative effect, e.g. using *shatter the ice* as an intensified version of *break the ice* 'remove or lessen the tension at a first meeting' (McGlone *et al.* 1994). See Findlay 2019, 43–47, 84–87, 92–96, 321–335 and references therein on lexical flexibility in substantive idioms more generally and on metaphorical extensions to idioms.

[28] This is not exactly true of the LFG formalism *stricto sensu*, since there is no obstacle to writing phrase-structure rules whose right-hand sides contain a mixture of terminals and non-terminals. In practice, however, this does not happen, presumably because it runs contrary to the lexicalist style of theorising. It is important to note, though, that such mixed rules still only permit description of a single generation in the tree, i.e. the daughters of a single mother node, so it does not make it possible to associate phonological form and semantic content across truly unbounded spans of c-structure – on which see Section 4.3.3.

Since the only locus of phonological form-meaning pairing in LFG is the lexicon, one very simple solution to the problem of substantive idioms is to deny their multiword status and instead treat them as "words with spaces" (Sag *et al.* 2002), so that they can be given lexical entries. This is probably the correct analysis for lots of the more morphosyntatically rigid idioms, i.e. what Sag *et al.* (2002) call FIXED EXPRESSIONS – those whose parts do not inflect and cannot be manipulated by syntactic processes – such as the examples in (68):

(68)  a.  all the same
      b.  by the by
      c.  in short
      d.  no can do

These can be represented in the grammar as if they were single words (Dyvik *et al.* 2019), i.e. single c-structure terminals, since they cannot be interrupted or split up (i.e. they obey the strictures of LI):

(69)  all␣the␣same    Adv    ($\uparrow$ PRED) = 'all-the-same'
                           *etc.*

(70)  All the same, I forgive you.

```
                  IP
               /      \
           AdvP        IP
            |         /    \
           Adv    I forgive you
            |
        all␣the␣same
```
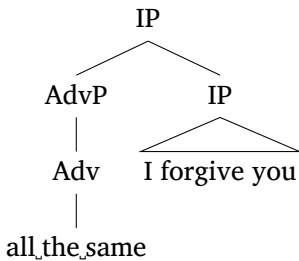
Indeed, there exist several expressions which are superficially very similar to these but which are written without spaces, and therefore already treated as single words:

(71)  a.  although (cf. all though)
      b.  nonetheless/nevertheless (cf. none/never the less)
      c.  notwithstanding (cf. not withstanding)

If the difference here is purely an accident of orthography, then we are right to treat the expressions in (68) analogously, as single words.

4.3.2                                    Lexical ambiguity

Of course, many substantive idioms are not so fixed as to be amenable to an analysis as single words. This is clear from the fact that their sub-parts can be inflected, modified, and manipulated syntactically (which can lead to discontinuous linearisation):

(72)    INFLECTION:
        That takes/took/has taken/will take the biscuit.

(73)    MODIFICATION (Findlay 2017, 212):
        a.    Musicians keep composing songs 'til they [kick the proverbial bucket].
              (*kick the bucket* ≈ 'die')
        b.    Britney Spears […] [came apart at the mental seams].
              (*come apart at the seams* ≈ 'to be in a very bad state; to fall to pieces')
        c.    Maybe by writing this book I'll offend a few people or [touch a few nerves].
              (*touch a nerve* ≈ 'annoy/upset someone by referring to a sensitive topic')
        d.    Tom won't [pull family strings] to get himself out of debt.
              (*pull strings* ≈ 'exploit connections')

(74)    SYNTACTIC MANIPULATION:
        a.    They finally [spilled the beans].
              (*spill the beans* ≈ 'reveal the secret(s)')
        b.    [The beans] were finally [spilled].
              (passivisation)
        c.    I really want to see [the beans] he [spills] under oath.
              (relativisation)
        d.    But [which particular beans] did he [spill]?
              (*wh*-fronting)

Each of these phenomena would be extreme violations of LI if the expressions in question were really single words.

It is this kind of data which motivates the CxG view that constructions (which can be of any size), not words, are the real building blocks of the grammar. Nonetheless, much recent theoretical work

on idioms has sought to avoid this conclusion and instead view idioms as licensed lexically.[29] In these theories, substantive idioms are treated as being made up of special versions of the words they contain, whose meanings combine to give an appropriate meaning for the whole construction. For example, there will be a special version, or a special sense, of *spill* that means 'reveal', and a special version or sense of *beans* that means 'secrets', so that the meaning of *spill the beans* can be 'reveal the secrets'. We will call this the LEXICAL AMBIGUITY approach (hereafter 'LA'; cf. Findlay 2017, 213), since it (i) treats idioms lexically, and (ii) does so by introducing ambiguities (e.g. *beans* is now ambiguous between literal 'beans' and idiomatic 'secrets').[30]

This kind of theory naturally explains the data in (72)–(74): it is no surprise that the parts of such expressions can be manipulated or modified, since they are just ordinary words, with their own meanings. It also explains why these expressions inhabit ordinary syntactic structures (like a verb+object VP).

However, this approach faces a number of issues (see Findlay 2019, 58–77 for a detailed critique). Firstly it must address the "collocational challenge" (Bargmann and Sailer 2018, 12): if *beans* can mean 'secrets' in *spill the beans*, how do we stop it from having this meaning elswhere?

(75)   #Have you heard the beans?
        (≠ 'Have you heard the secrets?')

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[29] This trend can be observed in many different frameworks, including, surprisingly, those which are, or have the potential to be, constructional: Sailer 2000 in HPSG, Kay *et al.* 2015 in SBCG, Lichte and Kallmeyer 2016 in LTAG, and Arnold 2015 in LFG. See also Bargmann and Sailer 2018. An early computational approach can be found in Fischer and Keil 1996.

[30] Lichte and Kallmeyer (2016) draw a distinction between LA approaches that invoke what they call a syntactic ambiguity, i.e. those which treat the different meanings of idiom words (like *spill* or *beans*) as belonging to different lexemes, and LA approaches that invoke what they call a semantic ambiguity, i.e. those which treat the idioms words as single, polysemous lexemes, rather than collections of homonymous ones. While most LA approaches take the former, syntactic, view, and so this is what I present in the text, Lichte and Kallmeyer (2016) advocate for the latter, semantic, view, and argue that it has formal, empirical, and psycholinguistic advantages. *Mutatis mutandis*, the challenges I note below still apply to this polysemy-based version of LA, however.

Although this may ultimately be surmountable through the use of (fairly extreme) selectional restrictions (see e.g. Sag 2007; Kay *et al.* 2015 for examples), it is not as straightforward as might be assumed, especially when parts of idioms can be separated across clausal boundaries and may not bear any direct syntactic relationship to each other, as is the case with the relativisation example in (74c) (Findlay 2017, 214–215). In this sentence, *spill* and *beans* bear no direct syntactic relationship to one another; instead, the relationship between them is mediated via a (in this case unpronounced) relative pronoun (see Dalrymple *et al.* 2019, 665–671 for the LFG analysis of relative clauses).[31]

Secondly, although LA makes sense for so-called decomposable idioms (what Nunberg *et al.* 1994 call IDIOMATICALLY COMBINING EXPRESSIONS), where the meaning of the idiom can be distributed among its parts, it is much less clear what the motivation might be for applying it to non-decomposable ones (what Nunberg *et al.* 1994 call IDIOMATIC PHRASES), where this is not the case. For example, we can well imagine a special meaning for *pull* such that it means 'exploit' and *strings* such that it means 'connections', which explains why (73d) has the meaning it does: *family* modifies the meaning 'connections' of *strings*, so that the sentence means that it is family connections which Tom refuses to exploit. But now consider idioms like *kick the bucket* (≈ 'die') or *shoot the breeze* (≈ 'chat'). In neither case can we readily assign meanings to the parts individually; rather, the complex whole has a simplex meaning – expressible by a single word in English.[32] Only one word need host the meaning, therefore, and it is a wholly arbitrary decision which one we choose.[33] Perhaps we assign the head

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[31] Falk (2010) advocates on the basis of such problematic data for eliminating this "mediated" analysis of relative clauses altogether, though this proposal has not been widely adopted, perhaps owing to the increased formal complexity it introduces.

[32] Of course, in keeping with the Principle of No Synonymy (Bolinger 1968; Goldberg 1995, 67), these paraphrases are necessarily inexact. *Kick the bucket* possesses entailments lacking in *die*, for instance, such as punctuality (#*she lay kicking the bucket for months* is decidedly infelicitous when compared with *she lay dying for months*); and *shooting the breeze* refers to a particular kind of aimless chit-chat, not just chatting in general.

[33] A reviewer points out that the "idiomatic mirroring" approach of Lichte and Kallmeyer (2016) alleviates this problem: since the meaning of a non-

*kick* the meaning 'die', and then have versions of *the* and *bucket* which make no semantic contribution at all (or at most a vacuous one). But we could equally well assign the 'die' meaning to *the* or *bucket* and then have the others words empty of meaning (see Findlay 2019, 67–74 for a discussion of these and various other possibilities explored in the LA literature). For non-decomposable idioms, LA is purely a technical solution, and no longer has any empirical motivation – unlike for decomposable idioms, where the parts were individually modifiable.

Thirdly, this strategy will lead to a massive proliferation of semantically empty lexical items – the lexicon will expand by as many entries as there are words in substantive idioms. This is because each semantically empty word must have its distribution constrained to a particular idiom so as to meet the collocational challenge. But this means the semantically empty *the* of *kick the bucket*, constrained to appear as the specifier of idiomatic *bucket*, cannot be the same as the semantically empty *the* in *shoot the breeze*, and so on.[34] Note that the situation is dif-

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decomposable idiom is assigned to *all* of its parts, there is no decision to be made about where it should live. This is true, but does not mean their proposal escapes the charge of arbitrariness, for it shares with any LA approach the lack of independent motivation in the case of non-decomposable idioms. The only reason to assume that *bucket* means 'die' or that *breeze* means 'chat' is that they appear in larger phrases which have those meanings; there is no theory-external reason to believe they bear those meanings independently. Lichte and Kallmeyer (2016, 124–125) suggest that the existence of the expression *bucket list* shows that *bucket* in fact *does* have this meaning independently, but Findlay (2019, 70–71) gives multiple reasons to doubt this. A limited analogical creation such as this does not show that there is a word *bucket* meaning 'die' that has an independent existence outside the idiom; the parts of such expressions cannot freely be used productively, for instance: there is no *#bucket book* in which to write one's bucket list, nor a *#breeze room* where one could shoot the breeze with a friend, etc. The idiomatic mirroring of Lichte and Kallmeyer (2016) is therefore just as guilty as any other LA approach of assigning meanings to words for no reason other than to serve the theory.

[34] Other approaches avoid having a proliferation of semantically empty words, but still face a blow-up in the lexicon due to the problem of properly constraining the distribution of idiom words. Bargmann and Sailer 2018 is one such example; see Findlay 2019, 71–73 for discussion. In the "idiomatic mirroring" approach of Lichte and Kallmeyer (2016), the lexicon is not expanded in quite the same way, since the difference between idiom words and their regular counterparts is treated as one of polysemy rather than homonymy, meaning there is just a single

ferent from that of e.g. expletive *it* or *there* in English (used in weather expressions like *it rains*, existential constructions like *there is/are*, and raising constructions like *it seems that* or *there seem(s) to be*), where we are happy to posit just a single lexical entry for each. This is because *it* and *there* occupy argument positions, and so their distribution will be constrained by standard well-formedness conditions, e.g. Completeness and Coherence in LFG (Dalrymple *et al.* 2019, 50–53).[35] By contrast, the grammar will freely permit NPs with and without determiners, which means that if we have an unconstrained semantically empty *the*, an NP like (76) will be ambiguous between a definite reading, where *the* has its usual semantic value, and a bare plural (generic) reading, equivalent to (77), where *the* is semantically inert:

(76)    The students (are hard-working.)

(77)    Students are hard-working.

Completeness and coherence cannot help us here, since we are dealing with the internal structure of an argument NP, rather than the presence or absence of an argument. Besides, we want the grammar to license both the *strings* in (76) and (77), it's just that the determiner in (76) must be the contentful one. This is why any hypothesised semantically empty *the* must have its distribution restricted to the idiom

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lexical entry for each word. However, this approach is not thereby off the hook: while it may not explode the lexicon, it avoids this by pushing the complexity into the individual lexical entries. So while it's true that there need not be as many new lexical entries as there are words in substantive idioms, there will instead be as many new *senses* as there are words in substantive idioms. This means that common words like *the* will still be a problem, since, by idiomatic mirroring, they must possess a different meaning for each substantive idiom which they are part of, and so they will become massively ambiguous. That is, in addition to its literal meaning, the word *the* must also mean 'die' (*kick the bucket*), 'chat' (*shoot the breeze*), 'get angry' (*fly off the handle*), 'sleep' (*hit the hay*), etc., etc. It is certainly not apparent *a priori* that this situation is preferable to the constructional view which stores the idiom in a single place, and thus only expands the lexicon by as many entries as there are idioms.

[35] Constraining the distribution of expletives is one area where the resource sensitivity of Glue cannot straightforwardly replace syntactic constraints on valency like Completeness and Coherence. See Asudeh 2012, 113 for some discussion of this problem.

it is associated with, and this leads to the lexical explosion described above.

Findlay (2019, 74–76) discusses several more problems for LA, including difficulties with syntactically idiosyncratic expressions, and incompatibility with psycholinguistic evidence. But in fact what I consider the most damning objection is this: LA does not capture (in fact rejects) the most significant fact about substantive idioms – namely, that they have an ontological status as wholes. As Williams (2007) somewhat sardonically puts it, "[a] traditional view of idioms is that they are 'things', that is, linguistic units". But LA bends over backwards to deny this: substantive idioms have no status as linguistic units; instead, they are conspiracies of single words. In a framework like LFG, where the only pairings of phonological form and semantic content allowed are words, this is the only strategy available. But such a strategy is flagrantly opposed to the CxG view of idioms, making this the real obstacle to considering LFG a suitable formalism for CxG.

Constructional LFG                                         4.3.3

If substantive idioms are to be 'things' in the grammar, we need to have a way of listing them. At present, LFG cannot do this, since phrase-structure rules, the basic building blocks of the grammar (of which lexical entries are a subset), only describe c-structure relations between a mother and her daughters, nothing more remote. But of course, "constructions need not be limited to a mother and her daughters, but may span wider ranges of the sentential tree" (Fillmore *et al.* 1988, 501), so in order to adequately describe constructions, something needs to change.

There is another reason to reach the same conclusion, from an LFG-internal perspective. At present, LFG lexical entries include a functional description which gives details of all levels of structure *except* c-structure. This description can also include very long-distance relations within or between structures expressed by functional uncertainty paths. But descriptions of c-structure are limited to mother-daughter relations: the lexical entry identifies the category of the pre-terminal node which hosts it (i.e. its mother) and nothing else. Such a discrepancy is striking, and it is natural to want to remedy it.

This limitation comes from the decision to use a context-free grammar (CFG) for the description of c-structure. While this has

practical benefits in terms of parsing, it limits the expressive power of c-structure descriptions to this smaller, mother-daughter, domain of locality. Findlay (2019, ch. 5, to appear) therefore proposes to replace the CFG with something more expressive, namely a tree-adjoining grammar (TAG: Joshi *et al.* 1975; Joshi and Schabes 1997; Joshi 2005; Kallmeyer 2010, ch. 4). Although this increases the expressive power of c-structure descriptions, it does not alter the computational complexity of the LFG formalism as a whole: LFG already has more than context-free power (Berwick 1982; Nakanishi *et al.* 1992), and, even at its most constrained, is still slightly more powerful than a TAG (being equivalent to a LCFRS – see Wedekind and Kaplan 2020). By moving to a more expressive tree formalism, LFG can, however, more completely embrace the CxG assumption of EDL.

Findlay's (2019, ch. 5) proposal employs a description-based TAG (Vijay-Shanker 1992) and makes use of lexical entries which contain descriptions of the tree corresponding to the maximal functional projection of the lexical item, as is standard in LTAG (Schabes *et al.* 1988) – e.g. nouns are represented as NPs, but verbs are represented as clausal trees containing positions for their arguments. Parsing, in this version of LFG, consists of gathering up all the descriptions associated with the lexical items in a sentence, and then finding the minimal structures – *including* c-structure – which jointly satisfy them.

Under this view, lexical entries are descriptions, i.e. lists of constraints, which cover all levels of the projection architecture simultaneously. Of course, there is now no requirement that such lexical entries describe only a single word, or indeed that they describe *any* word – the objects we are talking about are simply descriptions of pieces of linguistic structure. The class of such objects subsumes what are called constructions in CxG, i.e. descriptions of form-meaning pairings, but will also include purely formal objects that have no meaning associated with them. Substantive idioms now pose no problem, since trees containing multiple words can be described in a single place, without privileging one of the words over the others.

By way of illustration, Figures 4 and 5 show (simplified) constructional LFG entries for *kicks the bucket* and *pulls strings*. A number of conventions are employed here. Firstly, for the sake of exposition, I use diagrams of c-structure and f-structure to stand in for the full list of constraints which describe these structures – for the

formal details, see Findlay 2019, ch. 5 and Findlay to appear, §7. Of course, this shorthand has some limitations. For example, *pull strings* can also be passivised, separated by *wh*-questioning and relativisation, etc., and these options are not represented by such a static diagram. There are different ways of permitting this flexibility. Most naturally, perhaps, the description of c-structure in the lexical entry can contain disjunctions over permitted elementary trees, organised in templates in an appropriate hierarchy.[36] This is equivalent to the standard approach in LTAG of using a METAGRAMMAR which captures generalisations across elementary trees (e.g. Crabbé *et al.* 2013). Another approach, that employed by Findlay (2019, 243–258), is to use lexical rules to map correspondences between different types of elementary tree. Whichever is used, we can constrain different idioms according to their different levels of flexibility, either by simply excluding the relevant structures from their descriptions, or by marking them so as to make them incompatible with the relevant lexical rules (Findlay 2019, 257–258).[37]

The second convention employed in Figures 4 and 5 is the use of simplified c-structures which follow X-bar theory even more loosely

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[36] Note that the TAG approach to long-distance dependencies involves representing such dependencies locally, in an elementary tree; the filler and its gap can then be separated by adjunction of auxiliary trees between them. This means that the TREE FAMILY of a verb will include trees where its arguments are questioned, topicalised, relativised on, etc. See Abeillé and Rambow 2000 for an introduction to TAG, including the treatment of long-distance dependencies.

[37] It might be thought that explicitly describing such differences in syntactic flexibility in the grammar misses a generalisation: after all, as alluded to in the discussion of LA above, syntactic flexibility in idioms is supposed to correspond to semantic decomposability, as suggested by Nunberg *et al.* (1994) and assumed in much subsequent work. In fact, the empirical landscape is much more complex than this simple bifurcation would suggest. Fraser (1970), for instance, suggests a six-way classification of syntactic flexibility in idioms. In my own idiolect, it seems that some decomposable idioms are more flexible than others – for example, *pull strings* is far happier separated by relativisation or topicalisation than *spill the beans*. And Bargmann and Sailer (2018, 4, 20–21) present examples of non-decomposable idioms in German and English exhibiting syntactic flexibility. While there may ultimately be a semantic explanation for all of this, it does not seem unreasonable at present to allow for the grammar itself to have fine-grained control over syntactic flexibility.

than is common in LFG. This is both because many intervening bar-level nodes become unnecessary in a TAG as compared to a CFG, and in order to save space.
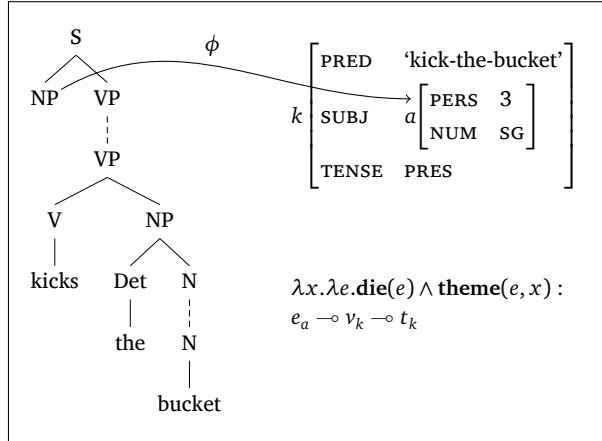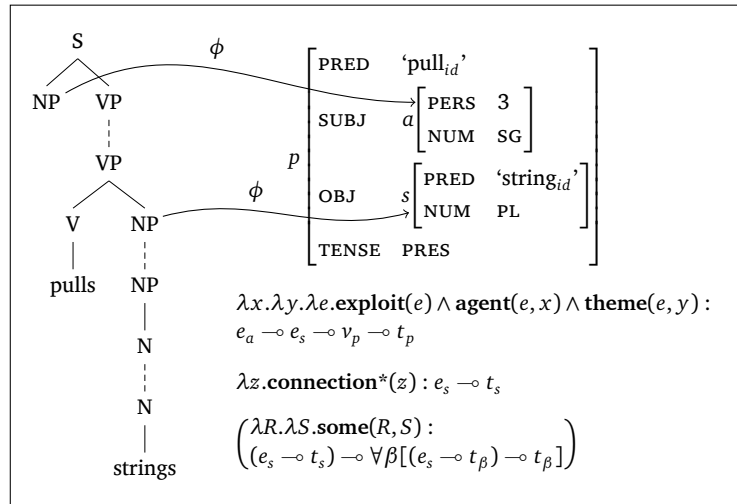
The third convention is the use of dashed lines in c-structures to represent simple dominance rather than immediate dominance: this enables adjunction at these nodes (see Vijay-Shanker 1992, 487–488 and Findlay 2019, 219–221), but if nothing is adjoined then the two nodes will be unified.
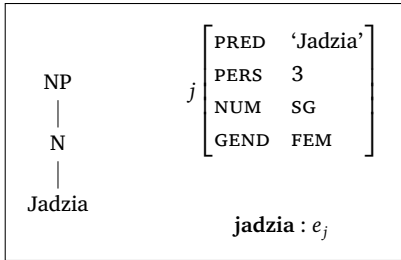
Figure 6:
Constructional LFG entry for *Jadzia*

The fourth convention is that, to avoid clutter, I only show the $\phi$ projection from maximal projections at c-structure to *embedded* f-structures – assume therefore that all undecorated maximal projections at c-structure map to the outermost f-structure shown, and that unannotated daughter nodes share the projection of their ancestors.

