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Argument alternations in complex predicates: an LFG+glue perspective

John J. Lowe, *University of Oxford*

Abstract

Vaidya et al. (2019) discuss argument alternations in Hindi complex predicates, and propose an analysis within an LTAG framework, comparing this with an LFG analysis of complex predicates. In this paper I clarify the inadequacies in existing LFG analyses of complex predicates, and show how the LFG+glue approach proposed by Lowe (2015) can both address these inadequacies and provide a relatively simple treatment of the phenomena discussed by Vaidya et al. (2019).

1 Introduction

Vaidya et al. (2019) discuss a number of issues in the analysis of Hindi complex predicates, or light verb constructions, in particular the agreement between light verbs and some embedded nominal predicates, selectional restrictions on possible noun verb combinations, and argument alternations as illustrated in (1) and (2).

(1) mẽdak=ne bicchu=se bahas
frog.M.SG-ERG scorpion.M.SG=INSTR quarrel.F.SG
k-ii
do-PRF.F.SG
'The frog quarrelled(/debated) with the scorpion.'

(2) bicchu=se bahas hu-ii
scorpion.M.SG=INSTR quarrel.F.SG be-PRF.F.SG
'There was a quarrel(/debate) with the scorpion.'

Following the assumptions of Vaidya et al. (2019), in both (1) and

(2) the noun *bahas* forms a complex predicate with the following light verb; the light verb also agrees with the gender of the noun (rather than showing default masculine gender). In (1), the complex predicate has two arguments, whereas in the resultative construction in (2), it has only one, the agent argument being impossible with the 'intransitivizing' light verb *hu* 'become'. According to Vaidya et al. (2019), *kar* 'do' vs. *hu* 'become' is the most productive light verb alternation in Hindi, but there are some nouns which cannot combine with *hu* because they imply too great a degree of agentivity (Ahmed and Butt, 2011, 308).

Vaidya et al. (2019) propose an analysis of these phenomena in an LTAG framework, comparing this with an LFG analysis of complex predicates. In the following I clarify the inadequacies in existing LFG analyses of complex predicates, and show how the LFG+glue approach proposed by Lowe (2015) can both address these inadequacies and provide a relatively simple treatment of the phenomena discussed by Vaidya et al. (2019).

2 Predicate fusion and argument merger in LFG

LFG approaches to complex predicates share with Vaidya et al. (2019) the commitment to a syntactic analysis of predicate formation, based on work by Mohanan (1994), Butt (1995) and Alsina (1996). Since this early LFG work, a rich vein of research has developed on complex predicates, much of it by Miriam Butt and colleagues.[1] The standard LFG treatment of complex predicates comes in two flavours, one more couched in the theory, the other more couched in the computational implementation, XLE; Lowe (2015) labels these the 'linking' approach and the 'XLE' approach respectively, and I use the same labels here. These two approaches are only partially distinct, but one of the differences is relevant to the argument alternations discussed by Vaidya et al. (2019), and will be discussed in more detail below.

To illustrate the basics of complex predicate formation in LFG, I provide an analysis of (1) above; my presentation differs slightly from that offered by Vaidya et al. (2019). In the standard LFG approach, the main issues with complex predicate formation involve the fusion of multiple predicates, and the merger of the arguments of these predicates; both issues centre on the f-structure feature PRED. The light verb *kar* 'do' supplies the PRED value ('semantic form') in (3), while the noun *bahas* 'quarrel' can be assumed to supply the PRED value in

[1] For example, see Butt (1997), Butt and Geuder (2001), Butt et al. (2003), Butt and Ramchand (2005), Butt and King (2006), Butt et al. (2010), Ahmed and Butt (2011), Raza (2011), Ahmed et al. (2012), Butt et al. (2012), Sulger (2012), Butt (2014).

(4).

(3) (↑PRED) = 'do ⟨ AGENT, %PRED ⟩'
[−O]

(4) (↑PRED) = 'quarrel ⟨ AGENT, COMITATIVE ⟩'
[−O] [+R]

As shown here, subcategorization is specified both in terms of the semantic role of an argument, and by reference to the features ±O or ±R, which constrain the possible relations between semantic roles and grammatical functions, as defined by LFG's (Lexical) Mapping Theory (Bresnan and Kanerva, 1989). The details of this are unimportant for the present purposes.

