Chapter 42

LFG and Minimalism

Peter Sells
University of York

I compare and contrast LFG and the Minimalist Program (Chomsky 1995) with regard to different overall aspects of the frameworks: fundamental design properties, the representation of phrase structure, the representation of clausal grammatical information, the nature and role of syntactic features, and the analysis of agreement.

1 A framework for comparison

LFG and the Minimalist Program (MP; Chomsky 1995, 2000) are not straightforwardly comparable, as they are articulated in quite different ways. Going back to the 1980s, it could be said that LFG and Government-Binding Theory (Chomsky 1981) had a certain amount of commonality of approach, but as MP has developed from the earlier Government-Binding theory (GB), more and more emphasis has been placed in MP on derivation (see e.g. Hornstein et al. 2006; Hornstein 2018), rather than on information and representation, which are of course cornerstones of LFG.

As both LFG and GB were responses to theoretical concerns about "classical" transformational grammar, which was developed during the 1970s, it is useful to start with the legacy of the early transformational period, which I summarize in (1):

(1) a. the overt part of syntax is represented in a phrase structure tree
    b. all information in syntax is structured
    c. different parts of a syntactic representation may share information

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As GB has developed into MP, it has been assumed that (1b-c) refer to the same structure as (1a): that only the structures of phrase structure represent syntactic information, and that relationships are expressed in that structure, being established by movement operations. For instance, topicalization of an object creates a relationship between a topic position and an object position, as a result of a derivational operation in the MP.

LFG is a framework which is also based on the principle that all syntactic information is structured, but importantly that not all syntactic information is structure in the sense of phrase structure, and so it embodies (1) by having (at least) three aspects to the overall representation of a sentence:

(2) a. overt phrase structure (c-structure)
    b. a clause-level representation of the information it conveys (f-structure)
    c. an argument-structure representation for predicate-argument structure (a-structure)

All syntactic frameworks have a means to represent argument structure, and for any given predicate, its argument structure is structured according to the Thematic Hierarchy (e.g. Jackendoff 1972) or something equivalent. This is a-structure in LFG (see Findlay & Kibort forthcoming [this volume]). There is a mapping between this structure and the surface grammatical properties, f-structure, which is the representation of (2b). These properties include the GFs such as SUBJ and OBJ. The representation of clausal grammatical information (2b) is not part of the phrase structure representation (2a), but rather is the information that the overt structure conveys. This clausal representation is nevertheless structured in the sense that the information it contains is organized and grouped, according to principles of organization pertinent to this level.

This is different to the approach to clausal information in the MP, where information may start out quite distributed throughout the overall derivation, but can be aggregrated through successive movements, but also modified (e.g. a feature specification being used to drive one operation, then being deleted subsequent to the application of that operation; see Section 4.2). The core arguments of a predicate are merged first into a vP-VP structure (see Chomsky 1995: 315ff.) and this is the representation of argument structure; the internal argument(s) merge into VP and the external argument is the specifier of vP. Then further functional structure such as TP or CP is projected above vP. Functional or relational properties such as 'subject' and 'object' are characterized by the particular 'Agree' relations between v and Obj and between T and Subj.

Broadly speaking, the "subjecthood" properties identified by Keenan (1976) divide into those which properly refer to argument structure, and those which refer to clausal grammatical information (Manning 1996). Different syntactic phenomena may relate to either representation. For instance, anaphor binding is determined by the argument structure hierarchy in some languages (e.g. Schachter 1976 on Tagalog; Wechsler & Arka 1998 on Balinese). In other languages, the hierarchy of grammatical functions holding over f-structure is most relevant (see e.g. Bresnan 2001: 212–213; Bresnan et al. 2016: 217 on 'syntactic rank').

The representations of argument structure and of clausal information are largely language-invariant, though the mapping between them shows more variation, as do the ways in which different syntactic phenomena refer to them. The information that they represent is carried by the overt phrase structures, (2a), which are of course subject to the most variation, and therefore the least revealing about "deep" properties of language.

In this chapter I evaluate different aspects of the LFG and MP approaches to grammatical theory. In Section 2 I consider overall "design features" of the frameworks, and what motivates them. In particular I outline how LFG took a different direction from transformational grammar. In Section 3 I contrast the approaches of the frameworks to phrase structure, and how the balance of analysis between c-structure and f-structure falls in LFG. Finally in Section 4 I compare the role(s) that features play in LFG and in MP, and how featural specifications participate in agreement.

2 Design features of a grammatical framework

Kaplan (2019a) gives a personal statement of how the passage below from Chomsky (1965) inspired his research which became part of the foundation of LFG (see e.g. Kaplan & Bresnan 1982: 173–174):

> No doubt, a reasonable model of language use will incorporate, as a basic component, the generative grammar that expresses the speaker-hearer's knowledge of the language; but this generative grammar does not, in itself, prescribe the character or functioning of a perceptual model or a model of speech production. (Chomsky 1965: 9)

Kaplan also pursued the idea that linguistic complexity will be best modelled through (possibly complex) interactions of different (relatively simple) components, different representational dimensions, inspired by Simon (1962).

In this section I will consider how LFG addresses the core aims of a generative grammar, and how it has done so according to certain key foundational properties which set it apart from the procedural approach which has characterized the GB/MP approach led by Chomsky.

2.1 Levels of adequacy

One way to approach how a given framework takes up the agenda for Generative Grammar is to consider how the framework concerns itself with Chomsky's successive levels of adequacy:

> To summarize briefly, there are two respects in which one can speak of "justifying a generative grammar." On one level (that of descriptive adequacy), the grammar is justified to the extent that it correctly describes its object, namely the linguistic intuition – the tacit competence – of the native speaker. In this sense, the grammar is justified on external grounds, on grounds of correspondence to linguistic fact. On a much deeper and hence much more rarely attainable level (that of explanatory adequacy), a grammar is justified to the extent that it is a principled descriptively adequate system, in that the linguistic theory with which it is associated selects this grammar over others, given primary linguistic data with which all are compatible. In this sense, the grammar is justified on internal grounds, on grounds of its relation to a linguistic theory that constitutes an explanatory hypothesis about the form of language as such. The problem of internal justification – of explanatory adequacy – is essentially the problem of constructing a theory of language acquisition, an account of the specific innate abilities that make this achievement possible. (Chomsky 1965: 26–27)

Since the GB era, Chomsky has taken explanatory adequacy to be the focus of syntactic theorizing (Rizzi 2016; D'Alessandro 2019). Yet to do this presupposes that there is a core of facts and generalizations so that there is a stable set of grammars which satisfy descriptive adequacy. Hornstein (2018: 55) presents a list of structural properties that syntacticians might agree are the "mid-level generalizations" of grammar; see also D'Alessandro (2019: 8) for a summary. For instance, data as in (3)–(4), from Chomsky (1973: 261), lead to well-established generalizations to classify verbs as being raising or control predicates, and binding conditions on anaphors and pronouns:

(3) a. They appeared to John to like each other.
    b. * They appealed to John to like each other.

(4) a. * We appeared to John to like us.
b. We appealed to John to like us.

At the level of what facts and what kinds of facts are in the domain of syntax – such as those just given – frameworks such as GB/MP, LFG, and HPSG (Pollard & Sag 1987, 1994) are roughly commensurate, and so can be compared as to how they embody descriptive adequacy. Of course the formal details of a syntactic system which is intended to have a good "correspondence to linguistic fact" vary between each framework, but these are the easiest points of comparison. I take up this kind of comparison in Sections 3 and 4 below.

LFG is a framework which has been developed to address descriptive adequacy, and which can be part of broader cognitive or computational approaches to human language, following the first Chomsky quote above. In this sense, it perhaps could be argued that LFG committed 40 years ago to what has become known in the MP literature as Chomsky's "third factor" (Chomsky 2005: 6) for explaining the format of grammatical knowledge:

(5) "... we should, therefore, be seeking three factors that enter into the growth of language in the individual:
1. Genetic endowment, apparently nearly uniform for the species, which interprets part of the environment as linguistic experience, ...
2. Experience, which leads to variation, within a fairly narrow range, ...
3. Principles not specific to the faculty of language ...
   - principles of data analysis that might be used in language acquisition
   - principles of structural architecture
   - principles of efficient computation"

The GB perspective on the language faculty put a great burden on an innate Universal Grammar which is essentially a parameterized blueprint for any individual grammar. This corresponds to Chomsky's first factor. Over the last 25 years, the trend in the development of the MP has been to reduce reliance on this purely innate component of grammar, in favor of the third factor. The reference in that factor to principles of data analysis and of structural architecture is quite salient as these are the principles at the basis of the considerations I raise in the next subsection, though of course this is not to imply that frameworks

such as LFG deny that there are any 'first factor' properties or principles of our language capacity. However, as O'Grady (2012: 498) comments: "… the shift of focus to third-factor effects in generative grammar marks a milestone of sorts. Not because the idea is new, for it is not. Broadly speaking, the rest of the field has been committed to the primacy of third-factor explanations for decades."

2.2 Foundational properties of syntactic systems

What kinds of property are fundamental to syntax, to be emergent from a theory which "constitutes an explanatory hypothesis about the form of language", as in Chomsky's notion of explanatory adequacy? From the Minimalist perspective, the key notion here is the binary merge of abstract syntactic elements – 'External Merge' for initial structure-building, and 'Internal Merge' for movement from an existing position to another one. The structure is built up incrementally, with steps in the derivation driven by categorial requirements of combination or by features (see Section 3.2 and Section 4.2 below); the terminal nodes of the structure are spelled out morphologically after the syntactic operations have taken place.

LFG has taken a different starting point as to what the key properties of syntax are; in the rest of this subsection I highlight the consequences of a few examples which determine the 'lexicalist' and 'functional' (that is, information-based) aspects of LFG.

2.2.1 Lexicalist

LFG is a lexicalist framework, built on the assumption that the terminals in the phrase structure are word-level entities, the X^0s of X′-theory. The roots of this approach are in the Lexicalist Hypothesis of Chomsky (1970). Chomsky argued that the shared properties of different words based on the same lexeme could be accounted for without recourse to transformation (a nominalization transformation for the specific examples considered in that paper), and he introduced X′-theory to account for structural similarities across categories. LFG, like other declarative frameworks, expands on this perspective, using other syntactic information not directly represented in the phrase structure (cf. (2)) to capture the appropriate similarities. An X^0 may be internally complex, carrying the same kinds of information as may be expressed by other elements or configurations in the syntax, but formed according to its constraints on morphology, not on syntax.