Finally, I only show c- and f-structures, along with the Glue Semantics meaning constructors, but of course full entries could also include information at other levels of representation within the projection architecture.

Turning now to the entries themselves, we see that the parallel representations of LFG allow us to illustrate what is the same and what is different across these two idioms. The fact that they both share the same surface form, that of a normal transitive VP, is shown by their c-structures, which are almost identical (the only difference is that *the bucket* already has its determiner fixed in the idiom, whereas the determiner position of *strings* is open).[38] The fact that *kick the bucket* cannot be decomposed but *pull strings* can is represented by (i) the latter having an articulated f-structure where the former does not, and (ii) by the latter contributing two different meaning constructors where the former only contributes one.

Both idioms take one external argument; for example, either of the descriptions in Figures 4 or 5 can combine with the entry for *Jadzia* in Figure 6, whose root node matches the open NP slot, and whose f-structure therefore unifies with the f-structure corresponding to that node. The resulting structures and Glue proof for *Jadzia kicks the bucket* are shown in Figure 7.

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[38] This is exactly the kind of shared inheritance that would be captured in TAG by the metagrammar, and in constructional LFG by the template hierarchy.

Figure 7:
Structures
and Glue proof
for *Jadzia kicks
the bucket*

S
NP VP
N V NP
Jadzia kicks Det N
the bucket

$$k \begin{bmatrix} \text{PRED} & \text{`kick-the-bucket'} \\ \text{SUBJ} & j \begin{bmatrix} \text{PRED} & \text{`Jadzia'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{GEND} & \text{FEM} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \end{bmatrix}$$

$$\cfrac{\cfrac{\lambda x.\lambda e.\mathbf{die}(e) \wedge \mathbf{theme}(e,x) :}{e_j \multimap v_k \multimap t_k} \quad \mathbf{jadzia} : e_j}{\lambda e.\mathbf{die}(e) \wedge \mathbf{theme}(e,\mathbf{jadzia}) : v_k \multimap t_k \quad \lambda P.\exists e[P(e)] : (v_k \multimap t_k) \multimap t_k}{\exists e[\mathbf{die}(e) \wedge \mathbf{theme}(e,\mathbf{jadzia})] : t_k}$$

Space precludes a full exploration of the possibilities of this new framework here, but see Findlay 2019, ch. 6 for a detailed demonstration of its application to a variety of substantive idioms, both verbal and non-verbal.[39] Hopefully what is clear is that by replacing the CFG standardly used to describe LFG's c-structure with something more expressive, it is straightforward to fill in the gaps in LFG's conception of EDL, extending it to every level of representation, and making LFG fully compatible with the assumptions of CxG.

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[39] One area which necessitates further exploration is the challenge of non-configurational languages for a TAG-based c-structure. This is a particularly pressing concern for LFG, given that its treatment of non-configurationality is one of the parade examples of LFG's utility as a framework. Although free word order languages go beyond the capabilities of TAG (Becker *et al.* 1991, 21–23), I am optimistic that, given the additional power of LFG, a suitably relaxed set of tree descriptions (e.g. removing statements of precedence relations from lexical entries so that order is underspecified in elementary trees) would be enough for constructional LFG to solve this problem. Nevertheless, this must be left for future work. Interestingly, some of the proposed extensions to TAG for tackling these problematic data (e.g. Multi-Component TAG: Weir 1988) are equivalent to LCFRSs (Kallmeyer 2010, 3), the same level of complexity attained by the tractable LFG of Wedekind and Kaplan (2020).

*Summary* 4.4

Because of the flexibility LFG permits in whether constraints are associated with lexical entries or with phrase-structure rules, the framework already has the ability to associate meaning with either words or phrases. It is therefore very capable of describing things like argument structure constructions and formal idioms. However, as idioms become more substantive, the framework begins to struggle. Although some substantive idioms can be treated lexically, as 'words with spaces', many cannot, and the most natural LFG solution, the lexical ambiguity approach, flies in the face of CxG dogma. The best solution, therefore, is to replace the unnecessarily restrictive CFG base of LFG with a more expressive TAG. By doing this, we give LFG the power to describe any kind of construction, formal or substantive, in a single place, just as is required of a CxG.

## CONCLUSION 5

This paper has aimed to demonstrate that Lexical Functional Grammar (LFG) is a suitable framework for formalising Construction Grammar (CxG). I began by discussing some central assumptions of CxG, and then showed that LFG also subscribes to many of them. One area of disagreement is over the principle of Lexical Integrity (LI), which states that there is a strict separation between morphology and syntax. We saw that in fact both camps need to cede ground: LI in the strictest sense is too rigid, but a total abandonment of the morphology-syntax divide cannot be justified either.

Recent work in LFG (Asudeh *et al.* 2013) supports the contention that LFG is suitable for formalising CxG, in that it shows that the framework already has the capacity to handle many constructional phenomena. However, it turns out that this capacity is limited to formal idioms, and that substantive idioms are much more trouble. But if the context-free base of LFG is replaced with a more expressive formalism (in this case, a description-based TAG), LFG acquires the ability to describe arbitrarily large structures pairing phonological form with semantic content, enabling it to handle substantive idioms just as well

as formal ones. In this new version of LFG, the morphology-syntax divide is maintained, but the lexicon-grammar distinction is collapsed: since parsing just involves combining and satisfying stored collections of constraints, the lexicon, in a very real sense, *is* the grammar. Perhaps ironically, then, taking a more constructional view of things emphasises the *lexical* aspect of Lexical Functional Grammar.

## ACKNOWLEDGEMENTS

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# The Dutch
# Anaphoric Possessive Construction

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## ABSTRACT

The Dutch anaphoric possessive construction (APC), as exemplified by *Tom zijn fiets* 'Tom his bike', shows a peculiar mix of regularity and idiosyncracy. The article provides a theory-neutral description of its properties and quantitative information about its use in two treebanks, one of spoken Dutch (CGN) and one of written Dutch (Lassy Small). It argues that the APC has a right branching structure and models it in the framework of Constructional Head-driven Phrase Structure Grammar. The latter's organization of constructions in terms of a fine-grained hierarchy of phrase types is shown to provide the means to capture both what the APC has in common with other possessive constructions and what is idiosyncratic of it.

## INTRODUCTION    1

Dutch has three semantically equivalent ways of expressing possession. Beside the PP[*van*] option and the genitive option, as exemplified in (1) and (2), there is the option of using a possessive determiner that is preceded by an NP, as in (3).

(1)     Ik heb   [de  fiets van Tom] verkocht.
        I   have  the bike of   Tom  sold
        'I have sold Tom's bike.'

(2)   Ik heb  [Toms     fiets] verkocht.
      I   have  Tom.GEN bike  sold
      'I have sold Tom's bike.'

(3)   Ik heb  [Tom zijn fiets] verkocht.
      I   have  Tom his  bike  sold
      'I have sold Tom's bike.'

We use the term 'Anaphoric Possessive Construction' (APC) for the latter, since the determiner (*zijn* 'his') necessarily has the same referent as the preceding NP (*Tom*). The choice between the options is mainly determined by style and register. The genitive, for instance, is typical of written and slightly formal language, while the APC is typical of colloquial speech.

The APC displays a peculiar mixture of regularity and idiosyncracy. Its regularity is clear from the fact that the NP before the determiner and the nominal after it can take nearly any form. Its idiosyncracy is clear from the fact that it lacks a counterpart in other languages, including closely related ones. English, for instance, does not have it (\**Tom his bike*), and the same holds for French (\**Tom sa bicyclette*) and Italian (\**Tom sua bici*).[1] This makes the APC an interesting test case for the larger issue of whether such constructions are amenable to formal analysis. We claim they are. To demonstrate it we adopt an approach that is inspired by the following quote: "To know what is idiomatic about a phrase one has to know what is nongeneral and to identify something as nongeneral one has to be able to identify the general ... The picture that emerges from the consideration of special constructions ... is of a grammar in which the particular and the general are knit together seamlessly" (Kay and Fillmore 1999, 30).

A framework that provides the tools for developing such a grammar is Constructional Head-driven Phrase Structure Grammar (HPSG), as pioneered in Sag 1997 and elaborated in more detail in Ginzburg and Sag 2000.[2] We will use it for a formal analysis of the APC in Section 4. To pave the way we first provide a theory-neutral description of

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[1] A language which also uses the APC is German, see (31).

[2] Another framework that would serve the purpose well is Sign-Based Construction Grammar (Boas and Sag 2012). The analysis in this paper can be translated directly into SBCG terms.

|  | CGN | % | Lassy | % | Sum | % |
|---|---|---|---|---|---|---|
| Genitive | 134 | 71.66 | 668 | 98.67 | 802 | 92.83 |
| Anaphoric possessive | 53 | 28.34 | 9 | 1.33 | 62 | 7.17 |
| Sum | 187 | 100.00 | 677 | 100.00 | 864 | 100.00 |

Table 1: Possessive NPs in the sample

the constuction in Section 2 and a discussion of its syntactic structure in Section 3.

For the purpose of exemplification we use a sample that consists of the treebank of the Spoken Dutch Corpus (CGN) (Oostdijk *et al.* 2002) and Lassy Small, a treebank of written Dutch (Van Noord *et al.* 2013). They contain approximately 1,000,000 words each and provide a syntactic analysis for every sentence that comprises both categorial and functional information. Every sentence is marked by an identifier.[3] To extract relevant examples and quantitative data from the sample we use the XPath search mode of Gretel 3.0 (Augustinus *et al.* 2012). It facilitates amongst others the retrieval of all APC occurrences in the sample. As expected, it is far more common in spoken Dutch than in written Dutch: Of the 62 tokens, 53 (85.48%) are from CGN and only 9 (14.52%) from Lassy Small. Confirmation is provided by a comparison with the genitive. It is more common than the APC in both treebanks, but the difference is much larger in Lassy Small (98.67% *vs* 1.33%) than in CGN (71.66% *vs* 28.34%), see Table 1.

## DESCRIPTION                                          2

The APC is described amongst others in Paardekooper 1984, 478–479, Haeseryn *et al.* 1997, 294–295, 822–823, and Broekhuis and Keizer 2012, 837–839.[4] It consists of a possessive determiner that is preceded by an NP and followed by a bare nominal. The nominal can take any

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[3] Identifiers with the prefix 'fn' stand for spoken data from the Netherlands, and identifiers with the prefix 'fv' stand for spoken data from the Dutch speaking part of Belgium. Identifiers with another prefix are taken from Lassy Small.

[4] In Broekhuis and Keizer 2012, 837, it is called the semi-genitival construction.

form but the possessive and the preceding NP are subject to a number of restrictions that will be presented in Section 2.1 and Section 2.2 respectively.

### 2.1                    *The possessive determiner*

The possessive determiner is invariably of the third person. It can be singular masculine (*zijn* 'his'), singular feminine (*haar* 'her') or plural (*hun* 'their'). The former two often appear in the reduced form, i.e. *z'n*, *'r* or *d'r*. Broekhuis and Keizer 2012, 837, claim that only the reduced forms can be used in the APC and that the plural *hun* 'their' is therefore not acceptable. This is not confirmed by the sample, where the full forms account for more than 60% of the tokens, including 6 for *hun*, see Table 2.[5]

Table 2: Anaphoric possessives in the sample

|  | Sing. masc. | | Sing. fem. | | Plural | | Sum |
|---|---|---|---|---|---|---|---|
| Full form | *zijn* | 19 | *haar* | 13 | *hun* | 6 | 38 |
| Reduced form | *z'n* | 20 | *'r, d'r* | 4 | | | 24 |
| Sum | | 39 | | 17 | | 6 | 62 |

Being anaphoric, the determiner shows number and gender agreement with the preceding NP. In (4), for instance, it is the singular masculine *z'n* 'his' that must be used, since the noun *Max* is singular and masculine.

(4)    dat  komt  gewoon op [Max z'n bankrekening]
       that comes simply   on  Max his bank.account
       'that simply goes to Max's bank account'
       [fnf007265_116]

That the agreement concerns natural gender is illustrated in (5).

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[5] In written language it is more common to use the full form. The 9 occurrences in Lassy Small, for instance, all concern the full form. In spoken language both forms are used. CGN, for instance, contains 29 occurrences of the full form and 24 of the reduced form.

(5)     van [dat  meisje haar ex-lief]
        of    that girl    her ex-boyfriend

        'of that girl's ex-boyfriend'
        [fva400508_64]

The noun *meisje* 'girl' is grammatically neuter, but denotes a female person, and it is the latter that is relevant for the choice of the determiner. If the preceding NP is underspecified for number or gender, it is compatible with more than one. The demonstrative pronoun *die* 'that.one', for instance, is combined with all three in the sample, as shown in (6)–(8).

(6)     [die       z'n idee] was dat
         that.one his idea  was that

        'that was his idea'
        [fva400459_141]

(7)     [die       haar broer]  is nog gekomen
         that.one her   brother is still come

        'her brother has still come'
        [fvd900058_140]

(8)     hebben ze    al [die        hun  meubels] d'ruit gegooid
        have     they all  those.ones their furniture out    thrown

        'they threw out all their furniture'
        [fva400466_99]

This anaphoric nature differentiates the APC from the English *'s*-possessive, in which the clitic indiscriminately combines with singular masculine NPs (*John's bike*), singular feminine NPs (*that girl's boyfriend*) and plural NPs (*the children's toys*).


*The possessor NP*                                              2.2


The possessor NP must be animate. This was already pointed out in Paardekooper 1984, 479, and is repeated in Haeseryn *et al.* 1997, 294–295, and Broekhuis and Keizer 2012, 838–839. It is a constraint that differentiates the APC from the genitive, as illustrated in (9) and (10).

(9)    a.   ['s      werelds    eerste multinational] werd in 1602
           the.GEN world.GEN first    multinational   was   in 1602
           ... opgericht
           ... founded
           'the world's first multinational was founded in 1602'
           [dpc-bal-001238-nl-sen.p.28.s.3]

         b.   * [de   wereld zijn eerste multinational] werd in 1602 ...
             the world   his   first    multinational   was    in 1602 ...
         opgericht
         founded

(10)    a.   het gevaar van [Iraks      wapenarsenaal]
           the danger of    Iraq.GEN weapon.arsenal
           'the danger of Iraq's weapon arsenal'
           [ws-u-e-a-0000000027.p.7.s.2]

         b.   * het gevaar van [Irak z'n/d'r   wapenarsenaal]
             the danger of     Iraq his/her weapon.arsenal

The animacy constraint is confirmed by the sample. Of the 62 tokens, 40 concern a proper noun that denotes a person, such as *Max*, or an animal, such as *Reynaert* (a fox). Proper nouns that denote a country or some other inanimate entity are not attested. 14 concern a pronoun with a human referent, such as *iemand* 'somebody' (3 tokens), *die* 'that.one' (10 tokens) or *wie* 'who'.[6] Their [–HUMAN] counterparts, *iets* 'something', *dat* 'that' and *wat* 'what', are not attested in the APC. The 8 remaining ones concern the common nouns *mensen* 'people' (3 tokens), *kind* 'child', *man* 'man', *tante* 'aunt', *meisje* 'girl' and *advocaat* 'lawyer', all of which have a human referent.

     A second constraint concerns the exclusion of "referential and reciprocal personal pronouns: **hij/hem z'n boek* 'he/him his book', **zij/haar d'r boek* 'she/her her book' and **elkaar z'n/hun boek* 'each.other his/their book'" (Broekhuis and Keizer 2012, 839). This is another way in which the APC differs from the genitive, at least for the reciprocal pronouns, as illustrated in (11).

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[6] For *die* it is worth adding that it may have a non-human referent in its other uses.

(11)   a.  dat mensen die op elkaar    lijken    van
           that people who   each.other resemble of
           [elkaars         paspoort] gebruik maken
            each.other.GEN passport   use      make
           'that people who resemble each other use each other's
           passport'
           [ws-u-e-a-0000000240.p.30.s.4]

       b.  * dat mensen die op elkaar    lijken    van
             that people who   each.other resemble of
           [elkaar       hun paspoort] gebruik maken
            each.other their passport   use      make

Not mentioned in Broekhuis and Keizer 2012, but equally unfit for use in the APC, are the reflexive pronouns, as in \*zich zijn kat 'himself his cat'.

At the same time, there are no constraints on the internal structure of the possessor NP. The noun that heads the NP may be preceded by a dependent, such as the demonstrative *dat* 'that' in (5). If the preceding word is a possessive determiner of the third person, it is possible to embed one APC in another, as in (12).

(12)   Ze   heeft [[[mijn vader] z'n tante] d'r boeken] geërfd.
       she has     my   father his aunt  her books     inherited
       'She has inherited my father's aunt's books.'

The noun may also be followed by a dependent, such as the PP[*van*] in (13) and (14).

(13)   [[wie  van jullie] z'n boek] is dit eigenlijk?
          who of   you.PL his book  is this really?
       'Who of you's book is this?'

(14)   ze   werken liever onder [[iemand   van ons] z'n
       they work   rather under   someone of  us   his
       hoede]
       surveillance
       'They'd rather work under the surveillance of someone of us.'

In this respect, the APC is less constrained than the genitive.

(15)   * [wiens     van jullie   boek] is dit  eigenlijk?
          who.GEN of    you.PL book   is this really?

(16)   * ze    werken liever  onder [iemands        van ons
          they work     rather under  someone.GEN of    us
        hoede]
        surveillance

Notice, finally, that the possessor NP can be coordinated, as in (17).

(17)   ... aansluitend bij [[Rianne en   Rika] hun   verhaal]
        ... related       to    Rianne and Rika  their story
        '... related to Rianne and Rika's story'
        [fvf600083_106]

2.3                      *Summing up*

Prenominal APCs are [NP$_i$ + Poss-Det$_i$ + Nominal]-sequences, in
which the possessive determiner is of the third person and anaphoric,
in the sense of showing number and gender agreement with the pre-
ceding NP. The latter must be animate and cannot take the form of
a personal, reciprocal or reflexive pronoun, but its internal structure
is free.


3                       STRUCTURE

To model the internal structure of the APC, one possibility is to treat
the possessive determiner and the preceding NP as a phrasal deter-
miner (DetP), as in (18).

(18)   Ik heb   [[Tom z'n] fiets] verkocht
        I   have    Tom his  bike  sold

This structure is adopted in the Dutch treebanks, and is suggested in
Broekhuis and Keizer 2012, 837, which emphasizes the resemblance
between the possessive determiner in *Tom z'n fiets* and the genitive
affix in *Toms fiets*. In fact, this structure was already proposed in
Paardekooper 1984, 478–479, albeit with the addition, put between

| | we | me | you | you | she/they | her |
|---|---|---|---|---|---|---|
| Full form | *wij* | *mij* | *jij* | *jou* | *zij* | *haar* |
| Reduced form | *we* | *me* | *je* | *je* | *ze* | *d'r, 'r* |

Table 3:
Personal pronouns
with a reduced counterpart

parentheses, that *z'n* and *d'r* are the only unaccented words that can be the head of a phrase.[7] This observation is worth a closer look.

For a start, notice that many of the Dutch personal pronouns have both a full form and a reduced form. Some examples are given in Table 3. Typical of the full forms is that they have a full vowel or a diphtong as their nucleus, while the reduced forms have the schwa. This phonological distinction corresponds to differences in syntactic potential. One concerns the fact that full forms can take dependents, while their reduced counterparts cannot (Van Eynde 1999). Notice, for instance, that both can be used as the subject in (19), but that only the full form can be used if the pronoun is modified by the adverb *alleen* 'alone', as in (20).

(19)    Wij/we hebben dat  bericht   nog niet gekregen.
         we      have     that message still not  received
         'We have not yet received that message.'

(20)    [Alleen wij/*we] hebben dat  bericht   nog niet gekregen.
          alone  we        have     that message still not  received
         'We alone have not yet received that message.'

Similarly, while both forms can be used as the subject in (21), only the full form can be used if we add a relative clause, as in (22).

(21)    Zij/ze krijgen een bonus.
         they   receive a    bonus
         'They receive a bonus.'

(22)    [Zij/*ze die   het verdienen] krijgen een bonus.
          they    who it   deserve      receive a    bonus
         'Those who deserve it receive a bonus.'

---

[7] This is a translation of the Dutch original: "*Z'n* en *d'r* zijn de enigste onbeklemtoonde woorden die kern van een patroon kunnen zijn" (Paardekooper 1984, 479).

A related difference concerns the fact that full forms can be conjoined, while their reduced counterparts cannot.

(23)    [Wij en   zij]  denken daar  hetzelfde over.
         we  and they think    there the.same about
        'We and they think the same about that.'

(24)    * [We and ze]   denken daar  hetzelfde over.
           we  and they think    there the.same about

Similar observations apply to the possessives. While both forms can be used in the determiner position of *bericht* 'message' in (25), only the full form can be used if the possessive is modified by *alleen*, as in (26).[8]

(25)    Zijn/z'n bericht   is al       verstuurd.
        his       message is already sent
        'His message has already been sent.'

(26)    [Alleen zijn/*z'n] bericht   is verstuurd. Het onze      niet.
         only   his        message is sent.       the our.NOM not
        'Only his message was sent. Ours was not.'

This is confirmed by the coordination test:

(27)    Als je   [zijn en  haar] getuigenis vergelijkt, dan  ...
        if  you  his  and her    testimony compare,  then ...
        'If you compare his and her testimony, then ...'

(28)    * Als je   [z'n en   d'r] getuigenis vergelijkt, dan  ...
        * if   you  his and her testimony compare,  then ...

(26) and (28) pose a problem for the DetP-analysis of the APC, since they make the reduced possessives doubly exceptional. Beside the stipulation that they are "the only unaccented words that can be the head of a phrase", we also need the stipulation that this exceptional behavior is limited to their use in the APC, since their incompatibility with

---

[8] The reduced form can be used in (26) if *alleen* modifies the entire NP, as in [*alleen* [*zijn/z'n bericht*]], but in that case *alleen* 'only' is not a dependent of the possessive. Similarly, in *al z'n berichten* 'all his messages', the quantifying *al* is not a dependent of the possessive, but of the NP *z'n berichten*. This is clear from the fact that it is the messages that are quantified over, rather than him.

adverbial modifiers and their non-conjoinability is as expected. Neither of these stipulations is needed if the possessive is taken to form a unit with the bare nominal that follows it, as in (29).