When the light verb and noun form a monoclausal predicate, the two PREDs in (3) and (4) must fuse to create a single semantic form for the single clausal f-structure. The semantic form of the lexical verb supplies the value of the %PRED variable in the argument structure of the light verb, and a process of argument merger associates (in this case) the agent of the light verb with the agent of the embedded predicate. The resulting semantic form is given in (5).

(5) 'do' ⟨ AGENT 'quarrel' ⟨ AGENT COMITATIVE ⟩⟩
[−O] ([−O]) [+R]
| |
SUBJ OBL_θ

This results in the f-structure in (6) for the sentence in (1).

(6)
$$\begin{bmatrix} \text{PRED} & \text{`do-quarrel}\langle\text{SUBJ, OBL}_{\text{comit}}\rangle\text{'} \\ \text{SUBJ} & \begin{bmatrix}\text{PRED} & \text{`frog'}\end{bmatrix} \\ \text{OBL}_{\text{comit}} & \begin{bmatrix}\text{PRED} & \text{`scorpion'}\end{bmatrix} \end{bmatrix}$$

Lowe (2015) discusses a number of inadequacies in this standard approach. One is the precise method of predicate fusion, i.e. how the two PRED values in (3) and (4) fuse into the single semantic form in (5) and (6). The standard approach makes use of the *restriction operator* \, defined by Kaplan and Wedekind (1993) as follows:

(7) If f is an f-structure and a is an attribute:
$f \backslash a = f \backslash_{\mathrm{Dom}(f)-\{a\}} = \{< s, v > \in f \backslash s \neq a\}$

By this definition, the f-structure $f \backslash a$ is identical to the f-structure that results from removing the attribute a from the f-structure f. Predicate fusion works by unifying the f-structure of the light verb (which equals the f-structure for the clause) with the f-structure that results from removing the PRED attribute from the f-structure of the embedded predicate, and at the same time specifying the role of the embedded PRED within the clausal PRED. So, given the schematic decomposition of PRED features in (8), the phrase structure rule in (9) will create a unified f-structure with an appropriately fused PRED feature.

(8) ‘FN ⟨ ARG_1, ARG_2 ⟩’

(9) V → V_{main} V_{light}

$\downarrow \backslash\text{PRED} = \uparrow \backslash\text{PRED}$ $\uparrow = \downarrow$

$(\uparrow \text{PRED ARG}_2) = (\downarrow \text{PRED})$

Vaidya et al. (2019) refer to restriction as a ‘nonmonotonic’ operation which effectively ‘deletes’ information in the formation of the monoclausal f-structure. This is not, in fact, the case, but their claim does reflect the slightly misleading way in which restriction is used in such analyses. Restriction is a well-defined set-theoretic operation, and is thoroughly monotonic: it does not delete or remove information from an f-structure, but rather specifies an f-structure which is identical to some other f-structure except in that it lacks one or more attributes.[2] But as discussed by Lowe (2015), this is problematic for the standard LFG approach, because it implies (or rather, necessitates) the existence of a distinct f-structure for the embedded predicate. That is, the intuition behind the use of restriction is that complex predicates are fundamentally monoclausal, and that both light verb and lexical predicate should co-head a single clausal f-structure. What is usually ignored is that restriction can only achieve this if, or rather because, there also exists a separate f-structure headed by the embedded predicate alone. The existence of such an f-structure is necessitated by the (monotonic) definition of the restriction operator, yet it crucially undermines the monoclausality of the resulting analysis.

A further problem with LFG’s linking approach to complex predicates is the precise mechanism of argument merger, that is how, for example, the AGENT argument of *bahas* ‘quarrel’ is merged with the AGENT argument of the light verb, resulting in a single argument to be mapped to a grammatical function. While there has been considerable work within the linking approach on the argument structure relations involved, and on the mapping from merged arguments to grammatical functions, any formalization of argument merger itself is lacking.

[2] Thinking of it in set-based terms: f-structures are sets of attribute-value pairs, and restriction simply defines an f-structure which is a proper subset of another independently defined f-structure.