The following Swedish example from Müller & Wechsler (2014: 29) illustrates several properties which motivate the lexicalist analysis. It involves coordination of an active and a passive verb:

(6) Swedish
Golfklubben begärde och beviljade-s marklov för
golf.club.DEF requested and granted-PASS ground.permit for
banbygget efter en hel del förhandlingar och kompromisser
track.build.DEF after a whole part negotiations and compromises
med Länsstyrelsen och Naturvårdsverket.
with county.board.DEF and nature.protection.agency.DEF
'The golf club requested and was granted a ground permit for track construction after a lot of negotiations and compromises with the County Board and the Environmental Protection Agency.'

Müller and Wechsler argue that this example does not involve Right-Node Raising, but rather coordination of two finite verbs at the X^0-level (*begärde och beviljades*). Each verb is a syntactic word, marked for past tense (the *de* part of each), and the second one is marked for passive (the *s*). Hence the voice alternation active/passive is represented on single words, and does not involve spans of structure involving separate heads such as V, v, and Voice. Additionally, the second verb is a straightforward counterexample to the 'Mirror Principle' (Baker 1985), which is supposed to diagnose a close relationship between syntactic structure and word-internal morpheme structure. Swedish passive *-s* always appears external to other tense or aspectual suffixes on the word, even though in an expanded MP-style clausal structure the Voice head would be taken to be lower than and therefore closer to the lexeme stem with respect to Aspect or Tense heads.

The French example in (7) also motivates both the lexicalist approach, as well as the design feature that agreement is not directional.

(7) French
Je suis heureuse.
I am happy.F.SG
'I am happy.' (spoken by a female)

Neither the subject pronoun *je* nor the inflected verb *suis* are categorized or marked for gender – as in English and many other languages – yet the predicate adjective is marked as feminine (and singular). The non-formal linguistic

intuition that the adjective agrees with its subject, or "agrees with a noun", has been the basis of many formalized linguistic analyses: the predicate adjective is a target and the subject should be its controller. Yet there is no plausible source in the lexical content of (7) for a feminine gender specification except for the adjective. It is certainly true of the *sentence* (7) that it expresses a meaning involving a feminine subject, but the morphosyntactic basis of that meaning could not be *je* or *suis*, under any plausible analysis of those words.

This example is very powerful. From it, it follows then that *heureuse* is a lexical item marked for feminine gender independently of the syntactic structure in which it appears, as there is no source for feminine in the rest of the structure. This entails the Lexicalist Hypothesis, as each X^0 in the syntactic structure has properties that do not refer to any other X^0 in the structure – usually referred to as 'Lexical Integrity' (e.g. Bresnan 2001: 92; Bresnan et al. 2016: 92).

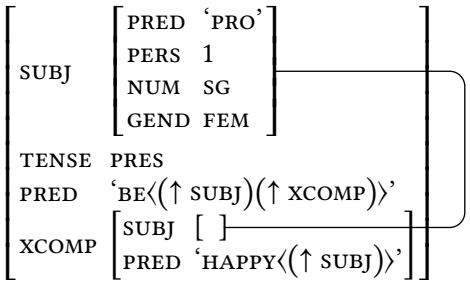
2.2.2 Information-based clausal representation

Next, from the same example, it follows that "agreement" is the name we give to a situation in which two or more syntactic elements put constraints on a single informational unit, but that there is no priority of one element over the other(s). In (7), all three such elements (the words in this case) put constraints on what the subject is; and as the combination of those constraints is not contradictory, the example is well-formed. The f-structure contribution of each word is shown in (8). (9) shows the f-structure for the full example.

(8) a.
$$\begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 1 \\ \text{NUM} & \text{SG} \end{bmatrix}$$
= je

b.
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PERS} & 1 \\ \text{NUM} & \text{SG} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{'BE}\langle(\uparrow \text{SUBJ})(\uparrow \text{XCOMP})\rangle\text{'} \\ \text{XCOMP} & \begin{bmatrix} \text{SUBJ} & [\ ] \end{bmatrix} \end{bmatrix}$$
= suis

c.
$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{GEND} & \text{FEM} \end{bmatrix} \\ \text{PRED} & \text{'HAPPY}\langle(\uparrow \text{SUBJ})\rangle\text{'} \end{bmatrix}$$
= heureuse

(9)


Local syntactic relationships indicated by the structure-sharing seen above are typically located in a predicate – these will involve what kind of arguments the predicate takes, possibly specifications of case, whether it is a raising or control predicate, agreement information, and so on. The apparent directionality of agreement seen in canonical examples has nothing to do with "agreement" itself – as a mechanism of agreement does not exist – but rather comes from the second property of *suis*, that it is effectively a raising predicate, and so whatever is true of its complement's subject is true of its subject. In (9) the information shown as the value of SUBJ is the minimal amount of which the constraints coming from each of the entries in (8) is true.

With regard to the implications for explanatory adequacy, this simple example shows that the format of grammars is only consistent with those that lack derivation and directionality – in other words, if the hypothesis space is restricted to declaratively stated grammars, we expect that languages will quite generally show examples like (7). In Section 4.3, I take up in more detail the key information-based properties of what we informally refer to as "agreement".

Other examples also show the importance of the information that an item carries over its phrase structure properties. (10) (originally from Hudson 1977; see also Gazdar et al. 1985: 64; Bresnan 2001: 19, Bresnan et al. 2016: 14) illustrates one of the "paradoxes of movement":

(10) a. * I aren't happy.
b. Aren't I happy?

An initial positioning of an internally-negated auxiliary is taken as evidence in movement analyses that the auxiliary has undergone several movements, combining with Neg and then with T[ense] before moving to C. However, from the notional analytic source *I am not happy* there is no pre-T-to-C version **I amn't happy*, as in (standard) English there is no form *amn't*, and (10a) is also ungrammatical. In this use, then, the form *aren't* is a word which can only appear in the C, or inverted-aux, position, but not in any other position. In terms familiar from

the early days of transformational grammar, (10b) would have to be analyzed as a grammatical example derived from an ungrammatical source.

The contrast in (10) shows that the syntactic properties that an item has (being a tensed negated auxiliary in this case) are not inexorably associated with structural derivations which aggregate information. A movement-based account of (10) would have to assume that the syntactic features of *aren't* can be assembled on T, and from there moved to C, but that there is no lexical item which can spell out those features on T, but only on C. In other words, what actually matters is the surface position of the realization of a set of syntactic properties, not where (or where else) those properties came from. This is exactly what a declarative framework such as LFG provides, with the same implication for explanatory adequacy – if an element in a higher position must correspond to a derivationally related version of itself in a lower position, pairs like (10) should not exist. But they do exist, and they show that the format of grammars should recognize that words have bundles of features which are associated with (sets of) syntactic positions. Within the broader Miminalist approach, the realizational account of morphology in the Distributed Morphology framework (Halle & Marantz 1993; see Bobaljik 2017 for a recent overview) has the same sensitivity to syntactic position: for *aren't*, a rule of vocabulary insertion could be made sensitive to the collection of relevant syntactic features in the context of C, but not of T.

2.3 Rules and representations

As syntactic frameworks have developed since the 1980s, they have diverged as to whether the focus is on constraints stated on representations, or on steps in a procedural derivation. Government-Binding theory has a mix of properties: conditions on rule application and conditions on representations. For instance, the examples above in (3)–(4) involve *appear* as a raising predicate which requires an operation of the rule Move-α, while *appeal* is a control predicate which requires a representational check involving a PRO subject (see e.g. Haegeman 1994 for a summary of GB). More recently, the "movement theory of Control" (e.g. Hornstein & Polinsky 2010) eliminates the representational condition on the empty category subject in favor of a derivational analysis similar in the relevant ways to the one for the raising predicate.

The GB Binding Theory Principles A and B were originally each stated as a condition on a representation. For instance, Principle A looks for a specific relationship of coindexing between antecedent and anaphor within a certain domain; reinterpreted as a condition on rule application, the principle must involve

an operation of movement up to (near) the antecedent, within a certain domain, following an idea first proposed in Lebeaux (1983).

In the development of the MP, Chomsky has taken the view that as some aspects of the grammar are procedural, and so require conditions on rule application, parsimony would dictate that all grammatical conditions are of that type, with no conditions on representation. Hence the levels of GB over which representational conditions were stated were eliminated. The MP is an attempt to deconstruct GB along purely procedural aspects (see e.g. Hornstein 2018: 54) – in the limit, there is no "stopping off" at any point to evaluate a representation. In fact, though, each step in a derivation must involve a local representation – but one within which or to which some further operation should take place. The proposed operation of 'Minimal Search' for the operation *Agree* (Chomsky 2007: 9) must inspect a structure to find something within it – here, an element W probing within a structure Z – and the outcome of that will constrain what (procedurally) can happen next: "Since W contains all information relevant to further computation involving Z, W is also necessarily the probe that selects a goal in any internal modification of Z. Minimal search conditions limit the goal of the probe to its complement, the smallest searchable domain."

The output of syntax is fed to the 'interfaces'. On the semantic side, the end of the syntactic derivation corresponds to the GB level of Logical Form (LF), which feeds to the 'conceptual-intentional' interface. On the phonetic side, the overt output of the derivation is spelled-out to Phonetic Form (PF), which feeds to the interface known as 'articulatory-perceptual' or 'sensorimotor' (see e.g. Chomsky 1995: 2, Chomsky 2007: 5). One leading idea of the Minimalist Programme is that LF and PF have no properties specific to them; rather, any apparent well-formedness conditions are due entirely to properties of the interfaces.

Within the core domain of syntax, there seem to be several phenomena which bear on the issue of rules vs. representations, and which appear to favor the latter – because their analysis seems irreducibly representational. I will mention two different instances and then go on to two others in more detail. First, as just noted, the MP operation of Agree has to access a representation, in order to establish a relation between Probe and Goal (see also Section 4.2). Second, the approach to case marking known as 'Dependent Case' (e.g. Baker 2015) calculates the case values of NPs by referring to larger structure – the underlying intuition being that in a clause containing two NPs, a subject c-commanding an object, the marked case value of Accusative for the object is the value assigned to an NP c-commanded by another, and in a typologically different system, the marked case value of Ergative for the subject is the value assigned to an NP

which c-commands another. Hence the computation of case values must refer to a structural representation.

I now go in more depth into two instances which illustrate a different kind of representational condition – a negative condition. It is difficult to imagine how such conditions could successfully be captured procedurally. Returning to the binding conditions of GB, for Principle A, there have been different proposals to reinterpret it derivationally, for instance Lidz & Idsardi (1998), Hornstein (2001) and Boeckx et al. (2007), though others take a more traditional view, such as Safir (2008) and Charnavel & Sportiche (2016). While Principle A requires two elements to have a certain relationship, Principle B forbids two elements from having a certain relationship – it is a negative condition. A procedural reinterpretation does not seem directly possible for Principle B, as it requires disjointness (unless perhaps the system of recording contra-indexing of Chomsky 1980 is revived), though Reuland (2011) presents a revised Binding Theory which refers to properties of predicates and semantic constraints on the interpretation of their arguments.