(29)    ik heb  [Tom [z'n fiets]] verkocht
        I  have  Tom  his bike    sold

In this structure, the possessive is part of an NP in which it takes its usual specifier position. Confirming evidence is provided by the fact that this NP can be conjoined, as in *Tom z'n schoenen en z'n laarzen* 'Tom his shoes and his boots'.[9]

    Within the rightmost NP in (29), the head is not the possessive determiner but the common noun that follows it. Evidence is provided by the fact that it shares the number and gender values of the NP. The NP *z'n zussen* 'his sisters', for instance, is not singular and masculine, like *z'n* 'his', but plural and feminine, like *zussen* 'sisters'.

    For the APC as a whole, we assume that the rightmost NP is the head, since the APC shares its number and gender with that NP. Notice, for instance, that the finite verb in (30) shows number agreement with the plural *z'n fietsen* 'his bikes', rather than with the singular *Tom*.

(30)    [Tom [z'n fietsen]] zijn/*is gestolen.
         Tom  his bike.PL  are/*is  stolen
      'Tom's bikes are stolen.'

Confirming evidence is provided by the the German equivalent of the APC, exemplified in (31).

(31)    Kennst du  [dem     Hans [seine    Mutter]]?
      know  you  the.DAT Hans  his.ACC mother
      'Do you know Hans' mother?'

---

[9] An anonymous reviewer points out that it is also possible to conjoin the combination of the possessive and the preceding NP, as in *Tom z'n en Marie d'r kinderen* 'Tom his and Mary her children'. This combination sounds awkward to the native speakers I consulted, but for those who consider it well-formed, it can be described as an instance of Right Node Raising, comparable to *vier grote en twee kleine kinderen* 'four tall and two small children'.

As the glosses show, the APC in (31) contains a dative NP followed by an accusative NP. The former's case is fixed: The possessor NP is invariably dative in the APC. The latter's case, by contrast, is determined by the context in which the NP as a whole appears. In this case, this is accusative, since the NP is the direct object of the verb *kennst* 'know'. The fact that it is the rightmost NP that bears accusative case, hence, indicates that it is the head. Beside the syntactic arguments for treating the rightmost NP as the head of the APC, there is the obvious semantic argument that the APC denotes something of the kind that is denoted by the rightmost NP. *Tom z'n fiets*, for instance, denotes a bike, rather than a person named *Tom*.

Pulling the strings together, we assume that the APC consists of two NPs and that the rightmost one is the head. Figures 1, 2 and 3 show how this applies to APCs in which the possessor NP has a more complex internal structure, as in (12), (13) and (17).

Figure 1:
*mijn vader z'n tante d'r boeken*
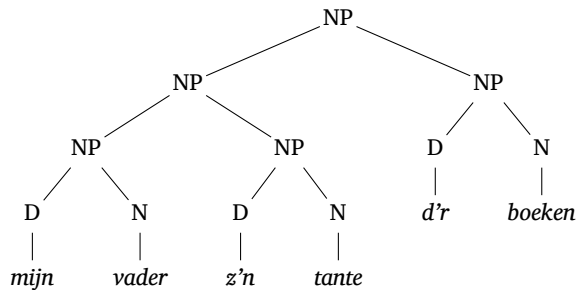


Figure 2:
*wie van jullie z'n boek*

```
                        NP
              NP                    NP
        N    Conj    N         D         N
     Rianne   en    Rika      hun      verhaal
```
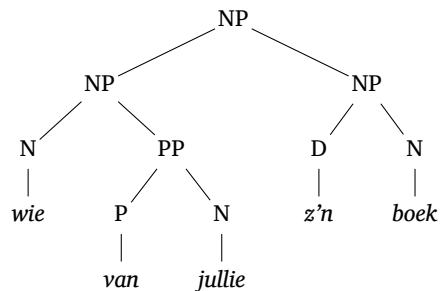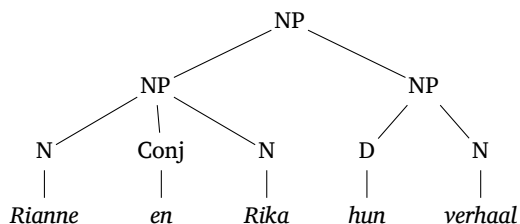
Figure 3:
*Rianne en Rika hun verhaal*

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ANALYSIS 4

</div>

Having described the main properties of the APC in theory-neutral terms we now turn to a formal analysis. The aim is to show, first, that also constructions with a high degree of idiosyncracy, such as the APC, are amenable to formal analysis, and second, that this requires a framework that allows the attribution of properties to phrase-size combinations; in other words, that it requires a constructional, rather than a purely lexicalist, approach.

The framework we employ is that of Constructional HPSG, as pioneered in Sag 1997 and developed more fully in Ginzburg and Sag 2000. A key property of that framework is the classification of phrases in terms of a bidimensional phrase type hierarchy.

In the first dimension, called HEADEDNESS, phrases are classified in terms of syntactic dependency. The basic distinction is that between headed and non-headed phrases. *Kim smiled*, for instance, is a headed phrase in which the verb is the head and the noun its subject. By contrast, *Kim and Mary* is a non-headed phrase, consisting of two conjuncts and the conjunction *and*. Characteristic of the HEADEDNESS classification is its cross-categorial nature. Heads, subjects and conjuncts, for instance, can belong to any syntactic category. In early HPSG this was the only dimension of classification for phrases (Pollard and Sag 1994). Modeling their properties was reduced to the interaction of a small number of highly abstract cross-categorial phrase types with a very large number of detailed category specific lexical types. When applied to phrases with idiosyncratic properties, this radically lexicalist stance turned out to have its limitations.

Taking a cue from the organization of the lexicon in terms of a bidimensional hierarchy of lexical types in Pollard and Sag 1987,

Figure 4:
A bidimensional
phrase type hierarchy

```
                              phrase
                          /            \
        HEADEDNESS                         CLAUSALITY
            |                                  |
       headed-phrase                        clause
            |                                  |
    head-subject-phrase                declarative-clause
                        \                      |
                         head-subject-declarative-clause
```
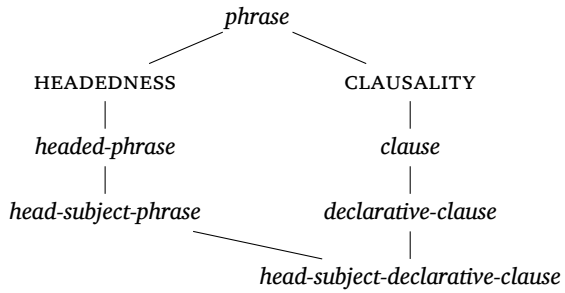
191–218, the phrase type hierarchy was enriched with a second dimension, called CLAUSALITY. The basic distinction in that dimension is between clauses and non-clauses. In contrast to the distinctions in the HEADEDNESS dimension, these are not cross-categorial. Instead, they capture generalizations about specific syntactic categories and/or semantic types, differentiating, for instance, between declarative, interrogative, imperative and exclamative clauses (Ginzburg and Sag 2000, 38–42).

Given that the HEADEDNESS and CLAUSALITY dimensions are orthogonal, in the sense that they make mutually independent distinctions, it is possible to define phrase types that combine properties from a type in the HEADEDNESS dimension, on the one hand, and properties from a type in the CLAUSALITY dimension, on the other hand. *Kim smiled*, for instance, is subsumed by a type, called *head-subject-declarative-clause*, that is a subtype of *head-subject-phrase*, on the one hand, and of *declarative-clause*, on the other hand, see Figure 4. The purpose of this hierarchy is to provide the means to capture generalizations at various levels of specificity, ranging from the very general, such as the properties that all headed phrases share, to the very specific, such as the idiosyncratic properties of an inverted exclamative clause like *Am I tired!*

While Ginzburg and Sag (2000) mainly focus on clauses, Van Eynde (2018) shows how the approach can be extended to noun phrases, yielding a framework in terms of which it is possible to model both ordinary nominals, such as *red boxes*, and idiosyncratic ones, such as the Big Mess Construction (*so big a man*) and the Binominal Noun Phrase Construction (*her nitwit of a husband*). It is this framework that we will adopt for an analysis of the APC. More specifically, we assume

that there is a type, called *anaphoric-possessive*, that inherits the constraints of one of the subtypes of *headed-phrase*, on the one hand, and one of the subtypes of *non-clause*, on the other hand.

The section subsequently focusses on the HEADEDNESS dimension (Section 4.1), the CLAUSALITY dimension (Section 4.2) and their combination (Section 4.3). The resulting hierarchy is then used to model the anaphoric possessive construction (Section 4.4). In a final step, we compare the resulting analysis with a lexicalist alternative (Section 4.5). Throughout, we use the Typed Feature Structure notation that has been employed in HPSG since Pollard and Sag 1987. A recent comprehensive survey is provided in Müller *et al.* 2021.

### *The* HEADEDNESS *dimension* 4.1

Building on the conclusion in Section 3 that the APC is an [NP + NP]-sequence in which the rightmost NP is the head, we start with a look at the hierarchy of headed phrases in Figure 5.

The properties of the various types in the hierarchy are represented by features. Which features are relevant for which types is spelled out in terms of feature declarations, as in (32).

(32)  *sign* : $\begin{bmatrix} \text{PHON} & \textit{list(phone)} \\ \text{SYNSEM} & \textit{synsem} \end{bmatrix}$

   *phrase* : $\begin{bmatrix} \text{DTRS} & \textit{list(sign)} \end{bmatrix}$

   *headed-phr* : $\begin{bmatrix} \text{HEAD-DTR} & \textit{sign} \end{bmatrix}$

Every sign, whether lexical or phrasal, has a PHON(OLOGY) feature whose value is a list of phonemes, and a SYN(TAX-)SEM(ANTICS)
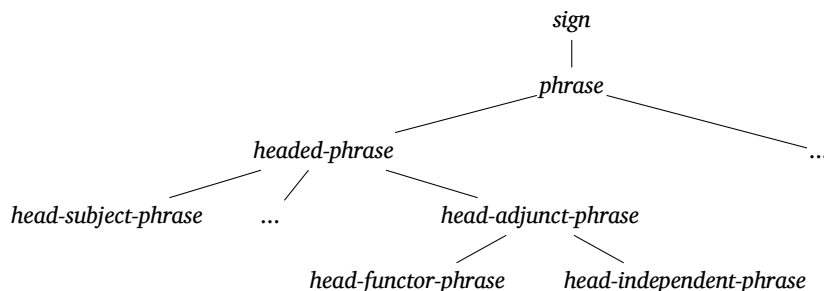


Figure 5:
The
HEADEDNESS
dimension

feature whose value is an object of type *synsem*, which stands for the various syntactic and semantic properties of a sign. In contrast to lexical signs, phrasal signs also have a D(AUGH)T(E)RS feature whose value is a list of signs. Moreover, headed phrases have a HEAD-D(AUGH)T(E)R feature whose value is a sign. The phrase *red box*, for instance, has two daughters, of which the head daughter is *box*. Non-headed phrases, such as *Kim and Mary*, lack this feature.

For our purpose, it is mainly the values of the SYNSEM feature that matter. They comprise among others the CATEGORY feature, whose value captures most of the syntactic properties of signs. Technically, this value is of type *category* and is declared to have the features in (33).

(33)    *category* :
$$\begin{bmatrix} \text{HEAD} & \textit{part-of-speech} \\ \text{MARKING} & \textit{marking} \\ \text{SUBJ} & \textit{list(synsem)} \\ \text{COMPS} & \textit{list(synsem)} \end{bmatrix}$$

The HEAD value is a part of speech, such as *verb* or *noun*. A partial inventory is given in Figure 6. Each of these may be declared to have other features. Verbs, for instance, have a VFORM feature, differentiating amongst others between finite and nonfinite forms, while nouns have a CASE feature. The finer-grained distinction between common nouns, on the one hand, and proper nouns and pronouns, on the other hand, is motivated by the fact that the former have morpho-syntactic NUMBER and GENDER features, while the latter lack these.

Figure 6:
Parts of speech and marking types

(34)   *verb* : $\begin{bmatrix} \text{VFORM} & vform \end{bmatrix}$

      *noun* : $\begin{bmatrix} \text{CASE} & case \end{bmatrix}$

      *c-noun* : $\begin{bmatrix} \text{NUMBER} & number \\ \text{GENDER} & gender \end{bmatrix}$

The main reason for differentiating the HEAD feature from other syntactic features is that its value captures precisely those properties which a phrase shares with its head daughter. The head daughter of a finite VP, for instance, is a finite verb, and the head daughter of an accusative NP is an accusative noun. Technically, this sharing is captured in terms of the implicational constraint in (35), quoted from Sag 1997, 439.[10]

(35)   **Head Feature Principle (HFP)**

      *headed-phrase*   ⇒   $\begin{bmatrix} \text{SYNSEM} \mid \dots \mid \text{HEAD} & \boxed{1}\ \textit{part-of-speech} \\ \text{HEAD-DTR} \mid \text{SYNSEM} \mid \dots \mid \text{HEAD} & \boxed{1} \end{bmatrix}$

The HFP is the HPSG equivalent of the central principle of X-bar syntax that phrases are projections of lexical categories, albeit with the important qualification that the HFP applies to surface structures, not to the abstract underlying structures of Transformational Grammar and its descendants.

The other syntactic features capture properties that are not shared between a phrase and its head daughter. In X-bar syntax this includes the bar level. In HPSG it concerns the properties that are captured by the valence features (SUBJ and COMPS) and the MARKING feature. For modeling the APC it is mainly the latter that matters. One of its functions is to register the degree of saturation of a projection, more specifically its degree of functional saturation. For nominal projections it differentiates those which are partially saturated, such as *box* and *red box*, from those which are fully saturated, such as *this box* and *she*. The relevance of this distinction is clear amongst others from the fact that the former can be combined with other prenominal dependents, as in *small red box* and *that red box*, while the latter cannot: *\*small this box* and *\*the she*. Formally, the partially saturated signs have the value *unmarked* and the functionally saturated ones the value *marked*.

---

[10] The recurrence of the boxed integer stands for token-identity, i.e. sharing. The feature paths are abbreviated, as indicated by the dots.

They both have a range of more specific subtypes, but the inventory in Figure 6 only contains the one we need for the APC, i.e. *poss-det*. It is assigned to the possessive determiners and to the NPs which contain them. This sharing between the determiner and the NP is not modeled by the HFP, since it is not the determiner, but rather the nominal, that is treated as the head of an NP in HPSG (Van Eynde 2021). Instead, the determiner is treated as adjoined to a nominal projection and the sharing is modeled in terms of the Marking Principle. Formally this is an implicational constraint on phrases of type *head-adjunct-phrase*. It is spelled out in (36).

(36) **Marking Principle**

$$
\textit{head-adjunct-phrase} \;\Rightarrow\; \begin{bmatrix} \text{SYNSEM}|\ldots|\text{MARKING} & \boxed{1}\ \textit{marking} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{SYNSEM}|\ldots|\text{MARKING} & \boxed{1} \end{bmatrix}, \boxed{2} \right\rangle \\ \text{HEAD-DTR} & \boxed{2}\ \textit{sign} \end{bmatrix}
$$

What this says is that signs of type *head-adjunct-phrase* share the MARK-ING value of their non-head daughter (⓵).

An example is provided in Figure 7. The adjective *red* has a MARK-ING value of type *unmarked*, and shares this with the phrase *red box* (⓶), while the article *the* has the value *marked* and shares this with the NP (⓵). [11]

While the MARKING value registers the degree of saturation, something more is needed to prevent the formation of ill-formed combinations, such as *\*small this box* and *\*the she*. For that purpose we use the SELECT feature. Its value specifies the properties which a sign imposes on its head sister. Prenominal adjectives and determiners, for

---

[11] An anonymous reviewer points out that in *red box* the sharing might as well be with the noun, since it has the same MARKING value as the adjective. This is indeed true for the example in Figure 7, but it is not true in cases where finer-grained distinctions are needed. One of them concerns the contrast between the Dutch nominals *een zwart paard* 'a black horse' and *het zwarte paard* 'the black.DCL horse'. In both cases the noun is unmarked, but while the addition of an adjective in the base form yields a bare nominal, the addition of a declined adjective yields a nominal that must be preceded by a definite determiner. This can be modeled if one assigns different subtypes of *unmarked* to the adjectives, depending on whether they are in the base form or declined, and if this more specific value is shared with the nominal, see Van Eynde 2006, 170–178.

N[MARKING [1] *marked*]

D[MARKING [1]]      N[MARKING [2] *unmarked*]

the      A[MARKING [2]]      N[MARKING *unmarked*]

red      box
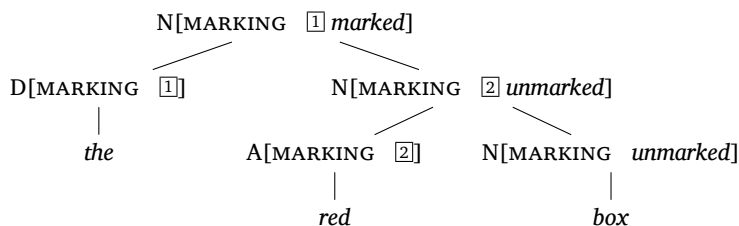
Figure 7:
Marking
in the NP

instance, select an unmarked nominal and are, hence, incompatible with a nominal that contains a determiner. Technically, SELECT is assigned to objects of type *part-of-speech* and its value is either a bundle of syntactic and semantic properties or *none*.[12]

(37)      *part-of-speech* : $\begin{bmatrix} \text{SELECT} & synsem \vee none \end{bmatrix}$

Since *part-of-speech* is the value of the HEAD feature, it is subsumed by the HFP, so that the SELECT value is shared between a phrase and its head daughter. For instance, if the adjective *large* selects an unmarked nominal, then so does the AP *very large*. To model the sharing that the selection involves, we employ a constraint on signs of type *head-functor-phrase*, which is a subtype of *head-adjunct-phrase*. It is spelled out in (38).

(38)      **Head-Functor Phrase**

*head-functor-phrase* $\Rightarrow$ $\begin{bmatrix} \text{DTRS} & \left\langle \begin{bmatrix} \text{SYNSEM}\,|\,...\,|\,\text{HEAD}\,|\,\text{SELECT} & [1] \end{bmatrix}, [2] \right\rangle \\ \text{HEAD-DTR} & [2]\begin{bmatrix} \text{SYNSEM} & [1]\ synsem \end{bmatrix} \end{bmatrix}$

The SELECT value of the non-head daughter is required to match the SYNSEM value of the head daughter ([1]). It interacts with the MARK-ING value in a way that is effective to prevent overgeneration, as illustrated in Figure 8. Adjectives and determiners both select an unmarked nominal sister, but since the former has a MARKING value of type *unmarked* (or one of its subtypes), while the latter has a MARKING

---

[12] Earlier versions of HPSG made a distinction between selection by members of the substantive parts of speech (noun, verb, adjective, preposition) and selection by members of functional parts of speech (determiner, complementizer). The former was modeled by MOD(IFIED), the latter by SPEC(IFIED) (Pollard and Sag 1994). This distinction is neutralized in the functor treatment.

N[MARKING  $\boxed{1}$ *marked*]

D[SELECT  $\boxed{4}$ , MARKING  $\boxed{1}$]  $\quad\quad\quad\quad\quad$  $\boxed{4}$ N[MARKING  $\boxed{2}$ *unmarked*]

$\quad\quad\quad$ *the* $\quad\quad\quad\quad\quad\quad$ A[SELECT  $\boxed{3}$ , MARKING  $\boxed{2}$] $\quad\quad$  $\boxed{3}$ N[*unmarked*]

$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ *red* $\quad\quad\quad\quad\quad\quad\quad$ *box*
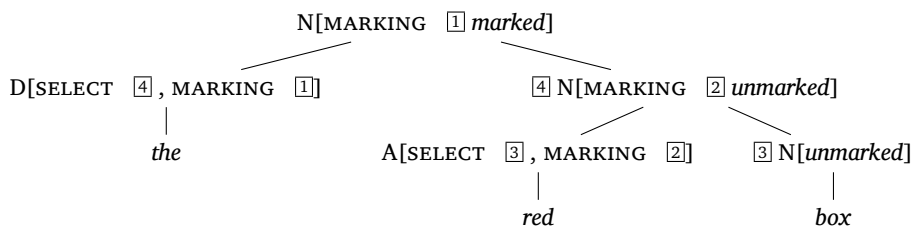
Figure 8: Marking and selection in the NP

value of type *marked*, it is possible to stack adjectives but not deter-
miners. Exploiting the potential of this combination of marking and
selection, Allegranza (2006) provides a detailed analysis of Italian NPs
and Van Eynde (2006) of Dutch NPs.

Not all adjuncts select their head sister. Loose apposition, for in-
stance, as exemplified by *Berlin, the current capital of Germany*, con-
cerns a juxtaposition of two NPs in which neither NP selects the other
(Van Eynde and Kim 2016). To model this we add another subtype of
*head-adjunct-phrase*, called *head-independent-phrase*, in which the SE-
LECT value of the non-head daughter is *none*.

(39)  **Head-Independent Phrase**

$$\textit{head-independent-phrase} \;\Rightarrow\; \left[ \begin{array}{ll} \text{DTRS} & \left\langle \left[\text{SYNSEM}\,|\,\ldots\,|\,\text{HEAD}\,|\,\text{SELECT} \quad \textit{none}\right], \boxed{1} \right\rangle \\ \text{HEAD-DTR} & \boxed{1} \end{array} \right]$$

This type of phrase is also used in Van Eynde 2018 for the analysis of a
number of nominals with idiosyncratic properties, such as the English
Big Mess Construction (*so big a mess*) and the Binominal Noun Phrase
Construction (*her nitwit of a husband*). It will play a role in our analysis
of the APC as well (Section 4.4).