Principles A and B as they apply to English are familiar. In some languages, with anaphoric systems more complex than that found in English, conditions on the various elements of the system may involve both positive and negative constraints – such as in Norwegian (Dalrymple 2001: 279–288, Bresnan et al. 2016: 259–261). Norwegian has four relevant anaphor/pronoun forms, shown in (11) with their LFG binding properties. The content of the binding properties is given in (12):

(11) Featural analysis of Norwegian pronouns:

a. seg [+sbj, −ncl]
b. ham [−ncl]
c. seg selv [+sbj, +ncl]
d. ham selv [−sbj, +ncl]

(12) a. [+sbj, −ncl] – The antecedent must be a subject in the minimal finite domain outside of the minimal nucleus containing the pronoun.
b. [−ncl] – The antecedent must be outside of the minimal nucleus containing the pronoun.
c. [+sbj, +ncl] – The antecedent must be a subject in the minimal nucleus containing the pronoun.
d. [−sbj, +ncl] – The antecedent must be a nonsubject in the minimal nucleus containing the pronoun.

The negative conditions here seem to refer crucially to representations – to check that a relationship does not hold in a certain local domain, or to check that a relationship does hold, but not with a subject.

A different consideration about the role of representations comes from the distribution of the depictive *sisxoli* 'alone' in Tsez, a language of the Caucasus which has an ergative-absolutive case marking system. The depictive may be associated with a preceding NP, but may not itself precede its NP associate (Polinsky 2000). Hence the depictive has two possible associates in (13a), one in (13b), and none in (13c).

(13) Tzez

a. kid-bā ziya sisxoli bišer-si
girl-ERG cow.ABS alone feed-PST.EVID
'The girl$_i$ alone$_i$ fed the cow.'
'The girl fed the cow$_i$ alone$_i$.'

b. kid-bā sisxoli ziya bišer-si
girl-ERG alone cow.ABS feed-PST.EVID
'The girl$_i$ alone$_i$ fed the cow.'
*'The girl fed the cow$_i$ alone$_i$.'

c. * sisxoli kid-bā ziya bišer-si
alone girl-ERG cow.ABS feed-PST.EVID

The linear precedence condition is reinterpreted as one of c-command in later discussions of these same examples in Polinsky & Potsdam (2006) and Fukuda (2008) – the associate must c-command the depictive.

The distribution of the depictive becomes more interesting in the context of raising and control predicates. In Tsez the predicate *yoq-* 'begin' is ambiguous between control and raising, and in fact is a backward control predicate in its control use or a forward raising predicate in its raising use (Polinsky & Potsdam 2006). In LFG, the higher and lower SUBJ values of control or raising are structure-shared in f-structure, and as discussed in Sells (2006) that f-structure property is consistent with c-structure expression of the relevant argument in the matrix clause ('forward') or in the embedded clause ('backward'). (14a) is an interesting example regarding the syntax of the depictive, as it is grammatical even though the depictive apparently precedes its associate. Polinsky & Potsdam (2006) analyze this as a backward control structure: a null (absolutive) subject of 'begin', indicated by ∅ in (14b), controls the lower (ergative) subject of 'feed'. ∅ is used here as a notation to suggest the analysis of the example, but it has no actual

correspondent in the c-structure, as is standard in the LFG analysis of control and raising. In this example, it is the null matrix argument indicated by ∅ which is the associate of the depictive, and both are constituents of the main clause (see the f-structure in (17) below):

(14) Tzez

a. sisxoli kid-bā ziya bišra yoq-si (backward control)
alone girl-ERG cow.ABS feed begin-PST.EVID
'The girl$_i$ alone$_i$ began to feed the cow.'
*'The girl began to feed the cow$_i$ alone$_i$.'

b. ∅$_i$ sisxoli [kid-bā$_i$ ziya bišra] yoq-si
alone [girl-ERG cow.ABS feed] begin-PST.EVID

The other use of *yoq-* is as a regular forward raising predicate. Its subject is in absolutive case as the predicate is not formally transitive, and the subject in the lower clause is the empty position, again indicated here by ∅. As seen in (15a), with the syntactic analysis in (15b), the same order of elements as in (14a) is ungrammatical in this instance, as the depictive does indeed precede its associate:

(15) Tzez

a. * sisxoli kid [ziya bišra] yoq-si (forward raising)
alone girl-ABS [cow.ABS feed] begin-PST.EVID

b. * sisxoli kid$_i$ [∅$_i$ ziya bišra] yoq-si
alone girl-ABS [cow.ABS feed] begin-PST.EVID

The LFG account of these data requires the concepts of f-command, which is like c-command but stated on f-structure, and of f-precedence (see Glossary for f-command and f-precedence). This latter concept makes reference to the c-structure expression(s) – if any – of f-structure elements. Crucially, an element such as a null argument which is present only in f-structure, but not in c-structure, has no (f-)precedence relations defined on it (Bresnan 2001: 195; Bresnan et al. 2016: 213). The LFG analysis of the Tsez depictive can be stated simply as in (16):

(16) a. The associate and the depictive f-command each other.
b. The depictive must not f-precede the associate.

(16a) is essentially a clause-mate condition, and (16b) is a negative condition. It does not require that the associate f-precede the depictive, but rather that the depictive does not f-precede the associate.

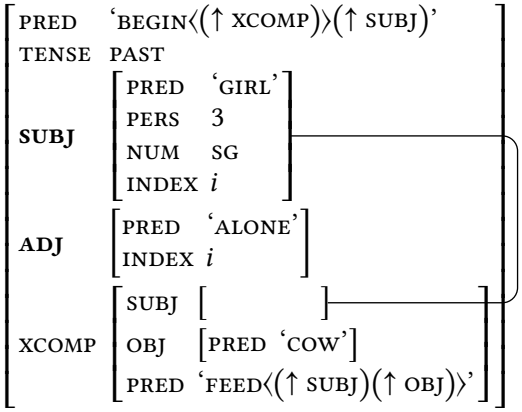
The f-structure of (14) is shown in (17), leaving out the case values of the arguments, which would formally conflict under straightforward structure-sharing (i.e. formal equality in LFG terms). The case values require a slightly nuanced analysis, whatever the framework (see Polinsky & Potsdam 2002, Sells 2006). For presentational purposes, I assume here that the formal relation between depictive and associate is that they share an INDEX value. Their GFs which f-command each other are indicated by the boldface GF names, in the matrix nucleus. The matrix SUBJ is structure-shared with the embedded SUBJ as the predicate is backward control. While there is a matrix SUBJ in f-structure, it has no c-structure expression (there is no '∅' in the c-structure); only the embedded subject is present in c-structure. Consequently, limited to the matrix f-structure in which the associate and depictive f-command each other, no precedence relation is defined on the boldface SUBJ, and so the condition in (16b) is also satisfied.

(17) F-structure of (14), ignoring the case values. **ADJ** does not f-precede **SUBJ**:

$$\begin{bmatrix}
\text{PRED} & \text{'BEGIN}\langle(\uparrow \text{SUBJ})(\uparrow \text{XCOMP})\rangle' \\
\text{TENSE} & \text{PAST} \\
\textbf{SUBJ} & [\quad] \\
\textbf{ADJ} & \begin{bmatrix} \text{PRED} & \text{'ALONE'} \\ \text{INDEX} & i \end{bmatrix} \\
\text{XCOMP} & \begin{bmatrix}
\text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'GIRL'} \\ \text{PERS} & 3 \\ \text{NUM} & \text{SG} \\ \text{INDEX} & i \end{bmatrix} \\
\text{OBJ} & [\text{PRED 'COW'}] \\
\text{PRED} & \text{'FEED}\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle'
\end{bmatrix}
\end{bmatrix}$$

In contrast, for (15), involving a forward raising use of the predicate, the constraint in (16b) is not satisfied, because the SUBJ is overt in the matrix clause, and so f-precedes the depictive ADJ.

(18) F-structure of (15), ignoring the case conflict. **ADJ** f-precedes **SUBJ**:



The Minimalist account in Polinsky & Potsdam (2006) (see also Fukuda 2008) is stated in terms of positive conditions, of which (19b) is the important one.

(19) a. The associate and the depictive are clause-mates.
b. The associate c-commands/binds (≡ precedes) the depictive.

What is interesting about (19b) is that it can only be successfully interpreted representationally. Suppose that at one point in the derivation, the associate (whether overt or covert) c-commands the depictive, and the relevant syntactic relationship is established, satisfying (19b). However, what is to prevent some later operation which scrambles the depictive higher, so that it c-commands its associate, in violation of (19b)? To prevent this possibility, (19b) must be interpreted as an output condition on the "final" representation, regardless of when during the derivation the relation between associate and depictive has been established. Hence even though (19b) is a positive condition, not a negative one, it is necessarily representational.

In the LFG analysis, (16b) is necessarily a negative condition, as the null subject in backward control is only represented in f-structure (14), and so could never be evaluated against a positive precedence condition like (19b). Evidence from other languages supports the position that null arguments are present in f-structure but absent from c-structure. Null pronouns in Malayalam are not sensitive to f-precedence conditions, unlike overt pronouns (Mohanan 1983: 664–665). Kameyama (1985) presents a similar argument for Japanese (summarized in Dalrymple 2001: 171ff. and 288ff.). For Malayalam, Mohanan observes that an overt pronoun may not precede its antecedent – compare (20) and (21a) with (21b) –

while a null pronoun (indicated for presentational purposes by *pro* in (21b)) may 'precede' its antecedent:

(20) Malayalam

a. [kuṭṭiyute ammaye] awan nuḷḷi
[child.GEN mother.ACC] he.NOM pinched
'He$_i$ pinched the child$_i$'s mother.'

b. * [awante ammaye] kuṭṭi nuḷḷi
[he.GEN mother.ACC] child.NOM pinched
'The child$_i$ pinched his$_i$ mother.'

(21) Malayalam

a. [awan aanaye nuḷḷiyaṯinə šeeṣam] kuṭṭi$_i$ uraŋŋi
[he.NOM elephant.ACC pinched.it after] child.NOM slept
'The child$_i$ slept [after he$_{*i/j}$ pinched the elephant].'

b. [*pro* aanaye nuḷḷiyaṯinə šeeṣam] kuṭṭi$_i$ uraŋŋi
[elephant.ACC pinched.it after] child.NOM slept
'The child$_i$ slept [after he$_{i,j}$ pinched the elephant].'

The overt pronoun 'he' in (21a) may not take 'child' as its antecedent, as the former precedes the latter, but this restriction is not there with the null pronoun in (21b). Why would overt and null pronouns have different precedence conditions on them? Mohanan (1983: 664) proposes that the correct analysis is that a pronoun cannot precede its antecedent, where precedence is defined on c-structure elements, such as overt pronouns, but is not defined for null pronouns, which are present only in f-structure.

Consider the c-structure relationships of the relevant parts of the examples, shown in (22a), with the f-structure of the example shown in (22b). The subscript numbers show the c-to-f-structure correspondences:

(22) a. C-structure:
(pronoun$_1$) pinched$_2$ child$_3$

b. F-structure:

$$\begin{bmatrix} \text{SUBJ} & {}_3\left[\text{PRED } \text{`CHILD'}\right] \\ \text{PRED} & \text{`SLEEP}\langle(\uparrow \text{SUBJ})\rangle\text{'} \\ \text{TENSE} & \text{PAST} \\ \text{ADJ} & {}_2\left\{\begin{bmatrix} \text{PRED} & \text{`PINCH'} \\ \text{SUBJ} & {}_1\left[\text{PRED } \text{`PRO'}\right] \end{bmatrix}\right\} \end{bmatrix}$$

In both examples in (21), the adjunct clause 2 f-precedes 3, 'child', because the c-structure correspondent(s) of 2 precede the correspondent(s) of 3. However with regard to 1 and 3, 1 f-precedes 3 only if 1 is present in c-structure, which is only the case in (21a). Hence the apparently different binding properties of pronouns reduce to their different properties in different parts of the syntactic analysis.

The implications of this analysis are far-reaching: if certain syntactic elements can have a range of grammatical properties without being represented in phrase structure – and the above is positive evidence that they are not represented in phrase structure – then every aspect of grammatical analysis which can or must refer to those properties must also be independent of any phrase structure representation, including phenomena such as subjecthood, agreement, binding, and so on.

Declarative frameworks have different dimensions of analysis – such as c-structure and f-structure as described below – but not different levels in the sense that GB had (e.g. D-structure, S-structure). As there are no rules or operations, there are no conditions on rules, and so all conditions are stated over representations, as constraints.

3 Phrase Structure

3.1 Heads and headed structures

LFG c-structures have some similarities with the S-structures of late GB. A canonical clause (for an SVO language) is structured around what I refer to as a 'skeleton' with a 'spine' (Sells 2001: 17). (24) below shows the skeleton, and the spine corresponds to all the non-argumental parts, V, I, C and their projections. These are separate categories which participate in the familiar clausal extended projection (Grimshaw 2000: 116ff. Bresnan 2001: 100), often now referred to as the 'Hierarchy of Projections' (Adger 2003).

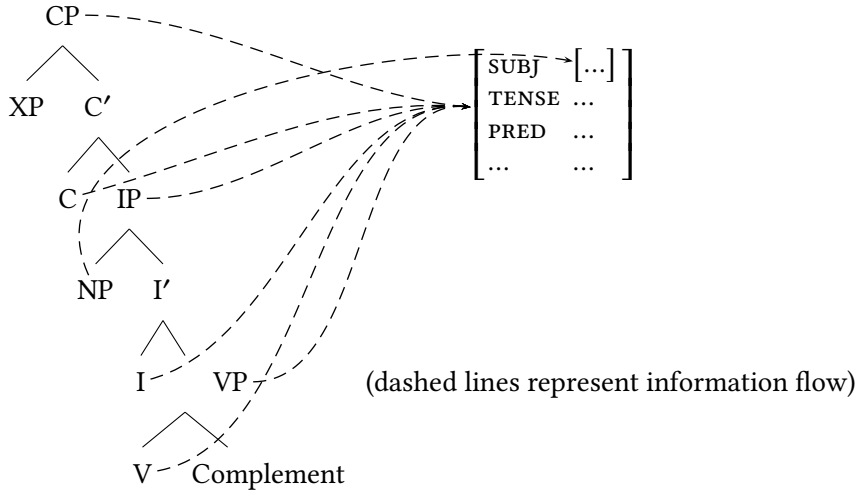
The formal relation in the c-structure between V and I and C is usually developed from the idea of 'extended projection' of Grimshaw (2000); see also Bresnan (2001: 100–101), Bresnan et al. (2016: 103). The clausal categories are all projections of the category verb, which is specified by the traditional labels [+V, −N] (Chomsky 1970).

(23) Extended Projections

a.	V = [+V, −N, P0]		(the zeroth-level projection of V)
b.	I = [+V, −N, P1]		(the first-level projection of V)
c.	C = [+V, −N, P2]		(the second-level projection of V)

The outline clause structure has specifiers of CP and IP, and complement position(s) within VP, schematized here with the placeholder label Complement.

(24)

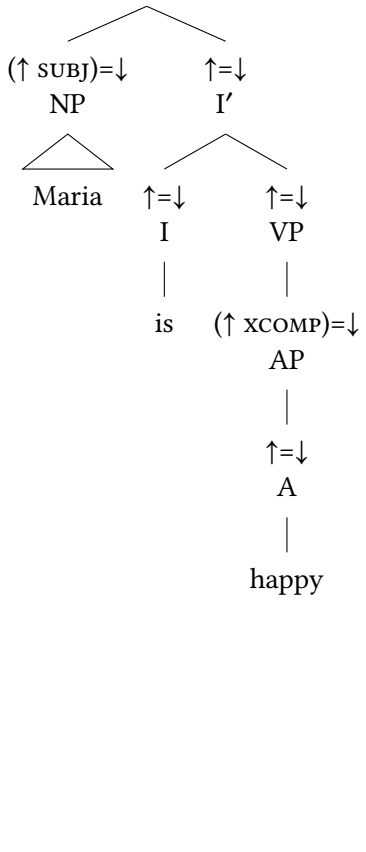


Each node in the c-structure is annotated as to how it contributes to the f-structure. The formal annotations on nodes are not shown in (24), for simplicity, but the dashed lines represent the way that information flows from the c-structure to the f-structure.

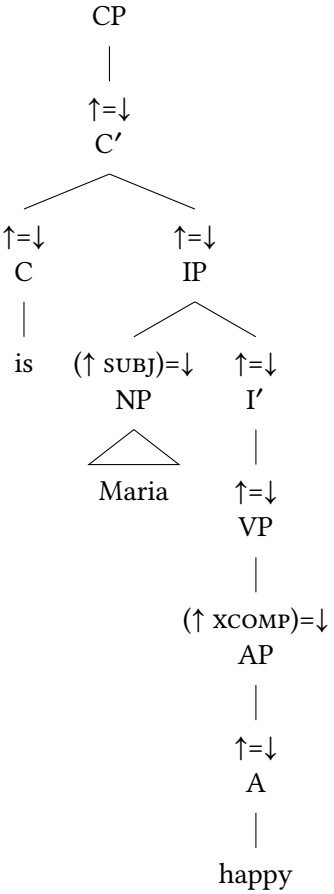
Every node in the clausal spine contributes its information to the main f-structure, as can be seen from the several lines converging on the outer f-structure, which represents the grammatical information of the clause (again for simplicity, I omit lines from the X′ nodes). The other nodes, XP, NP, and Complement, have different annotations on them, as they contribute to parts of the overall f-structure. For instance, the annotation on the node NP would indicate that its contribution is as the subject – in other words, NP as specifier of IP is the subject position. This is indicated by the dashed line going from NP in the c-structure to the value of SUBJ in the f-structure.

As far as clausal information is concerned, the verb itself contributes identically to the clause whether it is in V or in I or in C, a property usually referred to as 'head mobility' (see e.g. Bresnan 2001: 126ff. Bresnan et al. 2016: 129ff.). For instance, unless extra information is associated with the C node in (25b), both c-structures in (25) would determine the same f-structure:

(25) a.



b.



Head mobility can be illustrated with the c-structures above. On the assumption that the only VP can be the c-structure complement of I, then for the example *Maria is happy* in (25a) the VP lacks a c-structure head V, for the verb *is* is in I; and in (25b), for the string *Is Maria happy*, both IP and VP lack their X^0 heads. In these structures the finite form of *be* acts as an auxiliary verb, and so does not head a surface VP, but appears in a higher functional head position (in contrast *be* as a non-finite form would head VP, as in *Maria could [be happy]*).

Formally, the theory requires that every XP either has a c-structure head in the standard X′ sense, or that it maps to an f-structure shared with at least one YP which is headed in c-structure. Such a Y^0 is known as the 'extended head' of XP (the notion is originally due to Zaenen & Kaplan 1995: 221, revised to the formulation given here by Bresnan 2000: 353). So in (25a), I is the extended head of VP, and in (25b), C is the extended head of IP and of VP, leading to the illusion

that the head is "moving". Different verbal categories may be restricted, though, to particular c-structures positions: finite auxiliaries in English may only appear in I or C, not in V; finite non-auxiliaries must appear in V. Hence finite auxiliaries have the category [+V, −N, P>0] and finite verbs have the category [+V, −N, P0].

The discourse in the MP literature over the past 25 years as to whether head movement exists or whether it is part of 'narrow syntax' (see e.g. Roberts 2011; Harizanov & Gribanova 2019 for overviews) is quite puzzling from the perspective of declarative frameworks such as LFG or HPSG, as heads are central to the syntactic analysis. The issue arose in the development of the MP as position-occupying head movement does not obey the Extension Condition of Chomsky (1995), requiring that every operation of Merge extends the root node of the current tree. Head movement violates this condition, as it formally involves adjunction to a node lower than the root node (in contrast to XP adjunction, which does adjoin at the root). Consequently Chomsky raised the issue of the status of head movement (e.g. Chomsky 2000: 136–137; Chomsky 2001: 38) within the MP approach.

As the mapping from c-structure to f-structure in LFG suggests, the crucial fact about a clausal spine is that head positions share information, each being a functional co-head (see e.g. (25)). This is directly evidenced in various core cases of multiple expresssion of the same grammatical information in a single domain, as first described in LFG by Niño (1997). The same properties of clausal information are expressed on more than one head (see also Sells 2004, Lødrup 2014). The Finnish examples in (26) and (27) (Niño 1997: 135, 137) show the phenomenon:

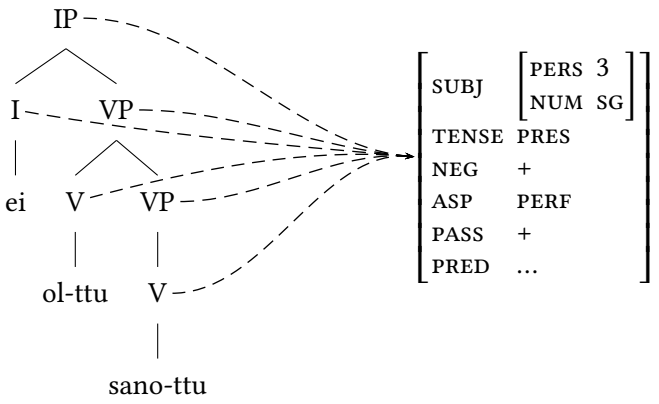
(26) Finnish
Äl-kää puhu-ko.
NEG.IMP-IMP.2.PL speak-IMP
'Don't (you pl.) speak!'