4.2 $\quad\quad\quad\quad\quad\quad\quad\quad\quad$ *The* CLAUSALITY *dimension*

Orthogonal to the dimension of HEADEDNESS is the dimension of
CLAUSALITY. The types that populate this dimension tend to include
constraints on semantic types, see Ginzburg and Sag 2000. To model
the semantic properties of signs HPSG employs the CONTENT feature.
It is part of the objects of type *synsem*, along with the CATEGORY fea-
ture. Its value is an object of type *semantic-object* and these come in
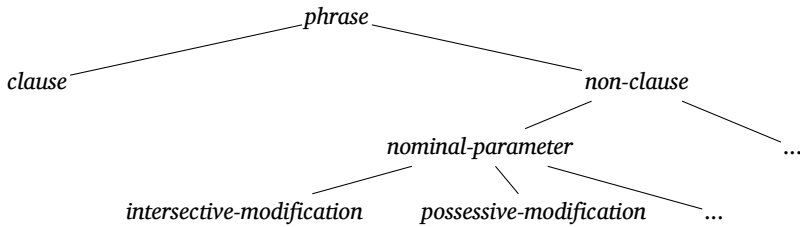
```
                              phrase
          clause                              non-clause
                              nominal-parameter              ...
               intersective-modification  possessive-modification  ...
```

a variety of subtypes, one of which is *scope-object*. This type is used to model the semantic properties of nouns, adjectives and determiners. Technically, it consists of an index and a set of facts that jointly restrict the denotation of the index.

(40)     *scope-object* : $\begin{bmatrix} \text{INDEX} & index \\ \text{RESTR} & set(fact) \end{bmatrix}$

The CONTENT value of the noun *bike*, for instance, consists of an index $i$ and the restriction that $i$ is a bike. HPSG indices are comparable, but not identical, to Predicate Logic variables. One of the differences concerns the fact that indices are declared to have agreement features, as spelled out in (41).[13]

(41)     *index* : $\begin{bmatrix} \text{PERSON} & person \\ \text{NUMBER} & number \\ \text{GENDER} & gender \end{bmatrix}$

Co-indexed nominals share the values of these features, thus modeling amongst others the agreement between an anaphoric pronoun and its antecedent: *I wash myself/*yourself/*ourselves*. Scope-objects come in two subtypes, depending on whether or not they contain a quantifier, such as *every* or *no*. Those which are not explicitly quantified are called *parameter*.

Making use of the semantic types and their associated features Van Eynde 2018 presents a type hierarchy for nominal phrases that is partially reproduced in Figure 9. The type *nominal-parameter* subsumes

---

[13] The GENDER feature in the index concerns natural gender. As such, it contrasts with the GENDER feature in the HEAD value of common nouns, which concerns grammatical gender.

nominals that are not explicitly quantified. Technically, its characteristic properties are spelled out in the following implicational constraint.[14]

(42) **Nominal Parameter**

$$
\textit{nominal-parameter} \;\Rightarrow\; \begin{bmatrix} \text{SYNSEM} & \begin{bmatrix} \ldots | \text{HEAD} & \textit{noun} \\[4pt] \ldots | \text{CONTENT} & \begin{bmatrix} \textit{parameter} \\ \text{INDEX} & i \\ \text{RESTR} & \boxed{\Sigma_1} \cup \boxed{\Sigma_2} \end{bmatrix} \end{bmatrix} \\[30pt] \text{DTRS} & \left\langle \begin{bmatrix} \text{SYNSEM} | \ldots | \text{RESTR} & \boxed{\Sigma_1} \end{bmatrix}, \boxed{1} \right\rangle \\[12pt] \text{HEAD-DTR} & \boxed{1} \begin{bmatrix} \text{SYNSEM} | \ldots \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \boxed{\Sigma_2} \end{bmatrix} \end{bmatrix} \end{bmatrix}
$$

In plain English, phrases of type *nominal-parameter* share the index ($i$) of their head daughter ($\boxed{1}$) and the set of restrictions on their denotation is the union of the restrictions that hold for the daughters.

At the next level we differentiate a number of subtypes, depending on the semantic relation between the daughters. The most common subtype is that of intersective modification, as exemplified by *red box*, which denotes entities which are boxes and which are red. To model this we use the constraint in (43), quoted from Van Eynde 2018, 14, where it is called restrictive modification.

(43) **Intersective Modification**

$$
\textit{intersective-modification} \;\Rightarrow\; \begin{bmatrix} \text{DTRS} & \left\langle \begin{bmatrix} \text{SYNSEM} | \ldots | \text{INDEX} & i \end{bmatrix}, \boxed{1} \right\rangle \\[10pt] \text{HEAD-DTR} & \boxed{1} \begin{bmatrix} \text{SYNSEM} | \ldots | \text{INDEX} & i \end{bmatrix} \end{bmatrix}
$$

What this adds to (42) is that the head daughter also shares its index ($i$) with its non-head sister. As such, it contrasts with combinations in which the non-head daughter has another index than the head daughter. This is the case in NPs which contain a possessive. To model it we introduce the type *possessive-modification* and define it as in (44).

---

[14] Boxed Greek characters stand for sets of objects. Recurrence stands for token-identity, i.e. sharing.

(44)   **Possessive Modification**

$$
\textit{possessive-modification} \quad \Rightarrow \quad
\begin{bmatrix}
\text{SYNSEM}|\ldots|\text{RESTR} & \left\{ \begin{bmatrix} \textit{poss-rel} \\ \text{POSSESSOR} & j \\ \text{POSSESSED} & i \end{bmatrix} \right\} \\[4ex]
\text{DTRS} & \left\langle \big[\text{SYNSEM}|\ldots|\text{INDEX} \quad j \big], \boxed{1} \right\rangle \\[2ex]
\text{HEAD-DTR} & \boxed{1}\big[\text{SYNSEM}|\ldots|\text{INDEX} \quad i \big]
\end{bmatrix}
$$

This type subsumes all instances of NP-internal possessives, including postnominal PP[*van*]s, genitives and NPs with a possessive determiner. It deliberately leaves the MARKING value of the possessive undefined, since it may as well be in a determiner position (being *marked*) as in a position where it intermingles with other adjuncts (being *unmarked*). Notice, for instance, that the Dutch and English possessive determiners are marked, while their Italian counterparts are not, as illustrated by their compatibility with a preceding determiner, as in *la mia tavola* 'the my table', and their admissibility in postnominal position, as in *tesoro mio* 'treasure my'.

## *Multiple inheritance* 4.3

Since the HEADEDNESS dimension is orthogonal to the CLAUSALITY dimension, it is possible to define types that inherit properties from types of either dimension. This is known as multiple inheritance. Exploiting this possibility, Van Eynde 2018, 15 defines a type,
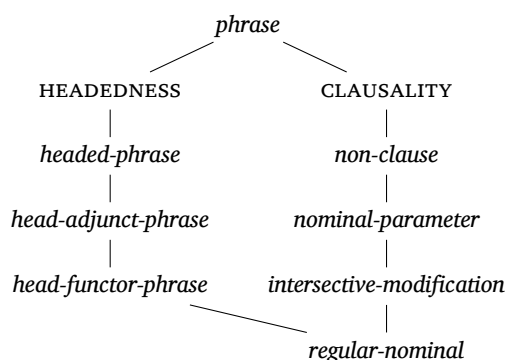


Figure 10:
Regular nominals

called *regular-nominal*, that is a subtype of *head-functor-phrase*, on the one hand, and *intersective-modification*, on the other hand, as made explicit in Figure 10. The properties of this type are spelled out in (45).[15]

$$
(45)\quad
\begin{bmatrix}
\textit{regular-nominal} \\[4pt]
\text{SYNSEM}
\begin{bmatrix}
\ldots \begin{bmatrix} \text{HEAD} & \boxed{1}\ \textit{noun} \\ \text{MARKING} & \boxed{2} \end{bmatrix} \\[12pt]
\ldots | \text{CONTENT}
\begin{bmatrix}
\textit{parameter} \\
\text{INDEX} & i \\
\text{RESTR} & \boxed{\Sigma_1} \cup \boxed{\Sigma_2}
\end{bmatrix}
\end{bmatrix} \\[24pt]
\text{DTRS}\quad
\left\langle
\begin{bmatrix}
\text{SYNSEM}
\begin{bmatrix}
\ldots \begin{bmatrix} \text{HEAD}|\text{SELECT} & \boxed{3} \\ \text{MARKING} & \boxed{2} \end{bmatrix} \\[12pt]
\ldots \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \boxed{\Sigma_1} \end{bmatrix}
\end{bmatrix}
\end{bmatrix}, \boxed{4}
\right\rangle \\[24pt]
\text{HEAD-DTR}\ \boxed{4}
\begin{bmatrix}
\text{SYNSEM}\ \boxed{3}
\begin{bmatrix}
\ldots | \text{HEAD} & \boxed{1} \\[6pt]
\ldots \begin{bmatrix} \text{INDEX} & i \\ \text{RESTR} & \boxed{\Sigma_2} \end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$

All of the constraints in (45) are inherited from the supertypes of *regular-nominal*. First, being a headed phrase, the HEAD value of the phrase is identical to that of its head daughter ($\boxed{1}$) (Head Feature Principle). Second, since the non-head daughter is an adjunct, the MARKING value of the phrase is identical to that of its non-head daughter ($\boxed{2}$) (Marking Principle). Third, since the non-head daughter is a functor, the latter's SELECT value is identical to the SYNSEM value of the head daughter ($\boxed{3}$). Fourth, being a nominal parameter, its HEAD value is of type *noun*, its CONTENT value is of type *parameter*, its index is shared with the head daughter (*i*), and its RESTR(ICTION) set is the union of the RESTR values of the daughters. Fifth, being an instance of intersective modification, the phrase also shares its index with the non-head daughter (*i*). An

---

[15] This is a slightly simplified version of that in Van Eynde 2018, 15. The full version also contains the valence features (SUBJ and COMPS).

instance of this phrase type is the combination of *red* with *box* in Figure 8.

In the same way, one can define a type that inherits the properties of *head-functor-phrase* and *possessive-modification*, and that subsumes among others the combination of a possessive determiner or genitive noun with its nominal head sister, as in *his bike* and *Tom's bike*.

Typical of highly regular combinations is that their properties are all inherited from their supertypes. Less regular ones, by contrast, show a mixture of inherited (general) properties and inherent (idiosyncratic) properties. The APC is one of those.

### *The anaphoric possessive construction*      4.4

As demonstrated in Section 3, the APC concerns a juxtaposition of two NPs of which the rightmost one is the head daughter. To model its properties we add a type to the hierarchy of phrases, called *anaphoric-possessive*, which is a subtype of *head-independent-phrase,* on the one hand, and *possessive-modification,* on the other hand, as spelled out in Figure 11.
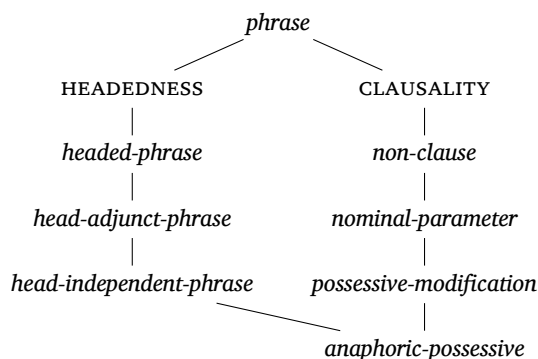
Figure 11:
Anaphoric possessive construction



We treat it as a subtype of *head-independent-phrase*, rather than of *head-functor-phrase,* since there is no selection involved. It does not make much sense, for instance, to treat the name *Tom* as a noun that selects *z'n fiets* 'his bike' in *Tom z'n fiets,* since names are fully saturated

NPs by themselves.[16] Moreover, we treat *anaphoric-possessive* as a sub-type of *possessive-modification*, rather than of *intersective-modification*, since the index of the possessive NP and its head sister are different. Beside the inherited properties, there are some properties that are specific for anaphoric possessives. They are spelled out in (46).

(46)   **Anaphoric Possessive Construction**

$$
\textit{anaphoric-possessive} \;\Rightarrow\; \left[ \begin{array}{l} \text{DTRS}\;\left\langle \left[ \ldots \left[ \begin{array}{ll} \text{INDEX} & \left[ \begin{array}{ll} j \\ \text{PERSON} & \textit{3} \end{array} \right] \\ \text{RESTR} & \left\{ \left[ \begin{array}{ll} \textit{animate} \\ \text{INSTANCE} & j \end{array} \right] \right\} \end{array} \right] \right], \boxed{1} \right\rangle \\[40pt] \text{HEAD-DTR}\;\boxed{1}\left[ \ldots \left[ \begin{array}{ll} \text{MARKING} & \textit{poss-det} \\ \text{RESTR} & \left\{ \left[ \begin{array}{ll} \textit{poss-rel} \\ \text{POSSESSOR} & j \end{array} \right] \right\} \cup \boxed{\Sigma} \end{array} \right] \right] \end{array} \right]
$$

The head daughter ($\boxed{1}$) is required to contain a possessive determiner, as made explicit by its MARKING value (*poss-det*). This blocks the combination with NPs in which the possessor is expressed by a genitive or a PP[*van*], as in *\*Tom Leo's fiets* and *\*Tom de fiets van Leo*.[17] Given the presence of a possessive determiner, the RESTR value of the head daughter contains a *poss(essive)-rel(ation)*.

The non-head daughter is required to share the index of the possessor denoting element in its head sister ($j$). The requirement that that index must be of the third person excludes combinations with first and second person forms, as in *\*ik mijn fiets* 'I my bike' and *\*jij jouw huis* 'you your house'. The restriction that it must have an animate referent excludes combinations, such as *\*de wereld zijn eerste multinational* 'the world his first multinational'. Coincidentally, this restriction also

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[16] Likewise, it does not make much sense to treat *z'n fiets* 'his bike' as an NP that selects *Tom*, since it is a fully saturated NP by itself.

[17] The constraint could also be captured in another way, invoking Principle B of the Binding theory, according to which referential (i.e. non-anaphoric) NPs must be free (Sag *et al.* 2003, 207). *Tom Leo's fiets* and *Tom de fiets van Leo* are then excluded, since the index of *Leo* must be distinct from that of *Tom*. A problem for this alternative is that it does not exclude *\*Tom$_j$ de fiets van zichzelf$_j$/hemzelf$_j$*.

blocks the combination with personal, reflexive and reciprocal pronouns, as in *\*hem z'n huis* 'him his house', *\*zich haar fiets* 'herself her bike' and *\*elkaar hun boek* 'each other their book'. This is due to the fact that these pronouns are assigned the empty set as their RESTR value in HPSG, reflecting their absence of descriptive content (Pollard and Sag 1994, 250). As such, they do not match the conditions on the non-head daughter in (46), whose RESTR value is required to be non-empty.

### *A lexicalist analysis* 4.5

The proposed analysis is constructional in the sense that the defining characteristics of the APC are captured by an implicational constraint on a phrasal type, see (46). It is not impossible to develop a lexicalist alternative. Taking a cue from a reviewer's comment, one could adopt the specifier treatment of determiners (rather than the functor treatment that we adopt) and treat the possessor NP as the specifier of the possessive determiner, yielding a DetP, that is in its turn the specifier of the nominal. In that analysis, the third person possessives can be claimed to select an NP as their specifier, requiring that NP to be animate and sharing its index. In that way, the constraints on phrases of type *anaphoric-possessive* are made part of the lexical entries of the possessive determiners that are used in the APC.

 This is, in essence, a variant of the analysis that was described in the opening paragraph of Section 3, and the reasons for dismissing it there also apply to this variant: It violates the constraint that reduced forms of pronouns and determiners cannot take dependents, and it requires special measures to deal with the coordination in *Tom z'n schoenen en z'n laarzen* 'Tom his shoes and his boots'. Besides, it necessitates the postulation of separate lexical entries for possessive determiners that are used in the APC (requiring a specifier) and possessive determiners in other contexts (not requiring a specifier), which is unfortunate since their other properties are the same.

## CONCLUSION 5

The Dutch APC is an example of a construction which has both regular and idiosyncratic properties. To pave the way for a formal analysis we

first described its main syntactic and semantic properties in a theory-neutral way (Section 2) and argued that it consists of two NPs, of which the rightmost one is the head (Section 3). For the analysis, we employed the framework of Constructional HPSG, as defined in Sag 1997 and Ginzburg and Sag 2000. More specifically, we used the bidimensional phrase type hierarchy for nominals developed in Van Eynde 2018 and extended it with a type for the anaphoric possessive construction which, on the one hand, shares a number of properties with its supertypes and, on the other hand, has some properties which are unique to the APC (Section 4). As anticipated in the introduction, the resulting grammar fragment is one "in which the particular and the general are knit together seamlessly" (Kay and Fillmore 1999, 30).

## GLOSSES

| | |
|---|---|
| ACC | accusative |
| CMP | complementizer |
| DAT | dative |
| DCL | declined |
| DIM | diminutive |
| GEN | genitive |
| PL | plural |

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# Copy raising reconsidered

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## ABSTRACT

There is no consensus in the literature regarding the defining char-
acteristics of copy raising (CR), or in other words what determines
whether a CR-like expression is CR or not. As a result, existing analyses
target different data sets. In this paper, I propose a different approach
to these constructions, which takes a functional perspective. I propose
to abandon the term *copy raising*, which is misleading in a number of
ways. Instead, I distinguish between *perceptual depiction reports* and
*perceptual inference reports* and show that the functions which they ful-
fill are not particular to CR-like constructions, but are in fact more
general. Such an approach, I claim, resolves existing conundrums sur-
rounding CR.

The analysis is formalized in the framework of Head-driven
Phrase Structure Grammar (HPSG) and is inspired by previous ac-
counts of CR in related frameworks such as LFG and SBCG, as well
as HPSG analyses. In the spirit of HPSG, the analysis employs type
inheritance hierarchies to distinguish between what is shared by the
two constructions and what is construction-specific in order to ac-
count for alternative realizations of a single lexeme and to ascribe
constructional (or extra-lexical) meaning to linguistic elements.

# 1          BACKGROUND

Copy raising (CR)[1] is a construction that resembles the well-known subject-to-subject raising (SSR) construction, which exhibits an alternation between sentences such as (1a), with an expletive matrix subject and an embedded complement clause, and (1b) where the subject of the embedded clause "raises" to the matrix subject position, leaving behind a phonetically empty trace.[2]

(1)     a.   It seems/appears that Richard is in trouble.

          b.   Richard$_i$ seems/appears t$_i$ to be in trouble.

Essentially, the matrix subject position in both cases is non-thematic and can host either an expletive or a raised argument, which in this position is only a syntactic argument of the matrix verb and a semantic argument of the embedded verb.

     Similarly to subject-to-subject raising, copy raising is also characterized by an alternation (2).

(2)     a.   It seems/looks/appears like Richard is in trouble.

          b.   Richard$_i$ seems/looks/appears like he$_i$ is in trouble.

In CR, unlike "regular" raising, the embedded subject that raises to matrix position presumably leaves behind a pronominal copy, hence the name "copy raising". Additional formal differences between the two constructions are (i) the embedded clause in CR is finite and in SSR it is not, and (ii) the complement clause in CR is obligatorily preceded by one of the particles *like*, *as if* and *as though*.

     The CR construction is not specific to English, and was found in languages including Hebrew (Lappin 1984; Landau 2011), Swedish (Asudeh and Toivonen 2012) and others (see Landau 2011).

---

[1] The CR construction was first mentioned by Postal (1974) in a footnote. It was discussed in a series of papers by Rogers (e.g., 1972, 1974).

[2] Although this paper is written within a non-transformational framework and does not assume any sort of movement, the terms "raising" and "trace" are used here as shorthand to describe the well-known phenomenon.

## PREVIOUS ANALYSES OF COPY RAISING 2

The obvious similarities between the SSR and CR constructions moti-vated researchers to propose analyses of the less-noticed CR construc-tion that are based on the more established accounts of its counterpart. There is, however, no consensus in the literature regarding the defin-ing characteristics of CR, or in other words what determines whether a CR-like expression is CR or not. The most contentious issues are the following:

- What is the semantic role of the matrix subject?
- Is a pronominal copy necessary?
- Is the pronominal copy necessarily the embedded subject?
- Are the expletive and CR variants simply paraphrases?

In the following sections, I will briefly present five approaches to CR which represent a range of perspectives regarding these questions and in particular the similarity between SSR and CR. I will begin with Kay's (2021) approach, which maintains the strongest link between the two constructions, and end with Landau (2011), who argues that in what is referred to as CR there is no copy and no raising.

### *True copy raising* 2.1

In a recent paper, Kay (2021) adopts a strict approach regarding the definition of CR, which builds on the parallelism between SSR and CR. According to his definition, in true CR the external argument is not a thematic argument of the main clause and does not denote a source of perception. Moreover, he proposes, citing Potsdam and Run-ner (2001), that "...true Copy Raising exists only where the pronomi-nal copy is in subject position".
    Kay's (2021) prime example of CR is given in (3).

(3)   Trump looks like he disappeared.          (Kay 2021, ex.1)

In this example, Trump's hypothesized disappearance rules out the possibility that he is visually perceived. This and the co-indexation between *Trump* and the embedded pronominal subject *he,* Kay (2021) claims, is what makes this "true CR".

Nevertheless not all *looks like* sentences with co-indexed subjects are as unequivocal as (3). For instance, consider the following example.

(4)  Marion looks like she will be elected.        (Kay 2021, ex.5a)

Kay suggests that this example is ambiguous. One reading – the CR reading – can be paraphrased as 'It appears likely that Marion will be elected'. In this reading, Marion is not visually perceived. In the second reading, which Kay calls "a perception report", Marion is indeed seen, and it is something about her appearance that suggests that she will be elected.

Not all verbs can head both CR and perception reports. Among the class of perception verbs, Kay identifies a sub-class that he refers to as *general perception verbs* that consists of *seem*, *appear*, *look* and *sound*. The verbs in this class can not only report perceptions (e.g., *She looks happy*) but also yield a "hearsay reading" (e.g., (5a)). Excluded from this class are the presumably more specific *taste* and *smell* (and possibly others), as is illustrated by (5b).

(5)  a.  It seems/appears/looks/sounds like Nero didn't really burn Rome.

 b.  # It smells/tastes like Nero didn't really burn Rome.

(Kay 2021, ex.25)

The double function of *general perception verbs* is accounted for in Kay's (2021) Sign-Based Construction Grammar (SBCG; Sag *et al.* 2012; Sag 2012) analysis by a lexical rule which takes a general "flip perception verb" (i.e., a verb with a stimulus subject) and creates a new CR verbal lexeme with a semantically bleached meaning that might be characterized as imparting a weak evidentiary force.

Kay's (2021) formal representation of the lexical rule is reproduced in (6).[3]

---

[3] The notions 'X ! [A]' and 'X : [B]' indicate that [A] and [B] are identical in all respects in which they are not shown to differ.