(27) Finnish
a. Ei ol-lut sano-ttu
NEG.3.SG PRF-PST.PTCP.SG say-PASS.PST.PTCP.SG
'It has not been said.'
b. Ei ol-ttu sano-ttu
NEG.3.SG PRF-PASS.PST.PTCP.SG say-PASS.PST.PTCP.SG
'It has not been said.'

(26) involves a special form of negation restricted to imperatives, as well as imperative marking on both the auxiliary and the main verb. In (27), singular

marking appears on all three words: the negative, which is a kind of auxiliary; another auxiliary; and the main verb. These examples also indicate that 'passive' is a feature in f-structure which can be accessed – see also Lødrup (2014) for evidence in Norwegian for the same conclusion. (27b) is a colloquial variant of (27a), in which the passive marking on the main verb also appears on the medial auxiliary. The c- and f-structure of (27b) are shown in (28). It can easily be seen that the constraints coming from each of the words in (27b) – using the glosses as a guide – are satisfied by this f-structure:

(28)



The co-head approach of LFG allows for different sources of the same constraint (e.g. that the value of NUM is SG) which will be true of just a single object (e.g. the subject). Hence feature exponence may be distributed or apparently multiplied. In the MP approach, each feature necessarily originates in only one position in the structure, and then must be copied or spread onto other positions, for data such as that above. In MP analyses, 'imperative' corresponds to a high position in the clause, so the IMP feature in (27) must spread downwards. However in (27b), the PASS feature would originate on the lowest verb, the only one marked in (27a), and so would have to spread upwards.

The distribution of morphological exponence is probably not related to direction of spreading, but rather concerns morphological constraints on each type of word as to what features it must express, might express, or cannot express. This can be seen clearly in the examples in (30) from Livonian (Niño 1997: 131), which obey the generalizations in (29):

(29) a. verbs are marked for number
b. participles are not marked for person

(30) Livonian

a. ä-b u-m and-ên-∅
NEG-1 be-1.SG give-PST.PTCP-SG
'I have not given.'

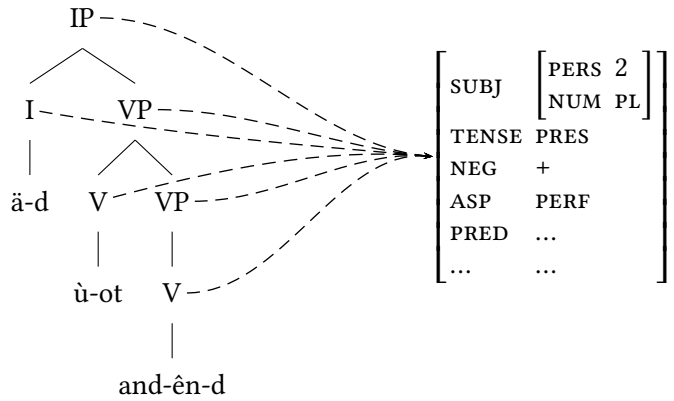
b. ä-b ù-om and-ên-d
NEG-1 be-1.PL give-PST.PTCP-PL
'We have not given.'

c. ä-d ù-od and-ên-∅
NEG-2 be-2.SG give-PST.PTCP-SG
'You have not given.'

d. ä-d ù-ot and-ên-d
NEG-2 be-2.PL give-PST.PTCP-PL
'You have not given.'

(31) shows the c- and f-structure of (30d). Again following the gloss, it can be seen that the PERS value of the subject is identically constrained by the first two words, while the NUM value is constrained by the last two words:

(31)



These patterns of multiple expresssion extend beyond simple clauses, into various kinds of complex predicate (see e.g. Sells 2004, Lødrup 2014), which might require a more nuanced syntactic analysis than simple embedding of f-structure nuclei – as argued for on the basis of entirely different data by Andrews & Manning (1999). The multiple expression data could profitably be analyzed in a realizational framework (as suggested in Sells 2004) – every informational element within a certain domain must have at least one rule of realization applying to it (this idea is formalized explicitly in Crysmann & Bonami 2016), but in certain

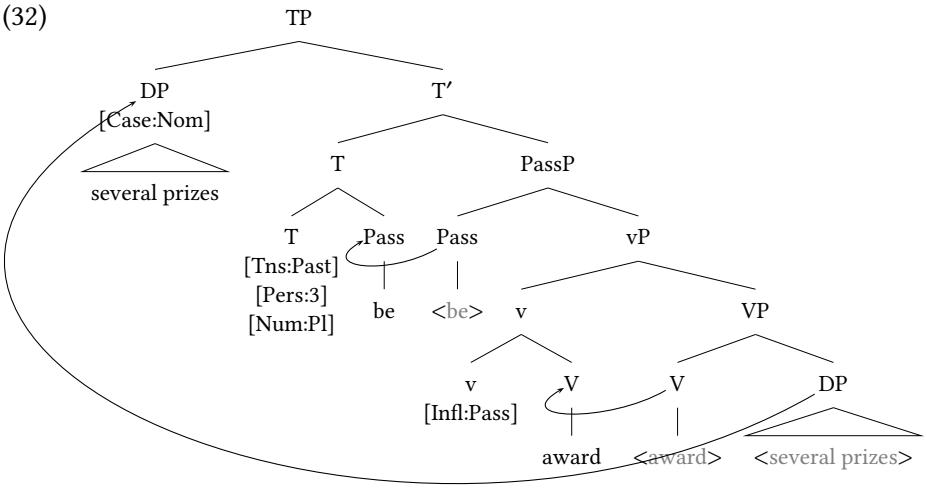
circumstances one piece of information can be referred to more than once, as the generalizations in (29) suggest. Crucially, again, it is not that one piece of morphological exponence on a c-structure head is copied to another head, but rather that different (co-)heads are acting as exponents of the same grammatical information.

3.2 The MP approach to phrase structure: Merge

The legacy of the Government-Binding model of syntax into the MP is a procedural approach to structure and structure-building. Binary structures are built up by Merge of two elements, often known as External Merge or 'first merge'. The GB idea of movement is reinterpreted in the MP as Internal Merge – one element from within a given structure is (re-)merged near the top of the structure. As noted in Section 1, the argument structure of the predicate is represented in a vP-VP structure, above which there are further projections such as TP and CP. By the time the structure has built up at least to TP, this structure effectively codes clausal information.

Strictly speaking, the syntactic derivation is abstract, with syntactic relationships referring to the structural notion of c-command but not linear order, which comes in the mapping from syntax to Phonetic Form (PF). The relevant terminal nodes of the structure are spelled out as words via the principles of Distributed Morphology (for an overview of this framework, see Harley & Noyer 2003 or Embick & Noyer 2007). Consider the derivation in (32) of the example *several prizes were awarded*, which will also feature later on:

(32)



The internal argument of a transitive verb is merged with V (a kind of root) within VP, at the lower right of the structure. The structure builds from the bottom up via successive applications of Merge. The VP is immediately the complement of a "little v" vP, which introduces the external argument in a canonical transitive. The particular example here is a passive, with the external argument suppressed. The two components of the verb, V and v, are combined by head movement of V to v, as the structure shows. The notation <award> indicates the original position of V before movement.

The passive is indicated here by PassP, following the analysis of English auxiliaries in Adger (2003). The Pass head *be* merges with vP as its complement. Next, above that, a T′ is created with a formative for past tense in its T head. The auxiliary verb *be* also undergoes head movement, to combine with T. Finally, following X′-theory, T′ has a specifier which hosts the surface subject. In the case of a passive example, a DP is raised from a VP-internal position to fill the subject position.

The arrows in (32) indicate movement. Standardly in the Minimalist approach, movement leaves behind a 'copy' of the moved constituent (Chomsky 1995), which the notation such as <award> etc. is intended to convey. Principles of realization at PF determine which copy is overt (pronounced) – usually the highest copy, as in the earlier versions of transformational grammar where moved constituents leave behind a trace, which is by definition unpronounced. The formalization of MP syntactic derivations due to Collins & Stabler (2016) captures the 'copy' idea by treating each operation of movement as creating a multidominance structure from a single terminal element; that formalization is extended to head movement by Bleaman (2021). However, for presentational purposes, I show the more familiar movement-with-copies structures here.

There are complex heads in T and v in (32), both formed via head movement. They also have a representation of the various features which are present or which are valued during the course of the derivation (see Section 4.2). These complex heads will realize their lexical and featural information as the words *were* and *awarded*.

Hence, the phrase structure derivation in the Minimalist approach represents all the clausal information, somewhat like LFG's f-structure, which is then spelled out as the overt form, which corresponds to some extent to LFG's c-structure.

3.3 Phrase structures are not isomorphic to clausal information

One difference between LFG and MP concerns how far the phrase structure is a direct representation of the clausal information. As just noted, the representa-

tion of clausal information in a Minimalist approach is encoded within the phrase structure (in its configuration and its derivation), while in LFG the relation between f-structure and c-structure is fundamentally more flexible. The Mandarin Verb Copy Construction (Li & Thompson 1981, Huang 1982) serves as a good example of how clausal information at f-structure can exist independently of any particular c-structure property. Postverbal arguments and adjuncts appear to be in competition within a single VP: in order to express an argument and an adjunct, the main verb must be duplicated to form a second VP, as in (33b).

(33) Mandarin

a. * Zhangsan tan gangqin de hen hao
Zhangsan play piano LNK very well
'Zhangsan plays piano very well'

b. Zhangsan tan gangqin tan de hen hao
Zhangsan play piano play LNK very well
'Zhangsan plays piano very well'

Huang (1982) proposed a phrase structure filter which essentially disallows arguments and adjuncts in the same VP. Fang & Sells (2007) note that both arguments of a ditransitive verb appear in the first VP (underlined in (34a)), and that an object may be displaced from within the first VP, otherwise preserving the phrase structure:

(34) Mandarin

a. wo song ta zhe jian liwu song de hen hao
I give him this CL gift give LNK very well
'I gave him this gift and it turned out to be a very good idea.'

b. zhe jian liwu wo song ta _ song de hen hao
this CL gift I give him _ give LNK very well
'This gift, I gave (it) him and (it turned out to be) very good.'

However, if an object is displaced from a monotransitive VP, verb "copying" is no longer an option (also see Huang 1982: 53):

(35) Mandarin

a. * gangqin Zhangsan tan _ tan de hen hao
piano Zhangsan play _ play LNK very well

b. gangqin Zhangsan tan _ de hen hao
piano Zhangsan play _ LNK very well
'The piano, Zhangsan played (it) very well.'