(6)

$$
\begin{bmatrix}
\textit{copy-raising-v-cxt} \\[4pt]
\text{MTR} \quad x! \begin{bmatrix}
\text{SYN} \begin{bmatrix}
\text{CAT} \begin{bmatrix} \text{XARG} & \text{Z:NP}_i \end{bmatrix} \\[4pt]
\text{VAL} \left\langle \text{Z,} \begin{bmatrix}
\text{SYN} \begin{bmatrix}
\text{CAT} \begin{bmatrix} \text{VFORM} & \textit{fin} \\ \text{XARG} & \text{NP}\begin{bmatrix}\textit{pron}\end{bmatrix}_i \end{bmatrix} \\[4pt]
\text{VAL} \quad \langle\rangle \\
\text{MRKG} \quad \textit{asif}
\end{bmatrix} \\[4pt]
\text{SEM} \begin{bmatrix} \text{LTOP} & l \end{bmatrix}
\end{bmatrix} \right\rangle
\end{bmatrix} \\[4pt]
\text{SEM} \begin{bmatrix}
\text{FRAMES} \left\langle \textit{seeming-fr(e, human-fr(j), l)} \right\rangle \\
\text{INDEX} \quad e
\end{bmatrix}
\end{bmatrix} \\[6pt]
\text{DTRS} \left\langle x\!: \begin{bmatrix} \textit{verb} \\ \text{SEM} \begin{bmatrix} \text{FRAMES} \langle \textit{gen-perception-fr(e)} \rangle \end{bmatrix} \end{bmatrix} \right\rangle
\end{bmatrix}
$$

Building on the external argument (XARG) feature, which is used in Head-driven Phrase Structure Grammar (HPSG) and Sign-Based Construction Grammar (SBCG) for making particular arguments visible outside their local domain (Sag 2007),[4] Kay defines that in the lexeme that is the output of this lexical rule (i.e., the MTR feature in (6)), the index of the matrix XARG (Z) is structure-shared with that of the pronominal XARG of the embedded clause (the second element in the VAL list). Moreover, the lexical rule replaces the input lexeme's *gen-perception-fr* with *seeming-frame*, a semantic frame which associates the main event variable $e$, a human experiencer $j$ and the semantic content of the embedded clause $l$.

## Perceptual characterization                2.2

Kim (2014), contrary to Kay (2021), does not limit the scope of his analysis only to cases of "true CR". He includes in the same category constructions with thematic matrix subjects and without embedded pronominal copy subjects. What is shared by all variants, according to his analysis, is the *perceptual characterization condition* according to which the matrix subject in CR serves as the topic and is "perceptually

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[4] Sag (2012) cites CR and tag questions as two phenomena which motivate the XARG feature. Nevertheless, his cursory analysis differs from Kay's (2021).

characterized" by the rest of the utterance. When this interpretive, pragmatic constraint is observed, "there is no need to resort to the co-reference constraint" (Kim 2014, p.184).

More concretely, Kim distinguishes between two types of *CR verbs*: *genuine CR verbs*, including *seem* and *appear*, and *perception CR* verbs, including *appear, smell, feel, look, sound,* and *taste*.[5] He suggests that all CR verbs have two argument realization options, with an additional argument realization pattern available only to *perception CR* verbs.

The alternation characteristic of CR (e.g., (2), (18), (22)) is accounted for by two alternative argument realizations of a monadic verbal lexeme of type *genuine CR*, which selects for a single CP complement: expletive-subject taking verbs, as in (7), and NP-subject verbs, as in (8).

(7) Expletive subject

$$
\begin{bmatrix}
\textit{expl-crv-wd} \\
\text{SUBJ} \left\langle \text{NP} \begin{bmatrix} \text{NFORM} & \textit{it} \end{bmatrix} \right\rangle \\
\text{COMPS} \left\langle \text{CP} \begin{bmatrix} \text{CFORM} \; \textit{like} \\ \text{XARG} \,|\, \text{IND} \; \textit{ref} \end{bmatrix} \right\rangle
\end{bmatrix}
$$

(8) NP subject

$$
\begin{bmatrix}
\textit{crv-wd} \\
\text{SUBJ} \left\langle \text{NP} \begin{bmatrix} \text{IND} & i \end{bmatrix} \right\rangle \\
\text{COMPS} \left\langle \text{CP} \begin{bmatrix} \text{CFORM} \; \textit{like} \\ \text{XARG} \begin{bmatrix} \textit{pron} \\ \text{IND} & i \end{bmatrix} \end{bmatrix} \right\rangle
\end{bmatrix}
$$
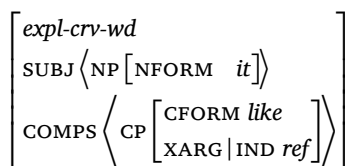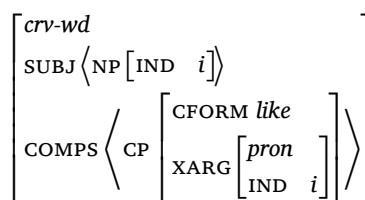
Kim's (2014) analysis of the alternation is similar to Kay's (2021) and accounts for the same dataset. In a nutshell, no real raising occurs (i.e., nothing moves) yet the matrix subject is only a syntactic argument of the matrix verb, with no semantic relation between them. Furthermore, in the NP-subject variant the matrix subject is co-indexed with the pronominal subject of the complement clause, via the XARG feature.

However, unlike Kay (2021), Kim extends the analysis to account for cases where the matrix subject does have a thematic role and there is no syntactic requirement for a pronominal copy in subject position. In this variant, which he restricts to *perception CR* verbs, the verb takes an NP subject and a sentential complement and introduces a semantic *crv-relation* which links between them.

---

[5] The verb *appear* belongs to both types.

(9)
$$\begin{bmatrix} perception\text{-}crv \\ \text{VAL} \quad \begin{bmatrix} \text{SUBJ} & \left\langle \boxed{1}\,\text{NP}\begin{bmatrix} \text{IND} & i \end{bmatrix} \right\rangle \\ \text{COMPS} & \left\langle \boxed{2}\,\text{CP}\begin{bmatrix} \text{IND} & sl \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{ARG-ST} \quad \left\langle \boxed{1}, \boxed{2} \right\rangle \\ \text{SEM} \quad \begin{bmatrix} \text{IND } x0 \\ \text{FRAMES} \left\langle \begin{bmatrix} crv\text{-}relation \\ \text{ARG1} & i \\ \text{ARG2} & sl \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

Although the lexical description in (9) does not explicitly specify the occurrence of a co-indexed pronominal in the complement clause, Kim (2014) maintains that all CR constructions are constrained by the perceptual characterization condition. This, he claims, explains the contrast between the grammatical (10) and the ungrammatical (11), both headed by *appear*, which is cross-classified as *genuine CR* as well as *perception CR*.

(10)    ...the scene appeared as though the children were up in the clouds falling through with the snow.        (Kim 2014, ex.4c)

(11)    * Bill appears as if Mary is intelligent.        (Lappin 1984)

The embedded subject in both examples is not pronominal so the matrix verbs cannot be a licensed by *crv-wd*, see (8). They are, however, compatible with the lexical description of *perception-crv* in (9) and are theoretically licensed by it. Nevertheless, the perceptual characterization condition distinguishes between the two. In (11), the matrix subject *Bill* cannot be construed as a topic which is characterized by the fact that Mary is intelligent. Hence the ungrammaticality. This is not the case with (10), where the content of the complement clause does describe the *scene*.

The general requirement for perceptual characterization, however, is too broad since it rules out grammatical cases such as the following two examples.

(12)   In spite of that, or just for that reason, she appeared as if everything were finally in its place.        (Kim 2014, ex.35b)

(13)   You sound as if the man has no choice in the matter.

(Kim 2014, ex.35d)

Although the two sentences were attested in a corpus and are clearly grammatical, their complement clauses do not characterize the referent of their respective matrix subjects. The analysis which I will subsequently present solves this conundrum by proposing that the sentences in (12) and (13) are instances of a construction that is different from the one instantiated by (10), and are subject to different constraints.

The tension between hard formal constraints and softer preferences is also reflected in Kim's (2014) treatment of the position of the pronominal copy. Although Kim writes that "Genuine CR verbs *seem* and *appear*... are preferred to have the pronominal copy in the highest embedded clause's subject" (p.196), this is not reflected in his formal analysis. As we saw in the lexical definition of *crv-wd*, which licenses CR constructions with *genuine CR verbs*, it is explicitly specified that the matrix subject is co-indexed with the pronominal XARG of the complement clause. This categorical constraint rules out grammatical cases of non-thematic matrix subjects with deeply embedded non-subject pronominal copies, such as (14).

(14)   Richard$_i$ seemed like the judges had decided to support Mary's complaint that he$_i$ cheated.

<div align="right">(Asudeh and Toivonen 2012, ex.79)</div>

The need to reconcile formal constraints with pragmatic preferences is a huge challenge which is inescapable when authentic corpus examples are taken into account.

2.3                     *Raising, copies and perceptual sources*

The questions of whether the pronominal copy must be the embedded subject and what exactly is the semantic contribution of the matrix subject are answered differently by Asudeh and Toivonen (2012). Building on extensive questionnaire-based surveys of CR in English and Swedish they find dialectal variations with regards to the pronominal copy. Of their English-speaking respondents, 45.1% only accepted CR sentences with pronominal copies in the embedded subject position, as in (15a). This is precisely the type of sentences which Kay (2021) refers to as "true CR". Nevertheless, 42.2% of the respondents also accepted non-subject pronominal copies, as in (15b), which are not included under Kay's definition.

(15)   a.   Tom seems like he hurt Bill again.

     b.   Tom seems like Bill hurt him again.

The analysis that Asudeh and Toivonen (2012) propose assumes the more permissive dialect, which accepts the two variants in (15). They note that specifying the more restrictive dialect only requires constraining the pronominal copy to be an embedded subject (as Kay does).

Asudeh and Toivonen (2012) formalize their analysis in Lexical Functional Grammar (LFG; Kaplan and Bresnan 1982; Bresnan *et al.* 2015; Dalrymple *et al.* 2019). Following Asudeh (2002, 2004, 2012) they propose that the complement of the main verb is not a finite complement clause, but rather a predicative PP headed by the particle *like* with a finite clause as complement. Raising is expressed as an equality between the raised matrix SUBJ and the unexpressed SUBJ of the open complement XCOMP. This is illustrated in (17), the f-structure of the example sentence in (16).

(16)   John seems like he won.

(17)   
$$\begin{bmatrix} \text{PRED} & \text{'seem} < \text{XCOMP} > \text{SUBJ'} \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'John'} \\ \text{PERSON} & 3 \\ \text{NUMBER} & \text{SG} \\ \text{GENDER} & \text{MASC} \end{bmatrix} \\ \text{XCOMP} & \begin{bmatrix} \text{PRED} & \text{'like'} \\ \text{SUBJ} & \underline{\quad} \\ \text{COMP} & \begin{bmatrix} \text{PRED} & \text{'win} < \text{SUBJ} >' \\ \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'pro'} \\ \text{PERSON} & 3 \\ \text{NUMBER} & \text{SG} \\ \text{GENDER} & \text{MASC} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

This analysis resembles the standard LFG treatment of subject-to-subject raising, but it diverges from the conceptualization of "copy raising" in that the embedded pronominal is not taken to be a copy (or a spelled-out trace) of the raised subject and is not involved in the equality relation between the SUBJs. Instead, following Asudeh's

work on resumption (Asudeh 2002, 2004, 2012), Asudeh and Toivonen (2012) suggest that the relationship between the matrix subject and the pronominal is anaphoric, and is enforced by a *manager resource* which is part of the lexical composition of copy raising verbs. CR constructions require there to be a co-indexed pronominal in the complement, but it does not need to be the subject.

A second property of "true CR" that is addressed in their analysis is the interpretation of the role of the matrix subject. Although it is assumed that, similarly to SSR, the two alternates in CR (e.g., (2a) and (2b)) are synonymous and the matrix subject in both is non-thematic, Asudeh and Toivonen (2012) find that they are in fact subject to different constraints. This is illustrated by what they refer to as *the puzzle of the absent cook*. Consider a situation where A walks into Tom's kitchen. Tom is nowhere in sight but there are clear signs of cooking activities such as bubbling pots and scattered ingredients. In this context, there is a difference in felicity conditions between the following two statements:

(18)    a.  It seems as if Tom is cooking.

       b.  Tom seems as if he is cooking.

The expletive-subject variant in (18a) is felicitous regardless of whether Tom is visible or not. The CR variant in (18b), on the other hand, is infelicitous if Tom is not visible. The fact that Tom needs to be visually perceived in order for the sentence to be accepted suggests that the matrix subject is semantically associated with the matrix verb contrary to what is expected of a raising construction and also contrary to the assumption that the two variants are synonymous.

Additional evidence for the semantic role of the matrix subject is found in the contrast between SSR and CR with respect to the active/passive alternation (Asudeh and Toivonen 2012).[6]

(19)    a.  Bush seemed to control Congress.                    (ex.142)

       b.  ≡ Congress seemed to be controlled by Bush.

(20)    a.  Bush seemed as if he controlled Congress.          (ex.143)

       b.  ≢ Congress seemed as if Bush controlled them.

---

[6] The symbol ≡ is used to indicate truth-conditional equivalence.

The active and passive instances of SSR (19) are synonymous since the matrix subject has no semantic relation with the main verb. This is not the case with CR, where the matrix subject denotes the source of the perception: *Bush* in (20a) and *congress* in (20b).

Furthermore, the observation that the matrix subject in CR is semantically linked to the matrix verb as well as to the embedded verb is incompatible with a raising account and violates the Theta Criterion (Chomsky 1981), according to which each argument bears one and only one θ-role. The solution proposed by Asudeh and Toivonen (2012) is that matrix subjects in CR are interpreted as the source of perception not by their semantic/argument relationship with the matrix verb. Rather, the states that CR verbs denote *entail* the existence of a perceptual-source (P-SOURCE) participant which is realized by their syntactic subject. Asudeh and Toivonen consider P-SOURCE a *semantic role* to distinguish it from *thematic roles*, which are linguistically encoded as arguments of predicates and are subject to the Theta Criterion.

### Perceptual source and evidential source  2.4

The interpretation of the matrix subject in CR is further investigated by Rudolph (2019), who conducted a set of experiments designed to gain a better understanding of the concept of perceptual source and its role in the CR construction. She found that, when the subject was not directly perceived, native speakers invariably rejected CR reports with *smell*, *taste* and *feel*. They did accept them with the *seem*, *look* and *sound* (Kay's "general perception verbs") under certain conditions.

One significant condition targets the embedded predicate. Similarly to Asudeh and Toivonen (2012), Rudolph (2019) found that sentences like (18b) were rejected by speakers in so-called "absent cook contexts". Nevertheless, when stage-level predicates in the embedded clause (e.g., *is cooking*) were replaced with individual-level predicates (e.g., *an experienced cook*), the modified sentences (e.g., (21)) were accepted.

(21)   Tom seems as if he is an experienced cook.

Rudolph concludes that the role that is assigned to the matrix subject does not necessarily require it to be a perceptual source. Instead,

she suggests a more limited role – *evidential source* (E-SOURCE). With the matrix subject construed as E-SOURCE the conditions on what constitutes evidence for a proposition depend on what the proposition is. More concretely, what the difference between the unacceptable (18b) and the felicitous (21) suggests is that the stage-level proposition *Tom is cooking* requires more stringent evidence than the individual-level proposition *Tom is an experienced cook*.

2.5                          *No raising, no copies*

A fifth type of CR analyses places less emphasis on their raising-like properties and on the existence and position of the pronominal copy and focuses instead on the alternation between the expletive vs. non-expletive subject. Landau (2011), for example, includes in the same category all cases which exhibit a so-called Richard-looking alternation (i.e. (2)), even when the subject is thematic and the pronominal copy is not the subject. One such example is given in (22).

(22)    a.  It tasted like there was pomegranate in the cocktails.

        b.  The cocktails$_i$ tasted like there was pomegranate in them$_i$.
                                                        (Landau 2011, ex.14)

Landau's data include examples in English and in Hebrew, which exhibits similar properties. Following are constructed examples of the Hebrew alternation.

(23)    a.  ze      meriax      ke'ilu še-avar
            it.SG.M smells.SG.M as.if   that-passed.3SG.M
            zman-a        šel ha-gvina        ha-zot.
            time.SG.M-her of  the-cheese.SG.F this.SG.F
            'It smells like the time of this cheese has passed.'

        b.  ha-gvina$_i$      ha-zot    merixa      ke'ilu
            the-cheese.SG.F this.SG.F smells.SG.F as.if
            še-avar            zman-a$_i$.
            that-passed.3SG.M time.SG.M-her
            'This cheese smells like its time has passed.'
                                                        (Landau 2011, ex.17)

In the expletive-subject variant in (23a), the matrix subject is the expletive *ze*, the matrix verb *meriax* 'smell' exhibits default SG.M agreement, and the embedded clause is preceded by *ke'ilu*, the Hebrew counterpart of *like/as if*.[7] In the CR variant in (23b), the subject *hagvina* 'the cheese' triggers SG.F agreement on the verb; there is an undeniable semantic relationship between the cheese and the verb *meriax* 'smell'; and the pronominal copy is the possessor of the embedded subject and not the subject.

Landau's (2011) approach is not compatible with any sort of raising analysis, where an embedded subject raises to a non-thematic matrix position and leaves behind a pronominal copy. And indeed he admits that the name *copy raising* is a misnomer and "doubly misleading" since there need not be a pronominal copy in the embedded clause, and if there is one, it is not due to raising. He explains that he uses the term only because it is an established term in the literature.

To account for the distribution of the pronominal copy Landau proposes the P-source–Copy Generalization, according to which pronominal copies are necessary if and only if the matrix subject is not the perceptual source (P-SOURCE). This generalization is illustrated by the following contrast.

(24)  Here's John:

    a.  Oh, he$_i$ looks like he$_i$ has failed the exam.

    b.  Oh, he looks like the exam was difficult.

(25)  Here's the grade sheet:

    a.   Oh, John$_i$ looks like he$_i$ has failed the exam.

    b.  # Oh, John looks like the exam was difficult.

In (24) John is visible and both (24a), with the pronominal copy, and (24b), without it, are acceptable. Conversely, the referent of the matrix subject in (25) is not visible and thus not a perceptual source. Consequently the variant without a pronominal copy, example (25b), is unacceptable.

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[7] The word *ke'ilu* is composed of *ke-* 'as' and *'ilu* 'counterfactual if'.

2.6                        *Interim summary*

There is no consensus in the literature regarding the defining characteristics of CR. The five approaches presented above offer different answers to questions regarding the semantic role of the matrix subject, the necessity of an embedded pronominal copy, the syntactic role of the pronominal copy, and the semantic similarity/identity of the expletive and CR variants.

In the next section, I propose a different approach to these constructions, which sidesteps their resemblance to the subject-to-subject raising construction and focuses on their function. As a first step, I avoid the misleading term *copy raising* and refer to the entire category as *look like* constructions.

## 3             COPY RAISING RECONSIDERED

This proposal stems from the observation that *look like* constructions serve two distinct functions, each subject to different syntactic, semantic and pragmatic constraints. As I show in the next sections, this approach to *look like* constructions dispels conundrums regarding CR.

As an initial illustration, consider the near-minimal pair in (26), with each sentence representing a different function.

(26)     a.    This cheese smells like it needs a shower.

         b.    This cheese smells like it needs to be thrown out.

In both sentences, the referent of the matrix subject *this cheese* is perceived olfactorily. However, I contend that they serve distinct functions. Sentence (26a) is of type *perceptual resemblance report*, whose function is to describe the experiencer's perception of the cheese by comparing it to another perception. In sentence (26b) the cheese is not described, but rather its perception is used as the basis of inference. For this reason, I will refer to this type as a *perceptual inference report*.

The two functions which these reports fulfill are not particular to *look like* constructions with embedded complement clauses such as (26), but are in fact more general. Consider the following examples in which the flip perception verb *look* appears with NP complements preceded by *like*.

(27)    a.   John looks like a Greek god (to me).
        b.   John looks like a good candidate (to me).

In (27a), John's appearance is characterized as similar to that of a Greek god, but there is no implication that the speaker suggests that he is in fact a Greek god. Example (27b) is similar to Kay's (2021) Marion example: the speaker infers either from her general perception of John or from John's appearance that he is a good candidate.

   One formal distinction between the *like*-S variants in (26) and *like NP* variants in (27) is that only the former alternate between *like*, *as if* and *as though*. With NP complements only *like* is possible. Nevertheless, the functional duality does not depend on the occurrence of *like* (and its counterparts). This is illustrated by the following examples in which the flip perception verb *smell* appears with adjectival complements.

(28)    a.   The cheese smells awful (to me).
        b.   The cheese smells rotten (to me).

Here too, in both sentences, the speaker reports an olfactory perception which involves a stimulus – the cheese – and an optionally realized experiencer. However in (28a) the speaker characterizes the (negative) olfactory perception of the cheese, with the complement *awful* describing the smell of the cheese, not the cheese. Conversely, in (28b) the speaker uses her perception of the cheese to infer something about it, namely that it is rotten.

   While the distinction between the depictive construction in (28a) and the inferential construction in (28b) is only semantic, it does have formal manifestation in Hebrew, a morphologically rich language, where adjectives exhibit number–gender marking. Consider the following (constructed) Hebrew counterparts of (28). In (29a) the

adjective *nora* 'awful' exhibits default singular–masculine agreement. In (29b), however, the adjective *mekulkelet* 'rotten' exhibits singular–feminine marking, in agreement with the grammatical gender of the subject. [8]

(29) a. ha-gvina     merixa     (li)   nora.
         the-cheese.SG.F smells.SG.F to.me awful.SG.M
         'The cheese smells bad (to me).'
     b. ha-gvina     merixa     (li)   mekulkelet.
         the-cheese.SG.F smells.SG.F to.me rotten.SG.F
         'The cheese smells rotten (to me).'

Corpus examples exhibiting the distinct agreement patterns of depictive vs. inferential constructions are given in (30), alongside alternative agreement markings, which were deemed ungrammatical by native speakers that I have consulted. [9]

(30) a. ha-sabonim     merixim     nifla/*nifla'im.
         the-soaps.PL.M smell.PL.M wonderful.SG.M/PL.M
         'The soaps smell wonderful.'
     b. ha-brauniz       ha-ele     merixim
         the-brownies.PL.M the-those smell.PL.M
         muxanim/*muxan.
         ready.PL.M/SG.M
         'Those brownies smell ready.'

The agreement patterns corroborate the proposed semantic characterization of the role of the complements of flip perception verbs. In the depictive variant, the adjective functions as an adverbial. It describes the *perception* of the referent of the subject; not the referent itself. This is the usual agreement pattern for adverbials in Hebrew. An example is (31), where the singular–masculine adverbial *nora* 'awful' modifies the verb *sixaku* 'played'.

---

[8] A similar distinction is made independently by Fishman (2023), who refers to the depictive construction as "the verbal construction" and the inferential construction as "the copulative construction".

[9] All Hebrew examples, unless indicated otherwise, are retrieved from the Hebrew *heTenTen14* corpus (Baroni *et al.* 2009) using Sketch Engine (Kilgarriff *et al.* 2004).

(31)  štei ha-kvucot      sixaku    nora.
      two the-teams.PL.F played.PL awful.SG.M
      'The two teams played awfully.'

In the inferential variant in (29b), the adjective is predicative and as is the case in Hebrew, it exhibits agreement with its subject. Moreover, (29b) can be paraphrased using a *look like* construction with a complement clause in which the adjective is the predicative complement in a copular construction and the embedded pronominal subject is co-indexed with the matrix subject. [10]

(32)  ha-gvina       merixa    (li)   ke'ilu še-hi    mekulkelet.
      the-cheese.SG.F smells.SG.F to.me as.if   that-she rotten.SG.F
      'The cheese smells (to me) as if it is rotten.'

The distribution of the agreeing and non-agreeing adjectives supports the proposed analysis. In a large-scale corpus study of these constructions, [11] Fishman (2023) conducted a Distinctive Collexeme Analyses and revealed a clear pattern with regards to the types of adjectives which are attracted to the complement slot. He found that the non-agreeing construction prefers more general evaluative adjectives (or adverbs) such as *tov* 'good', *nehedar* 'terrific', *mecuyan* 'excellent', and *ra* 'bad', regardless of the perception verb. Agreeing adjectives, on the other hand, were more varied and perception-specific.

The data presented so far suggests that an analysis of the two constructions cannot target only the CR-like constructions and overlook the larger scope of the phenomenon. Moreover, their formal similarity raises the question of whether flip perception verbs are inherently polysemous, with a distinct sense associated with each construction, or whether there is one shared sense, and the distinct meaning components are derived extra-lexically. Although the two options are theoretically possible, I will adopt the latter, constructional approach, and show that it captures the systematic relations between the shared and construction-specific meanings.

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[10] The present-tense copular construction in Hebrew generally involves a zero-copula.

[11] Fishman (2023) based his analysis on *heTenTen14*, the same corpus used here.

3.2                                     *Perceptual depiction reports*

Perceptual depiction reports are headed by flip perception verbs and are used to describe the experiencer's perception of the referent of the matrix subject. As we saw, in one type of perceptual depiction reports, the simple one, the perception is expressed by an adjective or an adverb (e.g., (28a), (29a), (30a)). The more complex construction involves the particle *like*, as well as *as if* and *as though* for clausal complements. I will refer to this sub-construction as *perceptual resemblance reports*, to distinguish it from the simpler one.

Perceptual resemblance reports are based on a simile, that is a comparison of one entity – the *tenor* – to another unlike entity – the *vehicle*. Prototypical simile examples are (33) and (34).

(33)   Watching the show was like watching grass grow.

(34)   Life is like a box of chocolates.

Generally, similes compare two entities, yet they leave it to the addressee to infer what is the ground for comparison, e.g., what is it about life that makes it comparable to a box of chocolates. In perceptual resemblance reports the shared property is made explicit by the perception verb. In (35), for example, it is specifically the smell of the cheese that is compared to the smell of old shoes.

(35)   The cheese smells like old shoes.

Similarly, in the *look like* example sentence in (26a) the tenor is the perception of the matrix subject – the smell of the cheese – and the vehicle is realized by the finite complement clause. The smell of the cheese is described as resembling the smell of someone who needs a shower.

More generally, in CR-like perceptual resemblance reports the matrix subject is both the tenor and the perceptual source and the ground is expressed by the matrix verb. The clausal vehicle, which is obligatorily preceded by *like*, *as if* or *as though*, denotes an imagined event or state which the speaker evokes to illustrate the experiencer's perception. The function of *like*, *as if* and *as though* is to signal both counterfactuality and similarity.

Many of the examples which are mentioned in the literature as counterexamples to the pronominal copy requirement of CR are in fact cases of perceptual resemblance reports. In (36), for example, the image of the car is compared to an imaginary car created by dust.

(36)   The Peugeot appeared as if dust had created it.

(Kim 2014, ex.33a)

In (37) the process of studying a language is compared to a journey.

(37)   For me, studying Yiddish seemed as though I were traveling, instead, through the streets of a long-forgotten hometown.

(Kim 2014, ex.35a)

And in (38) an image of lifeless clouds is conjured up to describe the sky.

(38)   In fact, even the sky appeared as though the clouds themselves had been stripped of life.          (Landau 2011, ex.21e)

In all these instances, the relationship between the matrix subject and the complement clause echoes Kim's (2014) *perceptual characterization condition* (see also (10) above).

In Hebrew, too, we find similar examples with no pronominal copy in the embedded clause. In (39), for example, the speaker describes the authentic visual, tactile and olfactory perception of a particular Chinese restaurant by comparing it to the feeling of actually being in China.

(39)   dim sam steišen nir'et      margiša   u-merixa        ke'ilu
       Dim Sum Station looks.SG.F feels.SG.F and-smells.SG.F as.if
       anaxnu mamaš be-sin.
       we      really   in-China
       'Dim Sum Station looks, feels and smells as if we were really in China.'

The lack of a pronominal copy in the embedded clause of perceptual resemblance reports is not surprising given that the function of the construction is to highlight the similarity between two unrelated entities, states or events.

3.3 *Perceptual inference reports*

The formal similarity between the two *look like* examples in (26), repeated here as (40), is undeniable. However, as previously mentioned, the semantic relationship between their respective components is different.

(40)  a.  This cheese smells like it needs a shower.

b.  This cheese smells like it needs to be thrown out.

Unlike (40a), where the complement clause colorfully describes the smell of the cheese, in (40b) the complement clause does not denote a property of the cheese, but rather it expresses a proposition that can be inferred from the smell of the cheese, namely, that it should be thrown out. This perception is used as evidence upon which the inference is made. Thus, the cheese is the P-SOURCE (Asudeh and Toivonen 2012, 2017) and the smell of the cheese is the E-SOURCE (Rudolph 2019).[12]

As we saw earlier in Section 3.1, the semantic relationship between the two dependents of a flip perception verb in perceptual inference reports is similar, regardless of whether the complement is clausal (e.g., *like it needs a shower*), a *like*-NP (*like a good candidate*) or an adjective (*rotten*). In what follows, I will focus mostly on the clausal CR-like variant.

3.3.1  P-SOURCE & E-SOURCE

The proposed characterization of *perceptual inference reports* does not allude to one question which has occupied most of the discussions of CR, which is whether the matrix subject is a perceptual source. While with perceptual depiction reports, whose function it is to describe the perception, the answer is unequivocally positive, this is not the case with inferential reports. Indeed, more often than not the semantic relation between the subject and the perception verb is literally perceptual. This, of course, is the case with (40b), where it is the smell of the cheese that constitutes supporting evidence for the inference. Nevertheless, the construction allows for more vagueness.

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[12] Unlike Rudolph (2019), who assigns the role of E-SOURCE to the referent of the matrix subject, I propose that the E-SOURCE is the perception of the referent.

Heycock (1994) points out that the sentence in (41) is clearly felicitous when the speaker is sitting in the car and commenting on its sound and what this sound suggests. In this case the car is a perceptual source – it is heard – and its sound is an evidential source – it provides evidence for the proposition that it needs tuning very badly.

(41)   Your car sounds like like it needs tuning very badly.

(Heycock 1994, ex.99)

Nevertheless, as Heycock (1994) argues, (41) is also acceptable if uttered during a phone-call, after hearing a description of the bizarre noise the car is making. In this case, it is not from the perceived sound of the car that the proposition can be inferred but rather from a more general perception involving the car.

Perceptual inference reports in which the referent of the matrix subject is not specifically perceived are precisely those which Kay (2021) labels "true CR". In his example (3), Trump is not seen, yet something about him suggests that he has disappeared. Other instances are Rudolph's (2019) examples of *look like* constructions with individual-level predicates (e.g., *an experienced cook* in (21)) and Landau's (2011) example (25), where John is not visible, yet something about him, namely his grade in the grade sheet, suggests that he has failed the exam.

The ability to head perceptual inference reports in which the matrix subject is not the perceptual source is not shared by all perception verbs. As Rudolph (2019) found, *seem*, *look* and *sound* allow "absent cooks" (under certain conditions), while *smell*, *taste* and *feel* never do. Thus, for example, the brownies' smell example in (30b) is felicitous only if the speaker smells the brownies. Following Kay (2021) I argue that this particular set of verbs, which he refers to as *general perception verbs*, can undergo a semantic process, which bleaches their literal meaning and assigns it a more *seem*-like sense. Nevertheless, and contrary to Kay's (2021) analysis, bleached or not, the inferential sense remains.

The fact that perceptual sourceness is not a defining property of the construction enables us to treat the ambiguity of cases such as Kay's (2021) Marion example (4) as secondary to the shared function of the two readings, which is to express a hypothesis and its evidentiary basis. In the two readings, something about Marion suggests that

she will win – with the difference being that in one reading this "something" is specifically her visual appearance and in the other it is an underspecified perception.

3.3.2                                                  Pronominal copies

Perceptual resemblance reports and perceptual inference reports differ with respect to an additional contentious issue in the CR literature: the distribution of pronominal copies. While in the former there is no functional motivation for pronouns to occur in the complement clause, perceptual inference reports prefer pronominal copies. Nevertheless, their occurrence is not a necessary condition nor is their syntactic role specified. The functional definition that I propose allows for different formal realizations.

Returning to Heycock's example (41), repeated here as (42a), and its modified version (42b), where the co-indexed pronominal is more deeply embedded, the messages of the two are quite similar.

(42)   a.  Your car$_i$ sounds like it$_i$ needs tuning very badly.

       b.  From what you say, your car$_i$ sounds like you really need to get it$_i$ tuned.              (Heycock 1994, modified ex.111)

Furthermore, similar perceptual inference reports can also be expressed with no pronominal copy at all (e.g., (43)).

(43)   From what you say, your car sounds like you need a new clutch.                                    (Heycock 1994, ex.111)

In all three cases something about the car, most likely the sound it is making, suggests that a trip to the mechanic is due.

The tendency for there to be pronominal copies in the complement clause is pragmatic – it is more natural for the evidence to play a role in the inferred state or event. Moreover, when the co-indexed pronominal is the embedded subject, the same entity plays the most prominent role in the evidential source and in the inference and the relationship between them is clear-cut; the speaker infers from the perception of X something about X (e.g., the sound of the car suggests that the car needs to be fixed in (42b)). The inferences in (42b) and (43) are more indirect, since they involve an additional, more prominent participant: *you*.

Finally, the proposed analysis provides a simple explanation for the fact that not all CR constructions obey Kim's (2014) perceptual characterization condition. One counterexample was given in (13) repeated here as (44).

(44)   You sound as if the man has no choice in the matter.

(Kim 2014, ex.35d)

Sentence (44) is clearly an inferential report which can be paraphrased as "from what I am hearing from you I can infer that the man has no choice in the matter". Unlike perceptual resemblance reports, in inference reports the matrix subject is not a topic that is "perceptually characterized" by the rest of the utterance. Rather it serves as evidence for the proposition denoted by the complement clause.

<div align="center">

*Semantic distinctions*   3.4

</div>

Formally, perceptual resemblance reports and perceptual inference reports are identical. The difference between the two functions is purely semantic and depends on the speaker's construal of the denotation of the complement clause. When a speaker expresses a perceptual inference report, she does not commit to the truth of the proposition expressed by the complement clause, but she does assume that the eventuality is probable given the perceptual evidence expressed by the matrix subject and verb. Consequently, (45b) are both natural continuations for (45a).

(45)   a.   The cocktails tasted like there was pomegranate in them.
       b.   And in fact there was. / But in fact there wasn't.

Then again, with perceptual resemblance reports, there is no such assumption. On the contrary, this construction is used creatively to describe the perception of the referent of the matrix clause by comparing it to an imagined, often improbable eventuality. In this case affirming or refuting the truth of this eventuality is at least odd.

(46)   a.   This cheese smells like it needs a shower.
       b.   # And in fact it does need one. / #But in fact it doesn't.

There are, however, cases where both interpretations are possible, depending on the context. Consider for example (47).

(47)   The bed appeared as if someone had recently been dragged
       from it.                                           (Kim 2014, ex.4b)

In a crime scene context where a detective examines the bed and ut-
ters (47), the sentence would be interpreted as a perceptual inference
report. Nevertheless, in a context where a frustrated tourist is review-
ing a hotel room and complaining about the level of housekeeping,
this would be interpreted as a resemblance report. The tourist does
not intend to assert the likelihood that someone had been dragged
from the bed, but this image captures his perception of the messiness
of the room.

The clear semantic distinction between the two report types on
the one hand, and their formal similarity and possible ambiguity, on
the other, support an analysis which captures the systematic relations
between the two functions. Unlike Asudeh and Toivonen (2017), who
argue that English CR verbs and perceptual resemblance verbs encode
indirect evidentiality, I propose that their semantic contribution is
more general: an eventuality whereby a stimulus triggers a percep-
tion by an experiencer. The depictive and inferential meaning com-
ponents are provided by each construction individually. More specif-
ically, with regards to the inferential function, I suggest that percep-
tual inference reports are instances of a grammaticalized means for
expressing evidentiality.[13] This approach is formalized in the follow-
ing section.

## 4                     A FORMAL HPSG ANALYSIS

In the spirit of the Head-driven Phrase Structure Grammar (HPSG; Pol-
lard and Sag 1994; Müller *et al.* 2021) framework, the formal analy-
sis distinguishes between what is shared by the two constructions and
what is construction-specific. It does so by employing inheritance hier-
archies in which more specific types inherit constraints from the more

---

[13] Asudeh and Toivonen (2017) propose a Glue Semantics analysis which cap-
tures the commonalities between non-grammaticalized evidentiality, which they
assume is the case in English, and grammaticalized evidentiality in languages
such as Tariana and Cherokee.

general ones. As the two constructions are assumed to have a similar syntactic structure, the focus of the analysis is on the semantic contributions of the lexical items and how they are composed together to form a representation of the content. The analysis is presented using English data for ease of exposition. Nevertheless, a similar analysis with some minor language-specific modifications can account for the Hebrew data.

<div align="center">

*Flip perception verbs*     4.1

</div>

We begin the presentation of the formal analysis by considering the types of verbs which can appear in the two constructions. The following semantic-relation type hierarchy reflects the distinction noted in the literature (e.g., Landau 2011; Asudeh and Toivonen 2012; Kim 2014; Rudolph 2019; Kay 2021) between verbs which require their subject to be a perceptual source and those which can also appear in so-called "absent cook contexts".

(48)
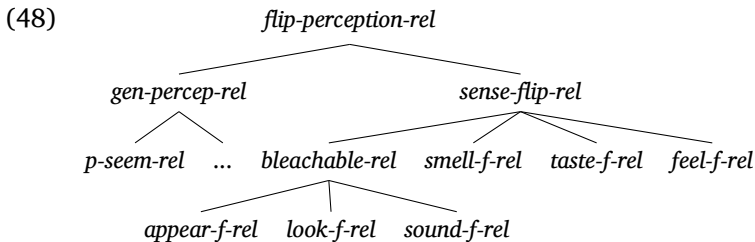


The most general semantic relation, *flip-perception-rel*, subsumes all the more specific relations. Verbs with these relations are licensed in perceptual inference reports. Immediately below this general type are two subtypes. The type *sense-flip-rel* includes all senses except that which is associated with *seem*. All verbs subsumed by these senses can appear in perceptual depiction reports. Within this category three particular senses are singled out – these are the senses which, along with *p-seem-rel* can appear in "absent cook contexts". This will be discussed in detail in the following sections.

The general verbal lexeme type that is associated with this construction is *flip-percep-verberb* described below.

(49)

$$
\begin{bmatrix}
\textit{flip-percep-verb} \\
\text{SYN}\,|\,\text{LOC}
\begin{bmatrix}
\text{CAT}
\begin{bmatrix}
\text{HEAD} & \textit{verb} \\
\text{SUBCAT} & \langle \text{NP}_{\boxed{1}}, \text{XP}, (\text{PP}_{\boxed{2}}) \rangle
\end{bmatrix} \\
\text{CONT}\,|\,\text{KEY}
\begin{bmatrix}
\textit{flip-perception-rel} \\
\text{STIMULUS} & \boxed{1} \\
\text{EXPERIENCER} & \boxed{2} \\
\text{PERCEPTION}
\begin{bmatrix}
\textit{percep-of-rel} \\
\text{INST} & \textit{ind} \\
\text{P-SOURCE} & \boxed{1}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$
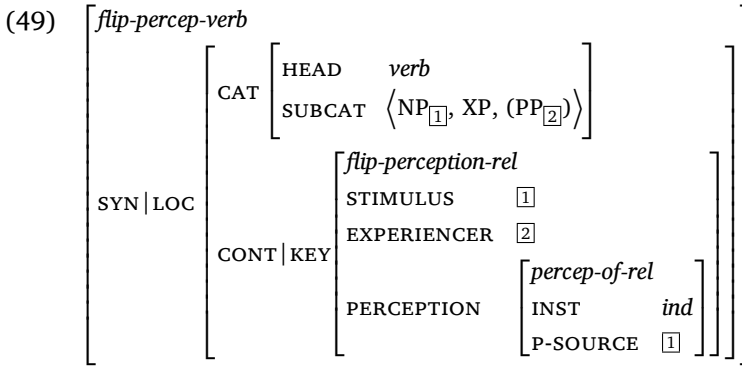
Essentially, the verb denotes an eventuality where a *stimulus* triggers a *perception* by an *experiencer*. The stimulus, appearing first on the SUB-CAT list, is realized as the subject. The experiencer is optionally realized by a *by*-phrase. Otherwise, it is contextually inferred by default as the speaker. The perception is an implicit relational semantic argument which links the perception (e.g., the smell) with its P-SOURCE (the cheese). Its function will be explicated below. The required complement only appears as XP in SUBCAT.

The underspecification of the syntactic category and semantic contribution of XP at the lexeme level is intended so that one lexeme type (*flip-percep-verb*) is associated with the core meaning that is shared by all flip perception verbs, regardless of the construction in which they occur. More specifically, due to their systematic dual function, rather than proposing two distinct lexemes for each flip perception verb – one denoting a perception and its depiction and the other inference by perception – only one lexeme type is assumed.

As such, the proposed analysis is constructional in that it ascribes extra-lexical meaning to the argument structures in which verbs appear. In particular, with regards to perceptual inference, it assumes that the evidential role of the perception is not a part of the core meaning of flip perception verbs. In this it parts from Asudeh and Toivonen's (2017) analysis according to which the verbs themselves encode evidentiality.

These meaning components are defined in a type inheritance hierarchy that is organized according to function and complement type, see (50). Immediately below the most general *flip-percep-verb* the hierarchy divides into two main branches, each associated with a

different function, or construction, that flip perception verbs can instantiate: depiction or inference. This configuration, where the types *percep-depict-verb* and *percep-infer-verb* are "sister" subtypes of one shared *flip-percep-verb* verbal lexeme, captures the systematicity of the relations between the shared sense and the particular instantiations with their specific semantics.

(50)

$$
\begin{array}{c}
\textit{flip-percep-verb} \\
\diagdown \\
\textit{prcp-depict-verb} \quad \textit{prcp-infer-verb}
\end{array}
$$
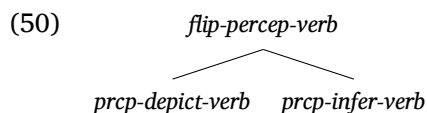
In what follows, I will zoom in to the sub-constructions which license the two *look like* constructions in the focus of this paper, namely those which are associated in the literature with CR and the CR debate. I will start the discussion with *perceptual depiction reports* and continue with *perceptual inference reports*.

## *Perceptual depiction reports* 4.2

In perceptual depiction reports, the XP complement of a flip perception verb characterizes the perception of the referent of the subject. This construction is limited to "real" perception verbs, that is verbs with semantic relations that are subsumed by *sense-flip-rel* (see hierarchy in (48)). The verb *seem* with its *gen-percep-rel* meaning is excluded.

The most general description of a perception depiction verb is given in (51).

(51)
$$
\begin{bmatrix}
\textit{percep-depict-verb} \\
\begin{bmatrix}
\text{CAT} \mid \text{SUBCAT} \left\langle \text{NP}_{\boxed{1}}, \text{XP}\begin{bmatrix} \text{MOD } \text{N}_{\boxed{3}} \end{bmatrix}, (\text{PP}_{\boxed{2}}) \right\rangle \\
\text{SS} \mid \text{LOC} \quad \text{CONT} \mid \text{KEY}
\begin{bmatrix}
\textit{sense-flip-rel} \\
\text{STIMULUS} \quad \boxed{1} \\
\text{EXPERIENCER} \quad \boxed{2} \\
\text{PERCEPTION}
\begin{bmatrix}
\textit{percep-of-rel} \\
\text{INST} \quad \boxed{3} \\
\text{P-SOURCE} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$
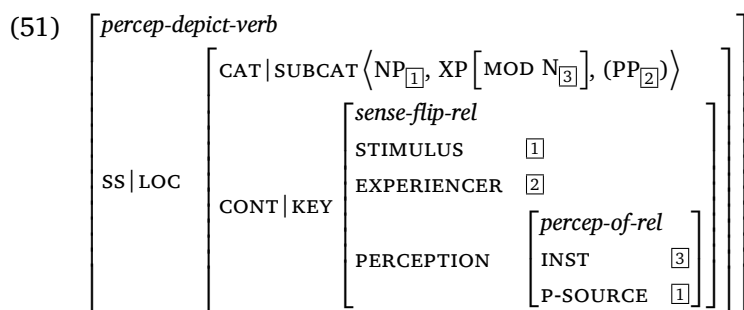
At this general level the function of the XP complement, which is unspecified at its super-type's level, is defined as a modifier of the perception. This is represented by the structure-sharing of the index of

its MOD value with the index of the implicit semantic argument of *percep-of-rel*, tagged ③.