If we take (36) to be the basic f-structure of what should be expressed in one structure of (33), given the constraint that arguments and adjuncts cannot be in the same c-structure VP, it follows that (33b) is the only possible expression.

(36)
$$\begin{bmatrix} \text{PRED} & \text{`PLAY}\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{'} \\ \text{SUBJ} & [\text{PRED `ZHANGSAN'}] \\ \text{OBJ} & [\text{PRED `PIANO'}] \\ \text{ADJUNCT} & [\text{PRED `VERY WELL'}] \end{bmatrix}$$

On the other hand, if 'piano' appears as a structural TOPIC, in clause-initial position, only a single VP is required to express the in-situ material, which consists of the PRED and its ADJUNCT in (37), as in example (35b). The identification of TOPIC and OBJ takes place only at f-structure (Kaplan & Zaenen 1989).

(37)
$$\begin{bmatrix} \text{TOPIC} & [\text{PRED `PIANO'}] \\ \text{PRED} & \text{`PLAY}\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{'} \\ \text{SUBJ} & [\text{PRED `ZHANGSAN'}] \\ \text{OBJ} & [\quad] \\ \text{ADJUNCT} & [\text{PRED `VERY WELL'}] \end{bmatrix}$$

Examples such as (35b) show that the competition between arguments and adjuncts for the same VP is a phrase-structure phenomenon, and is not relevant for the level of clausal grammatical information: a verb in Mandarin can perfectly well have a full array of arguments and any adjuncts, but only some of those can be expressed within a single VP. Following a careful survey of the research on this topic, Bartos (2019) proposes an MP analysis which has to appeal to haplology of V to derive (35b) from (35a) (already suggested in Huang 1982: 99), but this is merely symptomatic of an underlying misanalysis, for the core relations between a predicate and its arguments and adjuncts are not isomorphically represented in phrase structure.

4 Features and agreement

4.1 Feature theory and LFG

LFG is built on the foundation that featural specifications in morpho-syntax are of the form [attribute value], and that well-formedness requires every attribute in

a given representation to have an appropriate value. The attribute-value format is used in LFG to represent functional structure, which represents the relational and featural content of a clause, but not constituent structure. F-structure is deliberately designed to not look like a phrase structure, to signify that it represents a different kind of syntactic information, and also that the parts within it are unordered. (The concept of f-precedence in LFG (see Glossary) crucially makes reference to the c-structure realization of f-structure elements.)

Adger (2010) considers features and the format of features in MP. He also concludes that features should be represented as attribute-value pairs, but rejects the idea that feature names can have structured values, because that re-creates the hierarchical structure within the phrase structure (e.g. a structured value for SUBJ corresponds to a DP in the phrase structure with internal constituency). Of course, there is no claim in LFG that every attribute in f-structure is the name of a feature – 'f' stands for 'functional', not 'feature'. Hence the closest comparison will be the atomically-valued attributes in f-structure, which will correspond most closely to features in MP, and which also accord with the general notion of morpho-syntactic features. More precisely, these will be the 'syntactic' features identified by Sadler & Spencer (2001) (see also Spencer 2013), which are the target of morpho-syntactic exponence (as in the discussion of Finnish and Livonian above in Section 3.1). In this subsection I compare the LFG and MP approaches to such features. An extended discussion of features in the MP in comparison to other frameworks can be found in Asudeh & Toivonen (2006: 409–420).

Featural information associated with each word introduces constraints on the well-formedness of the whole structure, within a 'monotonic' system: information cannot be selectively ignored, nor can it be changed. Hence declarative frameworks such as LFG necessarily have a property which has come to feature in MP discourse – the 'No Tampering Condition' (Chomsky 2007), which does not allow information on an item to be changed as it is merged in as part of the derivation (see also Section 5).

For instance, (38) is ungrammatical as not all the constraints coming from the lexical items can be satisfied simultaneously, and no part of the information can be ignored:

(38) * You am happy.

In this example, *you* will specify the value of PERSON of the subject as 2, but *am* will specify that same value as 1. There is no way to satisfy the requirements of these first two words in a single structure.

LFG introduces featural information either via lexical items or by the rules which license phrase structure. Every well-formed feature specification in f-structure is of the form [attribute value], by definition (see e.g. Kaplan & Bresnan 1982: 181–182). If any lexical item specifies a feature but without a value, that is an 'unvalued feature'; some other element in the structure must introduce the value for that feature, or else the overall structure will be ill-formed. Unvalued features play a significant role in MP analyses (because their function goes beyond that of simply representing information; see Section 4.2); they also find their place in declarative analyses, as described below, although valued features tend to be the norm.

The basic way for information to be specified is as a defining equation – for instance the information carried by the appropriate lexical entries to give the f-structures in (8). There is another kind of informational contribution, the constraining equation of LFG. Kaplan & Bresnan (1982: 207–209) motivate constraining equations with familiar facts such as those in (39), with their proposal for analysis in (40):

(39) A girl is handing (*is hands, *is handed) the baby a toy.

(40) *is*: (↑ XCOMP PARTICIPLE) $=_c$ PRESENT

The VP complement of *is* has the grammatical function XCOMP in the LFG analysis, and within that, the grammatical form *handing* would provide the value 'PRESENT' for the attribute PARTICIPLE. That fulfils the requirement in (40). The important move to a constraining equation over a defining one concerns the ungrammatical variants in (39). For instance, as a finite form, *hands* is not specified at all for the attribute PARTICIPLE, and so does not provide the information that (40) needs. However, if that information in (40) were specified as defining information, it would be unified in with the information from *hands*, and – at least on that count – the sequence **is hands* would not be ungrammatical, as nothing would be inconsistent. Kaplan and Bresnan note that in a unification-based system, constraining equations have the important consequence that negative-value specifications for otherwise unnecessary features can be avoided. (For more on features see Kaplan 2019b.)

Accounts involving a constraining-type analysis are common. This is the situation that is modelled in MP analyses with an 'uninterpretable' feature – two elements between which there is some dependency have the same feature specifications, but only one such specification is the 'real one'. An MP analysis of the English auxiliary system by Aelbrecht & Harwood (2015) involves the same idea

as in (40), proposing that uninterpretable but valued features match between the governed verb and the higher auxiliary which governs it.

The use of a constraining equation can be further illustrated in the case of a strict Negative Polarity Item (NPI) – an item that must appear in the context of negation, but is not the expression of negation itself. Such an NPI constrains its syntactic environment to have the NEG feature with the value + (see e.g. Sells 2000); this information must be present, but supplied by some other element, namely overt negation. From the MP perspective, Zeijlstra (2015) discusses an analysis of NPIs in which they "carry some uninterpretable negative feature [uNEG] that must be checked against a higher, semantically negative element that carries an interpretable formal negative feature [iNEG]." Again, in the relevant sense, this is a valued feature which is contentful on one element, and is on another for the purpose only of establishing an abstract syntactic relation.

Returning to the case of an attribute introduced without a value, this is an existential constraint on f-structure (see Kaplan & Bresnan 1982: 210ff. and Dalrymple 2001: 112–114). For instance, the complementizer *that* in English introduces a clause which is tensed, but it places no restriction on the value of TENSE. Hence part of the functional information associated with *that* will be the existential constraint (↑ TENSE). This constrains the f-structure of the clause to have the attribute TENSE, and any well-formed f-structure must have a value for that attribute. The value is not supplied by *that*, so that information must come from elsewhere in the clause introduced by *that*.

In summary, the notions of 'unvalued' and 'uninterpretable' features which are important in MP analyses – see immediately below – have formalized equivalents in LFG, and in LFG, neither can by itself lead to a well-formed f-structure: an f-structure cannot contain an attribute without a value, and the contribution of a constraining equation must be matched by the contribution of a (valued) defining equation. In keeping with the character of the differences between the LFG and MP approaches, a clausal f-structure in LFG is never partial nor ill-formed, unlike stages in an MP derivation. Rather, each element in the c-structure in a given example contributes to a set of constraints which the overall f-structure must satisfy. If those constraints conflict, there is no f-structure which satisfies them, and the example is thereby ungrammatical.

4.2 Features in the MP

Features are put to at least three uses in MP analyses (see Adger 2010: 200–212). The first is to represent information, the second is to establish a relationship, and the third is to make something happen. The representational aspect usually involves valued features, and might involve unvalued ones. The second use involves the notion of interpretable and uninterpretable features, which is the

mechanism for establishing a relationship known as 'Agree' between a Probe and a Goal (Chomsky 2000: 101).

For instance, Adger (2010: 189) gives the following illustrative example of a feature that is unvalued, and also uninterpretable. The idea that some features are uninterpretable was originally introduced by Chomsky (1995: 277–278). In (41), the first group of features are features of the subject DP, and the second group are features on the T head of TP.

(41) {D, definite, plural} … {T, past, *u*plural}

The DP is definite and plural, and T is past and also marked as plural, but the prefix notation *u* indicates that the plural feature, though present on T, is uninterpretable on it. Adger describes (41) as follows:

> The idea is that a feature like [plural] only has an interpretation when specified on a category which can be potentially interpreted as plural (e.g. on a noun), otherwise an instance of this feature will be uninterpretable: interpretability is detectable from a feature's syntactic/semantic context. The formal property of features (the *u* prefix) which enables them to enter into dependency relations is thus linked to the interpretation of features … (Adger 2010: 189)

The [plural] feature is not interpretable on T – the interpretation of tense never makes reference to singular/plural – but the matching occurence of [plural] on the subject DP establishes the Agree relation between these two groups of features. After it has been checked by a matching interpretable feature, [plural] is then eliminated on T.

From the perspective of LFG, the equivalent of [*u*plural] in (41) would be as in (42).

(42) $(\uparrow \textsc{subj num}) =_c \textsc{pl}$

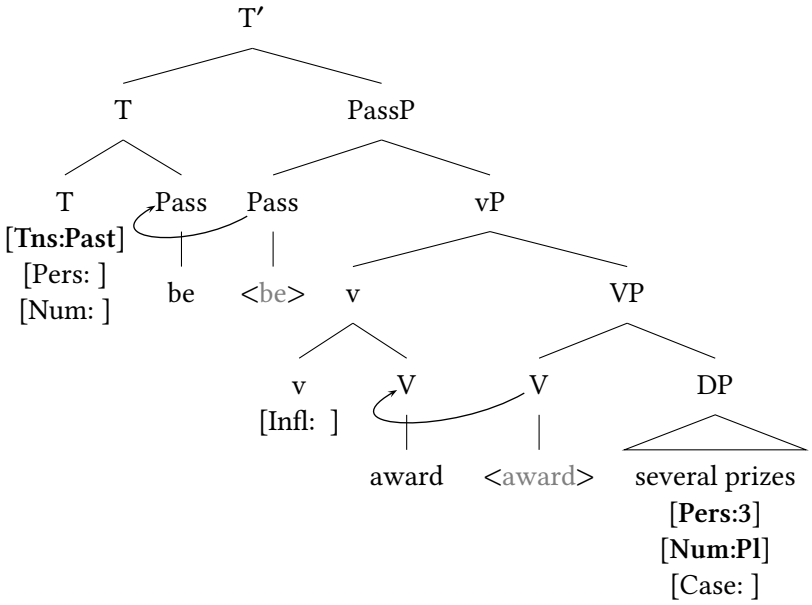
Just as with (41), a structure described by (42) will only be well-formed if some other element (e.g. the subject) specifies the PL value for the feature, but it represents a different approach to the role of features. In (41), the feature on T is understood to convey "I am plural", which is uninterpretable; but the specification in (42) conveys "my subject's number is plural", which is actually straightforwardly interpretable.

The third use of features in the MP is to trigger an operation. Such features do not seem to overlap with the features considered above, and exist solely to make something happen. The canonical example is the 'EPP-feature' derived from GB, but used in different ways to force either XP movement or X^0 movement (head

movement) in many MP analyses. This feature has been more recently cast as an 'Edge Feature' (e.g. Chomsky 2005). It is not clear formally what kind of feature this is – it must be satisfied, as an instruction for some structure to be built, and once satisfied, there are two options: either it becomes inactive, or it stays active, allowing for multiple specifiers (Chomsky 2007: 11).

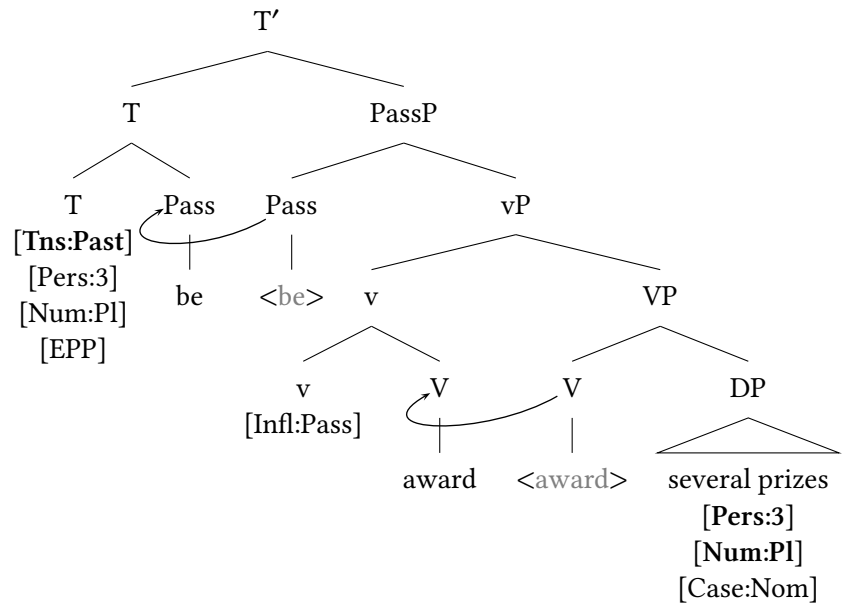
I now show in more detail how (un)valued and (un)interpretable features participate in an MP derivation. What is shown here is based on the presentation in Radford (2009: 284ff.), though using a slightly different representational format which is more internally consistent and which will also be more transparent in the context of the LFG approach to features described above. There is in fact a close relation between valued and interpretable features, as will be evident in the structures below. However, the two notions are formally distinct and can play different roles in an overall syntactic analysis (see e.g. Aelbrecht & Harwood 2015). The structure in (43) underlies the fragment *were awarded several prizes*, which is our illustrative example. The DP *several prizes* has interpretable features of person and number (it is 3rd person plural), and in the syntax it will have a value for case; but the case feature is initially unvalued, as the particular value of case will depend on the syntactic context of the DP. The v which ultimately hosts *award* has an Infl feature (sometimes referred to as VFORM in LFG), which will also be valued according to the syntactic context of the verb. Finally, the head T is specified as past tense, and it also hosts agreement features for person and number, which are unvalued at this initial stage. In the structure, the features shown in bold are those which are interpretable, and they also are the ones which are valued.

(43)



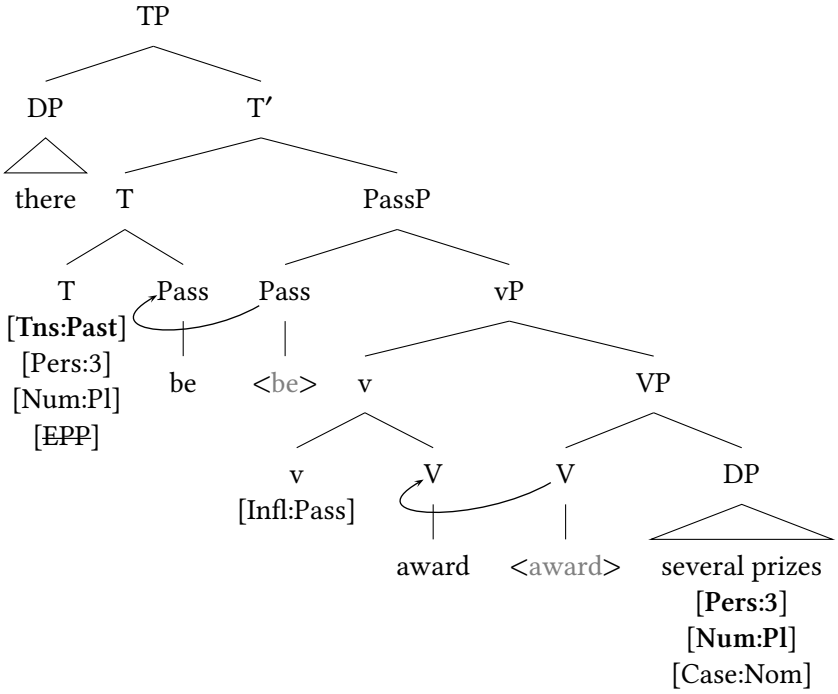
Formally, Agree establishes a relation between two nodes, a Probe and a Goal, one of which has an interpretable feature, with the other having a (matching) uninterpretable feature. In the simple example here, the uninterpretable features are the unvalued ones, and so they will become valued once Agree takes place. For instance, the Pass head *be* in (43) enters into an Agree relation with v and values the Infl feature as Pass(ive). The T head enters into an Agreement relation with the DP *several prizes*, valuing the Case on DP as Nom, and at the same time taking the values of person and number from that DP. Hence, after these Agree relations are established, all features are valued, as in (44), and these feature specifications will be relevant for morphological realization (e.g. the surface form of *be* will be *were*). Nevertheless, the non-bold (formerly unvalued) features are classed as uninterpretable, and must delete by the end of the syntactic derivation, Logical Form. Finally, (44) also shows one more feature on T, [EPP], which is discussed immediately below.

(44)



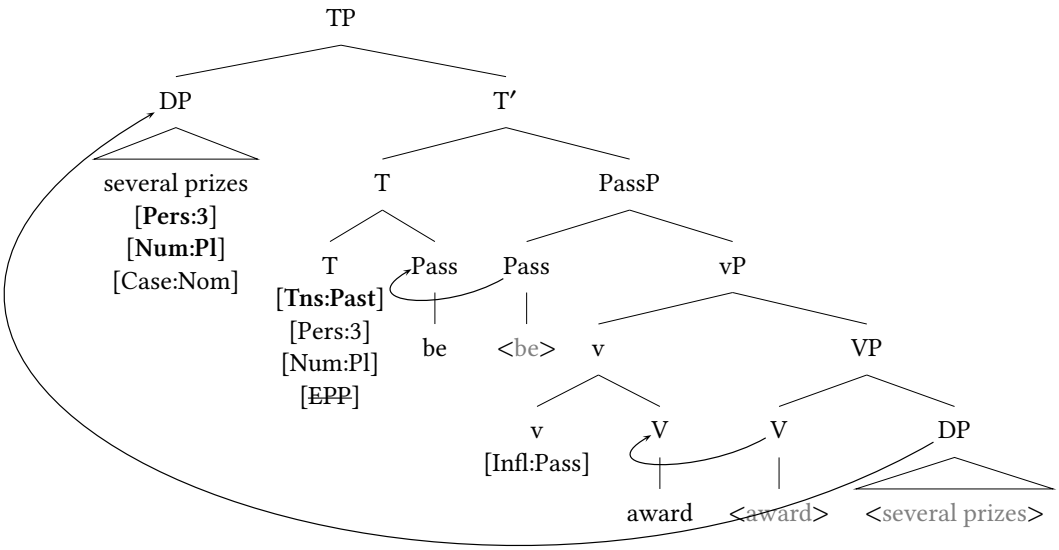
T in (44) has the [EPP] feature mentioned above, which has the effect that at the next step of the derivation a specifier must be created. This feature, then, does not represent a 'featural' property of the clause (unlike, say, 'past tense'), but represents a structural property. One option for satisfying this feature is to merge in an expletive placeholder, *there*:

(45)



Once the specifier is merged, the EPP feature is thereby satisfied, indicated in (45) by the strikethrough. Another way of satisfying this feature from the stage in (44) is to raise the object DP to the subject position, as a canonical passive:

(46)



4.3 Agreement and the direction of Agree

The second use of features in the MP noted above is that they participate in the process of Agree (Chomsky 2000), which is a prerequisite to establishing a relation in the syntax. The exemplar syntactic relation is that of agreement – say between a subject and a finite verb. As with canonical agreement (e.g. Corbett 2006), there is assumed to be a controller of agreement and a target for agreement, a directional or asymmetric relationship, formally instantiated as a Probe and a Goal in the MP. There is considerable debate in the MP literature as to the 'directionality' of Agree – is it upwards, or downwards? – as well as to whether feature valuation passes from the higher element to the lower one, or vice versa. For instance, Polinsky & Preminger (2019) make a linguistic argument about the direction of agreement (specifically, ϕ-feature agreement); they argue that agreement must be directional, looking downwards, but valuing features upwards. In contrast, Bjorkman & Zeijlstra (2019) argue for a more complex system in which a checking relation is first established, but only upwards, and then after that valuation can take place, in either direction. Some examples which bear on these issues are given below. These proposals are each 'substantive' proposals, motivated by empirical observations, as there is nothing formally about the MP system which requires a given directionality for Agree.

As noted above in Section 2.2.2, there is no sense in LFG in which agreement can be directional, as "agreement" is the informal notion we apply to a situation where more than one element provides featural information about some (other) element. The Archi examples below show that the distinction between Controller and Target, or between Probe and Goal, cannot be sustained anyway.