The three different instantiations of the perception depiction report construction, distinguished by the category of XP, are licensed by three verbal subtypes which are represented in the following hierarchy, accompanied by an example.

(52)
```
                        prcp-depict-verb
          /                               \
prcp-adj-depict-verb              prcp-resemb-verb
     (awful)                    /                  \
                    prcp-np-resemb-verb      prcp-s-resemb-verb
                    (like old shoes)         (like it needs a shower)
```
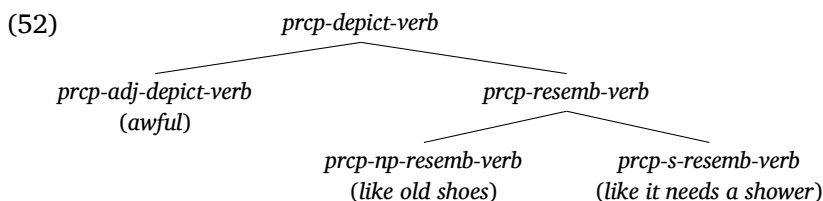
Broadly speaking, I distinguish between the simple case, *prcp-adj-depict-verb*, where XP is an AdjP that simply characterizes the perception, and *prcp-resemb-verb*, where XP is a *like*-phrase that characterizes the perception by comparing it to something else. This instantiation is further divided into two cases: *like*-NP and *like*-S.

4.2.1                         Simple perceptual depiction

In the simple case (*prcp-adj-depict-verb*), the complement XP is an AdjP which modifies the perception (e.g., the smell), not the stimulus (the cheese), nor the event.[14] In Hebrew, this is manifested in the agreement pattern (see (29a) above), whereby the adjective exhibits default singular–masculine agreement rather than agreeing with the stimulus, as would be expected if they were in a head–modifier relationship.

The semantic representation in (53) illustrates the interaction between the different semantic components in *The cheese smells awful*. The cheese (indexed ①) is the source of the smell (indexed ②). The characterization of this smell as awful is expressed by the embedding of ② as the argument of the *awful-rel* relation.

---

[14] I am grateful to an anonymous reviewer for pointing me in this direction.

(53)   The CONT value of *the cheese smells awful*

$$
\begin{bmatrix}
\text{LTOP} & \boxed{3} \\
\text{RELS} & \left\langle \boxed{3}\begin{bmatrix} \textit{smell-f-rel} \\ \text{STIM} \quad \boxed{1} \\ \text{EXP} \quad \textit{ind} \\ \text{PER} \quad \begin{bmatrix} \textit{smell-of-rel} \\ \text{INST} \qquad \boxed{2} \\ \text{P-SOURCE} \quad \boxed{1} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \textit{cheese-rel} \\ \text{INST} \quad \boxed{1} \end{bmatrix}, \begin{bmatrix} \textit{awful-rel} \\ \text{INST} \quad \boxed{2} \end{bmatrix} \right\rangle
\end{bmatrix}
$$
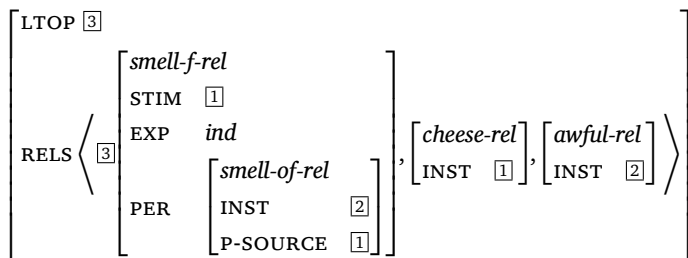
<div align="center">Perceptual resemblance          4.2.2</div>

Perceptual resemblance reports are not as straightforward, since the perception is characterized indirectly. The XP in this case is a preposition phrase headed by *like* (or *as if* and *as though* for *like*-S complements). The syntactic category of the complement of the preposition is left unspecified, and is resolved at the subtype level: NP for *prcp-np-resemb-verb* verbs and a finite clause for *prcp-s-resemb-verb* verbs.

As discussed in Section 3.2, the function of the *like* PP complement is to characterize the perception by comparing it to another entity or event, or, in other words, by using a simile. As a preliminary step, let us first consider the prototypical case of similes, illustrated by (34), repeated here as (54).

(54)   Life is like a box of chocolates.

I propose that simile *like* (*s-like*) is a predicative preposition whose semantic content is *simile-rel* (see (55)). The two explicit components of the simile, namely the *tenor* and the *vehicle* are realized in such cases by the raised subject and the complement of *like*, respectively. In example (54), they are *life* and the *box*. The third component, the *ground* is usually unspecified and inferred from the context.

(55)   Simile *like*
$$
\begin{bmatrix}
\textit{s-like} \\
\text{SS}\,|\,\text{LOC}\begin{bmatrix} \text{CAT}\begin{bmatrix} \text{HEAD} \quad \textit{prep} \\ \text{PRD} \qquad + \\ \text{SUBCAT} \quad \langle \text{NP}_{\boxed{1}}, \text{XP:}\boxed{2} \rangle \end{bmatrix} \\ \text{CONT}\,|\,\text{KEY}\begin{bmatrix} \textit{simile-rel} \\ \text{TENOR} \quad \boxed{1} \\ \text{VEHICLE} \quad \boxed{2} \\ \text{GROUND} \quad \textit{ind} \end{bmatrix} \end{bmatrix}
\end{bmatrix}
$$
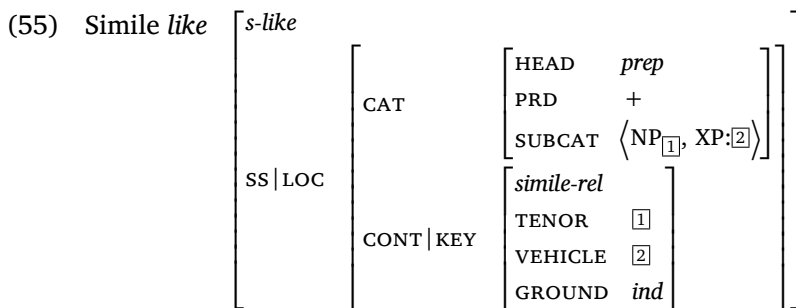
However, as noted in Section 3.2, unlike prototypical similes, in perceptual resemblance reports the ground for comparison between the tenor and vehicle is made explicit by the matrix verb. Thus, for example, in (35), repeated here as (56), the cheese is compared to old shoes on account of its smell.

(56)   The cheese smells like old shoes.

This information is an essential part of the meaning of the clause, and thus needs to be part of the semantic representation. As this is a particular property of the perceptual resemblance report construction I propose that the linking of the GROUND argument to the implicit PERCEPTION argument is defined at the *prcp-resemb-verb* level and is inherited by its subtypes. This is illustrated in (57).

(57)   Perceptual resemblance verb

$$
\begin{bmatrix}
\textit{prcp-resemb-verb} \\
\text{SS} \,|\, \text{LOC}
\begin{bmatrix}
\dots\text{SUBCAT} \left\langle \text{NP}_{\boxed{1}}, \text{PP}_{\textit{s-like}}:
\begin{bmatrix}
\textit{simile-rel} \\
\text{TENOR} \quad \boxed{1} \\
\text{VEHICLE} \quad \textit{ind} \\
\text{GROUND} \quad \boxed{3}
\end{bmatrix}, (\text{PP}_{\boxed{2}}) \right\rangle \\
\dots\text{KEY}
\begin{bmatrix}
\textit{flip-percep-rel} \\
\text{STIMULUS} \qquad \boxed{1} \\
\text{EXPERIENCER} \qquad \boxed{2} \\
\text{PER}
\begin{bmatrix}
\textit{percep-of-rel} \\
\text{INST} \quad \boxed{3} \\
\text{P-SOURCE} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$
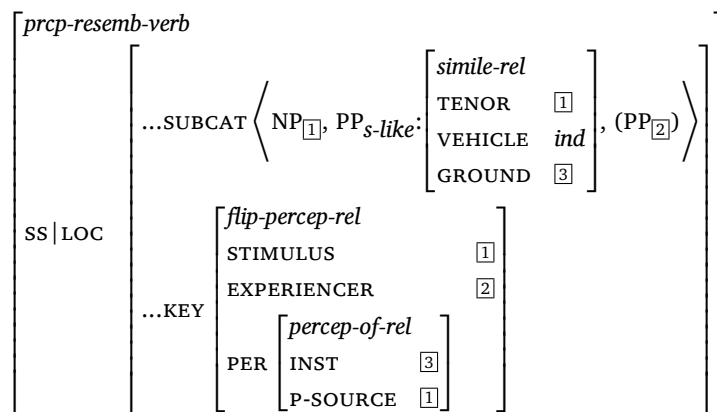
The resemblance aspect is denoted by *like* (or *as if* and *as though*), which introduces a *simile relation* that relates between the content of its complement (the vehicle), the index of its unsaturated subject (the tenor) and the implicit perception argument (the ground). With *prcp-np-resemb-verb* the vehicle argument is structure-shared with the NP complement of *like*, while with *prcp-s-resemb-verb* verbs, where the complement is a finite clause clause, the vehicle argument is co-indexed with the key semantic relation of the clause (i.e., the semantic relation denoted by its head). The *ground* argument is structure-shared with the index of the implicit perception argument ($\boxed{3}$).

For example, the semantic content of (40) is sketched in (58).

(58)   The CONT value of *the cheese smells like it needs a shower*

$$
\begin{bmatrix}
\text{LTOP} \; \boxed{5} \\[2pt]
\text{RELS} \; \left\langle
\begin{bmatrix}
\textit{smell-f-rel} \\
\text{STIM} \quad \boxed{1} \\
\text{EXP} \quad \textit{ind} \\
\text{PER} \quad
\begin{bmatrix}
\textit{smell-of-rel} \\
\text{INST} \qquad \boxed{2} \\
\text{P-SOURCE} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix},
\boxed{5}
\begin{bmatrix}
\textit{simile-rel} \\
\text{TENOR} \quad \boxed{1} \\
\text{VEHICLE} \quad \boxed{3} \\
\text{GROUND} \quad \boxed{2}
\end{bmatrix}, \right. \\[4pt]
\left. \begin{bmatrix} \textit{cheese-rel} \\ \text{INST} \quad \boxed{1} \end{bmatrix}, \boxed{3}
\begin{bmatrix} \textit{need-rel} \\ \text{ACT} \quad \boxed{1} \\ \text{THEME} \quad \boxed{4} \end{bmatrix},
\begin{bmatrix} \textit{shower-rel} \\ \text{INST} \quad \boxed{4} \end{bmatrix} \right\rangle
\end{bmatrix}
$$
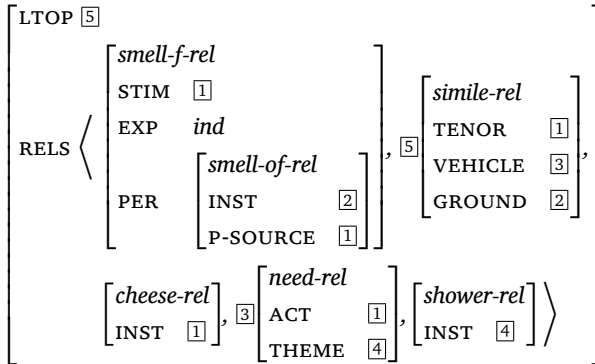
Importantly, the *like/as if/as though* + S[fin] expressions, realized here as PPs, are not limited to the construction in the focus of this paper. They can also appear as obligatory complements of verbs such as *act* and as adverbial modifiers (Kay 2021).

(59)   a.   Although it continued to float in midair, it acted *(like someone had cemented it to the ground).

      b.   The man called her as though he was calling a little cat.

<div align="right">(Kay 2021, exs. 10&13)</div>

Indeed, in (59a) their role is similar to the role they play in perceptual resemblance reports: they are obligatory complements as well as modifiers. In (59b), on the other hand, they are simply adverbials which can adjoin to a VP in a *head-modifier-phrase* type phrase. In all instances they are used as similes to express similarity and counterfactuality.

<div align="center">

*Perceptual inference reports*               4.3

</div>

Similarly to the *perceptual depiction report* construction, the verbs heading the perceptual inference report construction are a part of a type hierarchy which captures shared properties as well as specific ones.

(60)
```
                        percep-infer-verb
              _____/      _____
             /                                     \
   prcp-adj-infer-verb                    prcp-like-infer-verb
       (rotten)                          _____/        _____
                                        /                       \
                             prcp-like-np-infer-verb    prcp-like-s-infer-verb
                             (like a good candidate)    (like it should be thrown out)
```
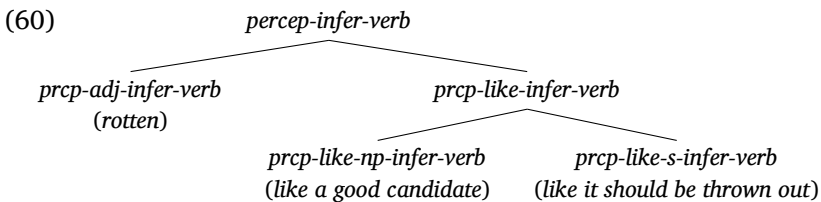
In all three cases, the XP complement of the flip perception verb in this construction denotes a proposition which is inferred on the basis of perceptual evidence.

### 4.3.1 Predication and perceptual inference

With adjectival complements the AdjP is a predicative complement, predicated of the referent of the matrix subject. Thus, a near paraphrase of the AdjP variant in (61a) is (61b), where the pronominal embedded subject is co-indexed with the matrix subject.

(61) a. The cheese smells rotten.

b. The cheese$_i$ smells like it$_i$ is rotten.

Assuming this, consider a first attempt at a lexical description of the specific verb type which licenses constructions such as (61a).

(62) Perceptual adjectival inference verb (first attempt)

$$
\begin{bmatrix}
\textit{prcp-adj-infer-verb} \\[2pt]
\textsc{ss}\,|\,\textsc{loc}
\begin{bmatrix}
\ldots\textsc{subcat} \left\langle \text{NP}_{\boxed{1}}, \text{ADJP}
\begin{bmatrix}
\textsc{prd} & + \\
\textsc{subj} & \left\langle \text{NP}_{\boxed{1}} \right\rangle
\end{bmatrix}
, (\text{PP}_{\boxed{2}}) \right\rangle \\[20pt]
\ldots\textsc{key}
\begin{bmatrix}
\textit{flip-percep-rel} \\
\textsc{stimulus} & \boxed{1} \\
\textsc{experiencer} & \boxed{2} \\
\textsc{per}
\begin{bmatrix}
\textit{percep-of-rel} \\
\textsc{inst} & \textit{ind} \\
\textsc{p-source} & \boxed{1}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$
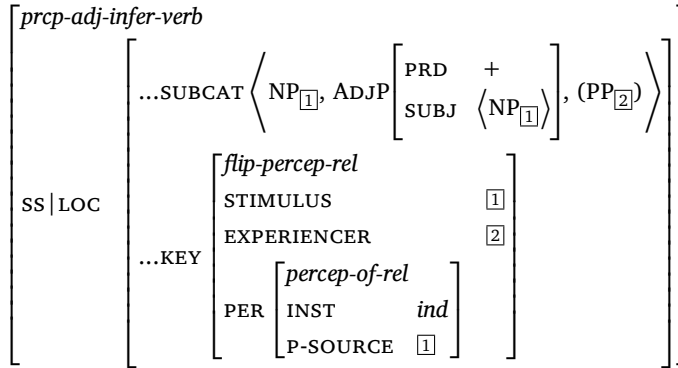
The XP complement, fully specified here as an AdjP, is predicative and has an unrealized subject co-indexed with the NP subject. Assuming such a lexical description, the semantic content of the resulting clause would be represented as in (63).

(63) The CONT value of *the cheese smells rotten* (first attempt)

$$
\begin{bmatrix}
\textsc{ltop} \ \boxed{2} \\[4pt]
\textsc{rels} \left\langle \boxed{2}
\begin{bmatrix}
\textit{smell-f-rel} \\
\textsc{stim} & \boxed{1} \\
\textsc{exp} & \textit{ind} \\
\textsc{per}
\begin{bmatrix}
\textit{smell-of-rel} \\
\textsc{inst} & \textit{ind} \\
\textsc{p-source} & \boxed{1}
\end{bmatrix}
\end{bmatrix}
,
\begin{bmatrix}
\textit{cheese-rel} \\
\textsc{inst} & \boxed{1}
\end{bmatrix}
,
\begin{bmatrix}
\textit{rotten-rel} \\
\textsc{inst} & \boxed{1}
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

[ 328 ]
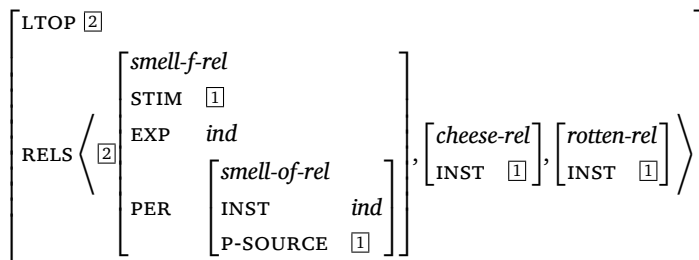
However, the semantic representation in (63) does not reflect the entire meaning of (61a) since it does not capture the inferential sense of the construction, and moreover, it wrongly asserts that the cheese is rotten.

As discussed in Section 4.1, the proposed analysis assumes that the core meaning of flip perception verbs, namely an eventuality where a *stimulus* triggers a *perception* by an *experiencer*, is shared by all verbs, whereas the inferential meaning component is introduced constructionally, in a particular argument-structure configuration. Thus, the meaning of instantiations of *percep-infer-verb* verb types combine the shared meaning inherited from the general *flip-percep-verb* verbal lexeme, represented by *flip-percep-rel*, with the construction-specific *inference-rel*, a semantic relation, which captures the relations between the components. The occurrence of this extra semantic relation is shared via inheritance by all the subtypes of this more general type.

Consequently, the lexical description of *prcp-adj-infer-verb* in (62) is amended in (64) to include an additional semantic relation, *inference-rel*, which identifies the implicit perception argument of the verb as the E-SOURCE, the semantic relation denoted by the AdjP complement as the INFERENCE, and the index of the optional *by*-phrase complement as the EVALUATOR, who is contextually inferred when not realized.

(64)  Perceptual adjectival inference verb (final)

$$
\begin{bmatrix}
\textit{prcp-adj-infer-verb} \\[2pt]
\text{SS}\,|\,\text{LOC}
\begin{bmatrix}
\ldots\text{SUBCAT}\ \left\langle \text{NP}_{\boxed{1}},\ \text{ADJP}
\begin{bmatrix}
\text{PRD}\ + \\
\text{SBCT}\ \langle \text{NP}_{\boxed{1}} \rangle
\end{bmatrix}\!:\!\boxed{4},\ (\text{PP}_{\boxed{2}}) \right\rangle \\[8pt]
\ldots\text{RELS}\ \left\langle
\begin{bmatrix}
\textit{flip-percep-rel} \\
\text{STIMULUS}\quad \boxed{1} \\
\text{EXPERIENCER}\quad \boxed{2} \\
\text{PERCEPTION}
\begin{bmatrix}
\textit{percep-of-rel} \\
\text{INST}\quad \boxed{3} \\
\text{P-SOURCE}\quad \boxed{1}
\end{bmatrix}
\end{bmatrix},
\begin{bmatrix}
\textit{inference-rel} \\
\text{E-SOURCE}\quad \boxed{3} \\
\text{INFERENCE}\quad \boxed{4} \\
\text{EVALUATOR}\quad \boxed{2}
\end{bmatrix}
\right\rangle
\end{bmatrix}
\end{bmatrix}
$$

4.3.2                                       A unified account

The semantic function of the XP complement is the same in all its
three syntactic instantiations: it denotes the inferred proposition. Nev-
ertheless, a unified account of the construction needs to address
the similarities and differences between each of the complement
types.

Perceptual inference reports with AdjP and *like*-NP complement
have *like*-S counterparts (see (61) and (65), respectively).

(65)    a.   ...the bill seems like a positive step for our state.

(Kay 2021, ex.27)

        b.   The bill seems like it would be a positive step for our state.

Similarly to the AdjP complement, the matrix subject is construed as
the subject of the predicative NP in the *like*-NP phrase, while in the
*like*-S counterpart it is co-indexed with the embedded pronominal sub-
ject. However, unlike predicative AdjPs and NPs, which are "open"
complements (Bresnan 1982), finite clauses like the complements of
*like*-S are "closed" and have no open slot to bind an external argument.
Moreover, as was discussed in Section 3.3.2, the embedded subject in
perceptual inference reports is not necessarily co-indexed with the ma-
trix subject.

In order to capture the semantic similarity between the "open"
AdjP and *like*-NP complements, on the one hand, and the formal sim-
ilarity between the two *like* phrases, on the other, I propose, that the
XP complement in all variants of this construction is predicative. I
adopt Asudeh and Toivonen's (2012) LFG raising analysis, illustrated
in (17), and adapt it to the proposed analysis and its theoretical frame-
work and formalism. Under this account the predicative component
of the *like*-S complement is introduced by the predicative preposi-
tion, and it is the index of *its* unsaturated subject, rather than the
subject of the complement clause, that is shared with the matrix sub-
ject. The relationship between the pronominal in the embedded clause
and the matrix subject is only anaphoric; there is no syntactic require-
ment for there to be a co-indexed pronominal subject, or a pronominal
at all.

Consequently, the most general verbal lexeme type *percep-infer-
verb* has the following description.