Polinsky & Preminger (2019) present examples such as (47) from Tsez, to support their claim that a Probe looks downwards to find a Goal – that the Probe c-commands the Goal – and the relevant feature values from the Goal are then valued upwards to the (previously incomplete) Probe. The key property of this example is that it involves long-distance agreement, in which the matrix verb does not agree with any local argument but rather agrees with the absolutive argument (object) of the embedded clause. Tsez has an ergative-absolutive case-marking system, and the verb agrees with an absolutive argument. The embedded absolutive in (47) is 'bread', class III, and both the local predicate 'eat' and the higher predicate 'know' agree with it in class, shown in boldface in the gloss:

(47) Tsez
eni-r [už-ā magalu b-āc'-ru-ɬi]
mother-DAT [boy-ERG bread.**III**(ABS) **III**-eat-PST.PTCP-NMLZ]

b-iy-xo
III-know-PRES
'The mother knows that as for the bread, the boy ate it.'

The particular argument that Polinsky and Preminger make is based on the observation that the opposite configuration appears to be unattested – we never find a structure in which a verb in a lower clause agrees with an argument in a higher clause. To rule out this logical possibility, they argue that syntactic theory should only allow downwards Agree/upwards valuation. The detail of their argument is not crucial here – what is relevant are the relative structural relations between the two elements in the agreement relationship. In (47), as the absolutive controls agreement on the higher predicate 'know', I will categorize this example as one in which the target must c-command the controller (hence, valuation is upwards).

The rest of the examples in this section are taken from Archi, another language with an ergative-absolutive system. Archi has a wide range of potential targets for agreement, but the controller is always the absolutive. (48) from Bond & Chumakina (2016: 67) shows various agreement targets (boldfaced in the gloss, each corresponding to the exponent *d-*):

(48) Archi
[d-ez χir] d-e⟨r⟩qˤa-r-ši d-i
[**II.SG**-1SG.DAT behind] **II.SG**-⟨IPFV⟩go-IPFV-CVB **II.SG**-be.PRES
'She follows me.' (male speaking)

Both the main verb and the auxiliary 'be' show agreement with the absolutive for gender and number. The gender system in Archi consists of four noun classes, and in this example, the gender agreement is for class II. The controller of agreement is not overt – it is the implicit subject of the intransitive predicate, formally in absolutive case. In addition, the first singular pronoun *d-ez* which is the object within the directional PP headed by 'behind' agrees with the absolutive of its clause, even though the pronoun is not a direct co-argument of the absolutive in this example. The pronoun is itself first person singular, but it also has an 'external agreement' slot for the clausal absolutive. Now that pronoun, inside the PP, cannot c-command anything outside that PP, and yet the intuition here is that it is the target of agreement: so for this example it must be the case that the controller (a null subject absolutive) c-commands the target. Valuation, if directional, should be downwards – exactly reversed from the Tsez example (47).

The LFG analysis of Archi agreement in Sadler (2016) codes each agreeing element for the relevant features of the notional agreement controller – the argu-

ment in absolutive case. As the GF of that argument could be SUBJ or OBJ depending on the transitivity of the predicate, Sadler uses the designator PIV, proposed by Falk (2006). Sadler (2016: 161) also uses the template approach (Dalrymple et al. 2004) to schematize over different agreement combinations. For the form in (49), @II.SG associates the gender and number agreement values with the word, as in the second commentary enclosed in [ ]:

(49)

d-ez, Pronoun
(↑ PERS) = 1
(↑ NUM) = sg [it is a first singular pronoun]
@II.SG((GF ↑) PIV) [its external agreement features are class II singular]
…

For (48), (GF ↑) PIV instantiates as (OBL OBJ ↑) SUBJ. The f-structure of the example is shown in (50), where the external agreement path for the first person pronoun – the inner [PRED 'PRO'] – follows this instantiation and specifies values for gender and number, shown in boldface:

(50) F-structure of (48); agreement of the pronoun with the absolutive ((OBL OBJ ↑) SUBJ) must be: CLASS II, NUM SG

$$\begin{bmatrix} \textbf{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 3 \\ \textbf{NUM} & \textbf{SG} \\ \textbf{CLASS} & \textbf{II} \\ \text{CASE} & \text{ABS} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{'GO}\langle(\uparrow \text{SUBJ})(\uparrow \text{OBL})\rangle\text{'} \\ \textbf{OBL} & \begin{bmatrix} \text{PRED} & \text{'BEHIND}\langle(\uparrow \text{OBJ})\rangle\text{'} \\ \textbf{OBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 1 \\ \text{NUM} & \text{SG} \\ \text{CASE} & \text{DAT} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

Note that the first person pronoun itself does not have any "agreement slot" within its own feature structure: it has no agreement feature specification which is supposed to match or be copied somewhere else in the (f-)structure.

The informal notions of controller and target have no embodied representation, which ultimately proves to be an important fact about the LFG analysis – because there are examples in which 'controller' and 'target' are the same single syntactic element. There are different types of example in Archi where an absolutive argument "agrees with itself" – a given syntactic element has an external

agreement slot, to agree with the absolutive of its clause, but that element happens to be the absolutive itself. (See also Corbett 2006: 68–69, Borsley 2016: 137.) In these examples, the distinction between controller and target – as two distinct elements in an asymmetric relationship – is invalid, but on a co-description account of the kind illustrated by (49) the examples work out straightforwardly.

(51) is one such example. A reflexive pronoun in Archi has two slots for agreement – one for the features of its antecedent, as is familiar, and another one for the features of the absolutive of the clause. In (51) (from Bond & Chumakina 2016: 70) the subject is the pronoun 'I', in dative case, and the object is the reflexive, in absolutive case, and it is class II, signifying a female referent. The subject pronoun, main verb and auxiliary verb each agree in class with the absolutive, as does one of the slots in the reflexive – the whole form is 1SG, agreeing with the subject antecedent, and there is also an infixed class II agreement, again agreeing with the absolutive, which is the reflexive itself.

(51) Archi
d-ez zona⟨r⟩u d-ak:u-r-ši d-i
II.SG-1SG.DAT 1SG.REFL.ABS⟨**II.SG**⟩ **II.SG**-see-IPFV-CVB **II.SG**-be.PRS
daχon-n-a-š
mirror(IV)-SG.OBL-IN-EL
'I am seeing myself in the mirror.'

So here, (GF ↑) PIV instantiates as (OBJ ↑) OBJ, one of the logical possibilities. The f-structure is shown in (52):

(52) F-structure of (51); agreement of the reflexive with the absolutive ((OBJ ↑) OBJ) must be: CLASS II, NUM SG

$$\begin{bmatrix} \text{SUBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{PERS} & 1 \\ \text{NUM} & \text{SG} \\ \text{CLASS} & \text{II} \\ \text{CASE} & \text{DAT} \end{bmatrix} \\ \text{TENSE} & \text{PRES} \\ \text{PRED} & \text{'SEE}\langle(\uparrow \text{SUBJ})(\uparrow \text{OBJ})\rangle\text{'} \\ \textbf{OBJ} & \begin{bmatrix} \text{PRED} & \text{'PRO'} \\ \text{REFL} & + \\ \text{PERS} & 1 \\ \textbf{NUM} & \textbf{SG} \\ \textbf{CLASS} & \textbf{II} \\ \text{CASE} & \text{ABS} \end{bmatrix} \\ \text{OBL} & \begin{bmatrix} \text{"MIRROR"} \end{bmatrix} \end{bmatrix}$$

Like other aspects of the grammar, the correct account of "agreement" does not involve moving something – in this case, featural information – from one place to another, but rather is a partial specification of featural information in a larger structure.

5 Conclusion

LFG takes up the challenges of accounting for human language precisely as Chomsky first articulated them, yet continuing with a view quite different from his as to what the core non-negotiable properties of the syntactic system should be. It was developed as a systematic and coherent framework for the representation of grammatical information, based on certain key design features. While these design features give these frameworks a very different character from a procedural framework such as the MP, many of the components of analysis which MP has developed are already present in declarative frameworks (see Section 4), as is the convergence of interest in exploring 'third factor' considerations (see (5)).

As Chomsky has noted, the choice between grammatical frameworks can be understood in terms of the "extra burdens" that an over-exuberant approach will entail (Chomsky 2007: 10–11). From a declarative perspective, any procedural approach creates such burdens, as the necessary mechanisms are either too powerful or are not well-founded. If those mechanisms can change or even delete syntactic information or syntactic substance, it is necessary to constrain those destructive operations with the 'No Tampering Condition' – indeed, a very natural property of a grammatical system, but one that should be intrinsic to it.

The 'copy theory' of movement (Chomsky 1995) is a way of expressing the intuition that some information is shared. However, copies involve duplication of substance, which amounts to more than the sharing of information. The discussion of structure in Section 3 provides a perspective on two kinds of further burden that necessarily arise in a copy-based approach. First, with regard to head mobility, the LFG view is that the issue is one of alternative positions, rather than successive positions which exist to provide hosts for position-occupying movement. The head is indeed only "in" one head position, but it makes the same contribution that it would have made from any of its alternative possible positions, and so might appear as if it were contributing from each position. The evidence from multiple expression of clausal information supports this view. A recent MP account of the syntax of heads by Arregi & Pietraszko (2021) associates only the informational part of a given head with several head positions, effectively recapitulating the LFG analysis of head mobility through various operations to create

the right representations. Second, the facts of Mandarin verb copying show that certain parts of the syntactic analysis indeed call for a duplication of substance (when there are both in-situ arguments and adjuncts in Mandarin), while other parts involve more abstract syntactic information (the notion of a verb *having* arguments and having adjuncts). If that abstract information is conflated with the phrase structure substance, the system generates too much, and then extra operations have to be invoked, pruning or conflating substance.

The formalization of the MP by Collins & Stabler (2016) is designed in part to address the No Tampering Condition, and the apparent duplication of substance. Instead of creating copies, in this formalization, successive movements of a given element create new multidominance relations from that single element, which therefore does not change during the derivation. Their formalization is extended to head movement by Bleaman (2021). This particular formalization might make MP derivations slightly closer in nature to f-structures, in that each object in the derivation is a single informational unit which may have multiple grammatical relations and phrase-structural relations (e.g. a topicalized object is both an object and a topic, but with just one overt realization, in topic position).

A different kind of burden of potential complexity falls on the feature system of the MP, as features are used to do more than represent information (see Section 4). It becomes necessary to posit "bad" feature specifications, such as uninterpretable features, which by design are not interpretable on their hosts, and which must be eliminated during the derivation. LFG has constraints of a different character for checking that certain grammatical relationships exist, and which do not involve recourse to local pockets of uninterpretability.

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