(66)   Perceptual inference verb

$$
\begin{bmatrix}
\textit{percep-infer-verb} \\[4pt]
\text{SS}\,|\,\text{LOC}
\begin{bmatrix}
\ldots\text{SUBCAT} \quad
\left\langle \text{NP}_{\boxed{1}},\ \text{ADJP}\lor\text{PP}
\begin{bmatrix}
\text{PRD } + \\
\text{SBCT}\ \langle \text{NP}_{\boxed{1}} \rangle
\end{bmatrix}
:\boxed{4},\ (\text{PP}_{\boxed{2}}) \right\rangle \\[12pt]
\ldots\text{RELS} \quad
\left\langle
\begin{bmatrix}
\textit{flip-percep-rel} \\
\text{STIMULUS} \quad \boxed{1} \\
\text{EXPERIENCER} \quad \boxed{2} \\
\text{PERCEPTION}
\begin{bmatrix}
\textit{percep-of-rel} \\
\text{INST} \quad \boxed{3} \\
\text{P-SOURCE} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix},
\begin{bmatrix}
\textit{inference-rel} \\
\text{E-SOURCE} \quad \boxed{3} \\
\text{INFERENCE} \quad \boxed{4} \\
\text{EVALUATOR} \quad \boxed{2}
\end{bmatrix}
\right\rangle
\end{bmatrix}
\end{bmatrix}
$$

The predicative preposition *like* can appear with two phrase types as complements. With NP complements, the analysis is straightforward: the semantic index of the NP is structure-shared with the index of the matrix subject, thus making, for example, *the bill* in (65a) the subject of the predicate *a positive step*. However, with the "closed" finite clause as complement, the predication relation between the matrix subject and the *like*-S complement is more abstract.

With regards to the semantic contribution of *like*, although formally identical to *like* in perceptual depiction reports, in this construction it does not denote similarity and counterfactuality. Rather, in this case *like, as if, as though* and the Hebrew *ke'ilu* function as epistemic hedges, as they do in other contexts as well.[15] Their semantic contribution here is to indicate that the inference is based only on indirect evidence and as such the proposition is likely to be true, but there is no certainty. Thus, although the two variants in (61) report that it can be inferred from the smell of the cheese that it is rotten, in (61a) the speaker expresses more certainty than in (61b), where the inference is hedged by *like*.[16]

---

[15] See Maschler 2002 regarding the discourse functions of *ke'ilu*.

[16] The epistemic hedging function of *look like* constructions is supported by experimental results reported in Asudeh and Toivonen 2017. Speakers

In light of this, the lexical description of hedging-*like* is given in (67). It is a predicative preposition; its complements are NPs or finite clauses; and its semantic contribution is represented by *likely-rel*, whose argument is co-indexed with the semantic content of its complement.

(67)   Hedging *like*

$$
\begin{bmatrix}
\textit{h-like} \\[2ex]
\text{SS} \,|\, \text{LOC}
\begin{bmatrix}
\text{CAT}
\begin{bmatrix}
\text{HEAD}
\begin{bmatrix}
\textit{prep} \\
\text{PRD } +
\end{bmatrix} \\[2ex]
\text{SUBCAT} \;\; \langle \text{NP, NP} \vee \text{S:} \boxed{1} \rangle
\end{bmatrix} \\[4ex]
\text{CONT} \,|\, \text{KEY}
\begin{bmatrix}
\textit{likely-rel} \\
\text{SOA-ARG} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix}
\end{bmatrix}
$$
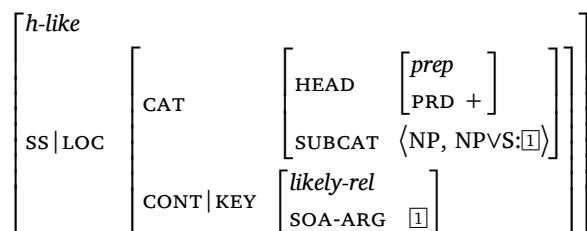
### 4.3.3                    Selective semantic bleaching

The last piece of the puzzle is an account of what Kay (2021) considers "true CR", that is *seem like* constructions with clausal complements for which the matrix subject is not a thematic argument of the verb and does not denote a source of perception. Within the analysis proposed here these constructions belong to the class of perceptual inference reports. As mentioned above, the option to head inference reports where the subject is not the perceptual source is not available to all verbs of perception. Rather, it is restricted to a subset of verbs whose meaning is subsumed by the type *bleachable-rel* (see type hierarchy presented in (48)), namely *appear, look* and *sound*, as well as to the already perceptually underspecified verb *seem*.

To account for this phenomenon I adopt Kay's (2021) conceptualization of "a lexical rule that converts a subtype of perception verb ...into a semantically bleached verb of mild evidentiary force, roughly equivalent semantically to *seem* in some uses" (p. 69). My version of the lexical rule takes as input a *lexeme* subsumed by the type *percep-infer-verb* with a semantic relation of type *bleachable-rel* and replaces the specific semantic relation with the underspecified semantic relation *p-seem-rel*. Everything else stays the same. In essence, this creates two versions for each "bleachable" perception verb, thus accounting

---

judged the reliability of *look/sound like* sentences lower than sentences with *see/hear*.

for the ambiguity of (4), repeated here as (68), where in one reading Marion is visually perceived and in the other she is not.

(68)   Marion looks like she will be elected.          (Kay 2021, ex.5a)

Moreover, similarly to Kay's (2021) analysis, the proposed lexical rule accounts for his prime example of CR repeated here as (69).

(69)   Trump looks like he disappeared.          (Kay 2021, ex.1)

The verb *looks* in this example is a bleached version of a *prcp-like-s-infer-verb* verb type where the application of the lexical rule replaced the specific perceptual sense *look-f-rel* with the bleached sense *p-seem-rel*. The resulting semantic representation of (69) is given in (70).

(70)   The CONT value of *Trump looks like he disappeared*

$$
\begin{bmatrix}
\text{LTOP } \boxed{5} \\[2pt]
\text{RELS } \left\langle 
\begin{bmatrix} naming\text{-}rel \\ \text{NAME} \quad trump \\ \text{IND} \qquad \boxed{1} \end{bmatrix},
\boxed{3}\begin{bmatrix} likely\text{-}rel \\ \text{SOA-ARG} \quad \boxed{4} \end{bmatrix},
\boxed{4}\begin{bmatrix} disappear\text{-}rel \\ \text{THEME} \quad \boxed{1} \end{bmatrix}, \right. \\[20pt]
\left. \begin{bmatrix} p\text{-}seem\text{-}rel \\ \text{STIM} \quad \boxed{1} \\ \text{EXP} \quad \boxed{6} \\ \text{PER} \begin{bmatrix} seem\text{-}of\text{-}rel \\ \text{INST} \qquad \boxed{2} \\ \text{P-SOURCE} \quad \boxed{1} \end{bmatrix} \end{bmatrix},
\boxed{5}\begin{bmatrix} inference\text{-}rel \\ \text{E-SOURCE} \quad \boxed{2} \\ \text{INFERENCE} \quad \boxed{3} \\ \text{EVALUATOR} \quad \boxed{6} \end{bmatrix} \right\rangle
\end{bmatrix}
$$
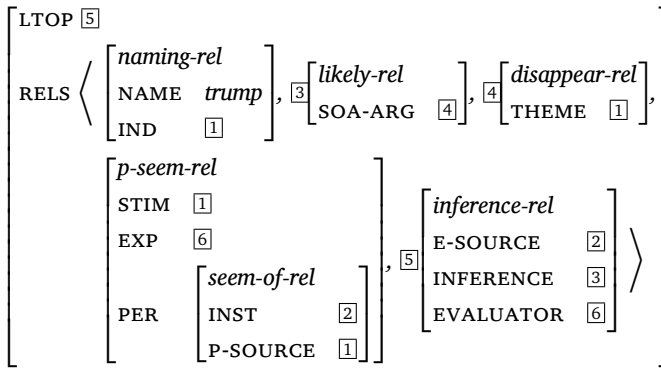
## CONCLUSIONS          5

To conclude, let us consider two cases of ambiguity and the semantic analysis of each reading. Recall that it is assumed that the syntactic structure of the two constructions is identical (and simple). The different interpretations are derived from the two distinct realizations of one verbal lexeme: *percep-depict-verb* heading perceptual depiction reports and *percep-infer-verb* heading perceptual inference reports. The two lexical subtypes which account for the two constructions are illustrated in (71).

(71)

$$\begin{bmatrix} \textit{percep-depict-verb} \\ \text{CAT} \,|\, \text{SUBCAT} \left\langle \boxed{A}, \boxed{B}\left[\text{MOD N}_{\boxed{3}}\right], \boxed{C} \right\rangle \end{bmatrix}$$

$$\begin{bmatrix} \textit{flip-percep-verb} \\ \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{verb} \\ \text{SUBCAT} & \left\langle \boxed{A}\text{NP}_{\boxed{1}}, \boxed{B}\text{XP}, \boxed{C}(\text{PP}_{\boxed{2}}) \right\rangle \end{bmatrix} \\ \text{CONT}\,|\,\text{KEY} \,\boxed{2} \begin{bmatrix} \textit{flip-perception-rel} \\ \text{STIM} & \boxed{1} \\ \text{EXP} & \boxed{2} \\ \text{PER} & \begin{bmatrix} \textit{percep-of-rel} \\ \text{INST} & \boxed{3} \\ \text{P-SOURCE} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

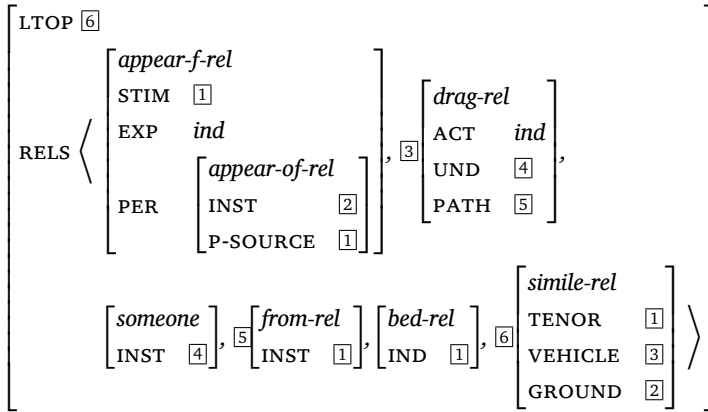$$\begin{bmatrix} \textit{percep-infer-verb} \\ \text{CAT}\,|\,\text{SUBCAT} \left\langle \boxed{A}, \boxed{B}\begin{bmatrix} \text{PRD} + \\ \text{SUBCAT} \left\langle \text{NP}_{\boxed{1}} \right\rangle \end{bmatrix}:\boxed{4}, \boxed{C} \right\rangle \\ \text{CONT} \begin{bmatrix} \text{RELS} & \left\langle \boxed{2}, \begin{bmatrix} \textit{inference-rel} \\ \text{E-SOURCE} & \boxed{3} \\ \text{INFERENCE} & \boxed{4} \\ \text{EVALUATOR} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix}$$

The first example, discussed earlier in Section 3.4, has two interpretations depending on the context in which it is uttered.

(72) The bed appeared as if someone had recently been dragged from it. (Kim 2014, ex.4b)

In the "negative reviewer reading", the speaker is describing the messy appearance of the bed by comparing it to the state of a bed following an imagined event whereby a person was dragged from it. In this *perceptual resemblance report*, a subtype of *perceptual depiction report*, the tenor of the simile-like comparison is the perception of the bed and the vehicle is the imaginary dragging event. This meaning is represented formally in (73).
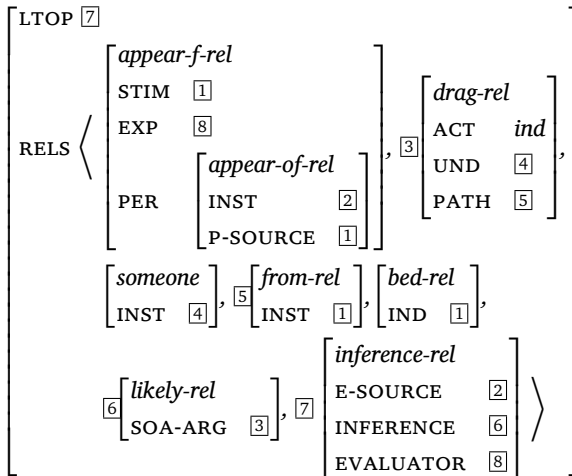
(73)   The negative reviewer reading of (72)

$$
\begin{bmatrix}
\text{LTOP } \boxed{6} \\[4pt]
\text{RELS } \left\langle
\begin{bmatrix}
\textit{appear-f-rel} \\
\text{STIM } \boxed{1} \\
\text{EXP } \quad \textit{ind} \\
\text{PER } \begin{bmatrix}
\textit{appear-of-rel} \\
\text{INST} \qquad \boxed{2} \\
\text{P-SOURCE } \boxed{1}
\end{bmatrix}
\end{bmatrix},\ 
\boxed{3}\begin{bmatrix}
\textit{drag-rel} \\
\text{ACT} \quad \textit{ind} \\
\text{UND} \quad \boxed{4} \\
\text{PATH} \quad \boxed{5}
\end{bmatrix}, \right. \\[4pt]
\left.
\begin{bmatrix}
\textit{someone} \\
\text{INST } \boxed{4}
\end{bmatrix},\ 
\boxed{5}\begin{bmatrix}
\textit{from-rel} \\
\text{INST } \boxed{1}
\end{bmatrix},\ 
\begin{bmatrix}
\textit{bed-rel} \\
\text{IND } \boxed{1}
\end{bmatrix},\ 
\boxed{6}\begin{bmatrix}
\textit{simile-rel} \\
\text{TENOR} \qquad \boxed{1} \\
\text{VEHICLE} \quad \boxed{3} \\
\text{GROUND} \quad \boxed{2}
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

In the "detective reading", the speaker is relying on the appearance of the bed to infer the occurrence of an earlier event – the dragging event. To account for this *perceptual inference report,* the proposed analysis recruits constructional semantic content represented by the *inference-rel,* which is added to the core lexical meaning of the flip perception verb. This is illustrated in (74).

(74)   The detective reading of (72)

$$
\begin{bmatrix}
\text{LTOP } \boxed{7} \\[4pt]
\text{RELS } \left\langle
\begin{bmatrix}
\textit{appear-f-rel} \\
\text{STIM } \boxed{1} \\
\text{EXP } \quad \boxed{8} \\
\text{PER } \begin{bmatrix}
\textit{appear-of-rel} \\
\text{INST} \qquad \boxed{2} \\
\text{P-SOURCE } \boxed{1}
\end{bmatrix}
\end{bmatrix},\ 
\boxed{3}\begin{bmatrix}
\textit{drag-rel} \\
\text{ACT} \quad \textit{ind} \\
\text{UND} \quad \boxed{4} \\
\text{PATH} \quad \boxed{5}
\end{bmatrix}, \right. \\[4pt]
\begin{bmatrix}
\textit{someone} \\
\text{INST } \boxed{4}
\end{bmatrix},\ 
\boxed{5}\begin{bmatrix}
\textit{from-rel} \\
\text{INST } \boxed{1}
\end{bmatrix},\ 
\begin{bmatrix}
\textit{bed-rel} \\
\text{IND } \boxed{1}
\end{bmatrix}, \\[4pt]
\left.
\boxed{6}\begin{bmatrix}
\textit{likely-rel} \\
\text{SOA-ARG } \boxed{3}
\end{bmatrix},\ 
\boxed{7}\begin{bmatrix}
\textit{inference-rel} \\
\text{E-SOURCE} \qquad \boxed{2} \\
\text{INFERENCE} \quad \boxed{6} \\
\text{EVALUATOR} \quad \boxed{8}
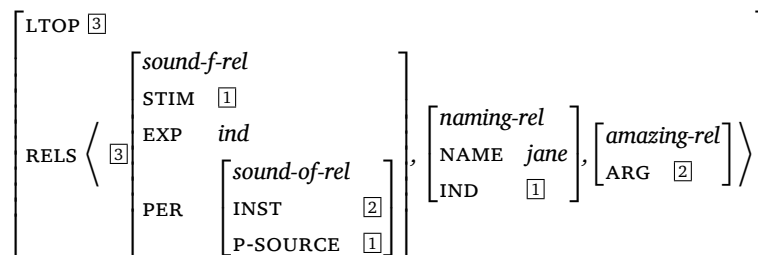\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

The proposed analysis widened its scope beyond cases that have been treated as instances of CR in the literature, and identified similar semantic relations in instances of flip perception verbs with other types of complements. An ambiguous example with the flip perception verb *sound* complemented by an AdjP is given in (75).[17]

(75)   Jane sounds amazing.

In the "singer reading" the speaker is characterizing the sound which she hears Jane making, presumably Jane's singing or music playing. In this perceptual depiction report, the adjective *amazing* modifies the implicit perception argument. This is captured in the representation in (76) via the *amazing-rel* relation, whose argument is co-indexed with index of the perception *sound-of-rel* which links the perception to its source.

(76)   The singer reading of (75)

$$
\begin{bmatrix}
\text{LTOP } \boxed{3} \\[2pt]
\text{RELS } \left\langle \boxed{3}
\begin{bmatrix}
\textit{sound-f-rel} \\
\text{STIM} \quad \boxed{1} \\
\text{EXP} \quad \textit{ind} \\
\text{PER}
\begin{bmatrix}
\textit{sound-of-rel} \\
\text{INST} \quad \boxed{2} \\
\text{P-SOURCE} \quad \boxed{1}
\end{bmatrix}
\end{bmatrix},
\begin{bmatrix}
\textit{naming-rel} \\
\text{NAME} \quad \textit{jane} \\
\text{IND} \quad \boxed{1}
\end{bmatrix},
\begin{bmatrix}
\textit{amazing-rel} \\
\text{ARG} \quad \boxed{2}
\end{bmatrix}
\right\rangle
\end{bmatrix}
$$

However, as noted by Kay (2021, fn.1), in addition to its perception sense, the verb *sound* has a "hearsay" sense. In this case, Jane is not a perceptual source, however something about Jane, in this case something the speaker is hearing about her, is causing the speaker to infer that she is amazing. In this *perceptual inference report*, the adjective *amazing* is predicated of Jane.

---

[17] A similar case is *The stranger smells bad*, discussed by Asudeh (2012, 389ff).

(77)   The hearsay reading of (75)

$$\begin{bmatrix} \text{LTOP} \; \boxed{5} \\ \\ \text{RELS} \; \left\langle \begin{bmatrix} \textit{p-seem-rel} \\ \text{STIM} \quad \boxed{1} \\ \text{EXP} \quad \boxed{4} \\ \\ \text{PER} \begin{bmatrix} \textit{seem-of-rel} \\ \text{INST} \qquad \boxed{2} \\ \text{P-SOURCE} \quad \boxed{1} \end{bmatrix} \end{bmatrix}, \begin{bmatrix} \textit{naming-rel} \\ \text{NAME} \quad \textit{jane} \\ \text{IND} \qquad \boxed{1} \end{bmatrix}, \boxed{3}\begin{bmatrix} \textit{amazing-rel} \\ \text{ARG} \quad \boxed{1} \end{bmatrix}, \\ \\ \boxed{5}\begin{bmatrix} \textit{inference-rel} \\ \text{E-SOURCE} \quad \boxed{2} \\ \text{INFERENCE} \quad \boxed{3} \\ \text{EVALUATOR} \quad \boxed{4} \end{bmatrix} \right\rangle \end{bmatrix}$$
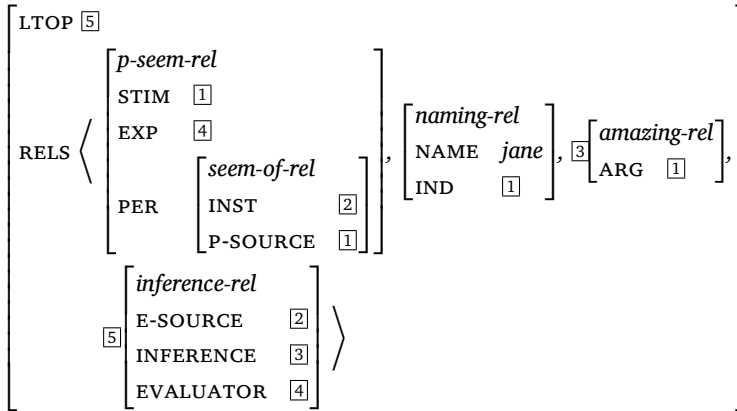
The fact that in the hearsay reading the verb is not interpreted literally in its auditory sense and that the referent of the subject, *Jane* in this case, is not the perceptual source is reflected by the semantic relation that is associated with it in (77): the bleached *p-seem-rel*. A flip perception verb attains this meaning by way of a lexical rule which applied to a subset of the verbs and creates a semantically bleached version of them. Admittedly, this is a very formal and sparse representation which does not express the nuanced sense of *sound* in its hearsay sense.

More generally, the formal analysis proposed here is naturally categorical, while the data itself is fuzzy and gradient. The semantic relations type hierarchy (in (48)) divides the verb senses into discrete categories, although the behavior of the verbs in each category is not uniform. For example, Landau (2011, p. 788) observes that among the verbs categorized here as "unbleachable" flip perception verbs, *smell* and *feel* are "less choosy in their perceptual implications" than *taste* in that they are also used metaphorically. This gradience is not reflected in the hierarchy. Similarly, the conditions which Rudolph (2019) discovered for licensing utterances in "absent cook contexts" e.g., the distinction between stage-level and individual-level predicates, is not formalized in this analysis. Moreover, the pragmatic constraints which determine whether a particular perception warrants an inference may not be amenable to a formal analysis. Thus, for example, how can a formal analysis account for the distinction between

the ungrammatical *Bill appears as if Mary is intelligent* and the grammatical *You sound as if the man has no choice in the matter*? As mentioned earlier with regards to Kim's (2014) analysis, the need to reconcile formal constraints with pragmatic preferences is a huge challenge which is inescapable when authentic corpus examples are taken into account.

Nevertheless, the analysis presented in this paper provides a new perspective on a construction for which competing analyses have been proposed in the literature and for which there is no consensus even regarding its descriptive characterization. The new functional approach extended the scope of the phenomena beyond the disputed constructions and proposed a unified account of a larger dataset. Although the formalization of the analysis abstracts away from nuanced semantic and pragmatic distinctions and constraints,[18] it promotes consistency, clarity and attention to detail. Moreover, it is contextualized within a larger body of research conducted in a coherent and comprehensive theoretical framework.

## ACKNOWLEDGMENTS

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[18] One specific issue which requires further consideration is the compatibility of the proposed analysis with scope phenomena discussed by Asudeh (2004, 2012). It is left for future research.

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