Within the XLE approach, argument merger is avoided by taking a reduced view of the valency of the predicates involved. For example, the XLE treatment of 'do-quarrel' would take *bahas* 'quarrel' to be a monovalent predicate, not subcategorizing for an agent argument, as shown in (10).[3]

(10) $(\uparrow \text{PRED}) =$ 'quarrel $\langle$ $(\uparrow \text{OBL}_{\text{comit}})$ $\rangle$'

Notice that this approach to the subcategorization of 'quarrel' significantly simplifies the analysis of the *kar* vs. *hu* alternation discussed by Vaidya et al. (2019): there is no need to assume that 'quarrel' has two separate subcategorization frames, one which does, one which does not, select for an agent argument, as in Vaidya et al.'s LTAG analysis. If 'quarrel' selects for a single, non-agent, argument, then it can fuse with either *kar* or *hu* unproblematically to create a bivalent or monovalent predicate respectively.

Nevertheless, non-XLE linking approaches to complex predicates in LFG do assume the unformalized process of argument merger, and would ordinarily treat *bahas* 'quarrel' as having two distinct subcategorization frames, one of which (used when fusing with *kar*) subcategorizes for an agent argument.

3 A glue analysis

Given the problems with the standard LFG approaches to complex predicates, in particular the question mark over their monoclausality and the lack of formalization of argument merger, it is worth considering an alternative. Compared with the wealth of syntactic analyses, there has been relatively little work in LFG on how semantics interacts with the syntax of complex predicate formation; exceptions include Kaplan and Wedekind (1993), Dalrymple et al. (1993), Andrews and Manning (1999), Andrews (2007), Homola and Coler (2013) and Lowe (2015). The latter is the only existing account of complex predicates within the standard 'new' glue format and within standard assumptions regarding the LFG architecture. In this section, I show how the approach of Lowe (2015) can simply and effectively handle the argument alternations discussed by Vaidya et al. (2019).

3.1 Preliminaries

The two main weaknesses in the standard LFG approach to complex predicates both concern semantic forms (PRED features): firstly how se-

[3] Note that the details of Mapping Theory are not modelled in XLE, so 'quarrel' directly subcategorizes for an oblique argument (rather than for a comitative argument which is subsequently mapped to $\text{OBL}_{\text{comit}}$).

mantic forms may fuse, and secondly how an argument of an embedded semantic form may be merged with an argument of the superordinate semantic form. Lowe (2015) builds on work by e.g. Asudeh and Giorgolo (2012) and Asudeh et al. (2014) within LFG+glue, which argues that much of the work traditionally attributed to argument structure in LFG can be done more simply using glue semantics.

F-structures are traditionally subject to certain well-formedness constraints, including COMPLETENESS and COHERENCE, which together require that any well-formed f-structure will contain all and only the governable grammatical functions subcategorized for by the PRED of that f-structure. Glue is crucially *resource sensitive*, meaning that as long as all syntactic arguments correspond to a semantic argument, the glue derivation necessarily requires all and only the subcategorized arguments to appear; glue thus automatically enforces COMPLETENESS and COHERENCE, rendering them superfluous as f-structure constraints.[4] The consequence of this is that subcategorization frames are no longer required as part of f-structure PRED features, since constraints on subcategorization are almost entirely contained within the semantics (Kuhn, 2001, Asudeh, 2004, 2012, Asudeh and Giorgolo, 2012).

Within such a framework, semantic forms have little function besides ensuring the uniqueness of f-structures (Dalrymple et al., 1993, Andrews, 2008). This permits a significant simplification in the syntactic treatment of complex predicate formation: it is no longer necessary to model predicate fusion and argument merger in the f-structure, because the relevant properties captured by these processes no longer need to be represented in the f-structure. Lowe (2015) therefore proposes that in place of an f-structure like (6), the following f-structure should be assumed:

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[4]Not all syntactic arguments are also semantic arguments, of course: expletive arguments, such as *it* and *there* in *It rains* and *there is a problem*, and nonthematic arguments of raising predicates, such as *Bill* in *Bill seems to like cake*, constitute exceptions. Syntactic constraints on expletive and nonthematic arguments cannot be captured by the resource sensitivity of glue, but they can be unproblematically handled by simple lexical constraints which are independently motivated. For example, the standard control equation in the lexical entry of raising verbs like *seem*, $(\uparrow\text{SUBJ}) = (\uparrow\text{XCOMP SUBJ})$, already requires *seem* to have a subject argument, and a necessary constraint in the lexical entry of *rain*, requiring its expletive subject to have the form *it* (rather than, say, *there*), e.g. $(\uparrow\text{SUBJ FORM} =_c \text{IT})$, likewise enforces the presence of a subject argument. Ruling out undesired expletive arguments can be done in the same way. Thus COMPLETENESS and COHERENCE are unnecessary as independent principles, since the fundamental principle of constraint-based grammar, mutual satisfaction of constraints, can do all the work.

(11)
$$\left[\begin{array}{ll} \textsc{pred} & \text{‘quarrel’} \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{‘frog’} \end{array}\right] \\ \textsc{obl}_{\text{comit}} & \left[\begin{array}{ll} \textsc{pred} & \text{‘scorpion’} \end{array}\right] \end{array}\right]$$

The f-structure in (11) differs from that in (6) only in respect of the semantic form, which is now specified by the lexical head of the complex predicate alone. The light verb does not contribute a PRED feature, meaning that both lexical predicate and light verb can contribute to the same f-structure without the need for restriction. This in turn means that, in positive contrast with the standard LFG analysis, there is no separate f-structure for the embedded predicate alone. In the case of the light verb *kar*, Lowe (2015) assumes that it makes no contribution to the f-structure (besides requiring a subject argument), but other light verbs may contribute features, such as the permissive light verb *de*, which contributes the feature <PERMISSIVE,+>.

3.2 Illustration

The main advantage of Lowe's (2015) glue account is its simple treatment of argument fusion. This is best illustrated with an example where lexical predicate and light verb have significantly different subcategorization frames; I therefore summarize the analysis of the sentence in (12) provided by Lowe (2015, 427–436).

(12) anjum-ne saddaf-ko citthii likh-ne
Anjum-ERG Saddaf-DAT note.NOM.F.SG write.INF.OBL
d-ii
let-PERF.F.SG
‘Anjum let Saddaf write a note.’

(13)
$$\left[\begin{array}{ll} \textsc{pred} & \text{‘write’} \\ \textsc{permissive} & + \\ \textsc{subj} & \left[\begin{array}{ll} \textsc{pred} & \text{‘Anjum’} \end{array}\right] \\ \textsc{obj}_{\text{goal}} & \left[\begin{array}{ll} \textsc{pred} & \text{‘Saddaf’} \end{array}\right] \\ \textsc{obj} & \left[\begin{array}{ll} \textsc{pred} & \text{‘note’} \end{array}\right] \end{array}\right]$$

The complex predicate in (12) consists of the lexical predicate *likh* ‘write’ and the permissive light verb *de*. The verb ‘write’ selects for an agent argument and a theme argument, which ordinarily surface as subject and object respectively. This is captured in the following lexical entry:[5]

(14) 'write' V
$(\uparrow \text{PRED}) = \text{'write'}$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG}_1)$
$(\uparrow \text{OBJ})_\sigma = (\uparrow_\sigma \text{ARG}_2)$

$$\lambda y.\lambda x.\lambda e.write(e) \wedge agent(e,x) \wedge theme(e,y) :$$
$$(\uparrow_\sigma \text{ARG}_2) \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$$

As a lexical predicate, *likh* 'write' contributes a semantic form to its f-structure by the equation $(\uparrow \text{PRED}) = \text{'write'}$. It selects for a SUBJ and an OBJ, which are associated with the semantic structure attributes ARG_1 and ARG_2 respectively. Semantic composition is constrained by the glue term on the right-hand side of the meaning constructor, which is defined in relation to semantic structure attributes. Thus the theme of the act of writing is associated, via ARG_2, with the OBJ argument, and the agent of the act of writing is associated, via ARG_1, with the SUBJ argument. Now consider the lexical entry of the permissive light verb *de* 'let':

(15) 'let' V
$(\uparrow \text{PERMISSIVE}) = +$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG}_1)$
$(\uparrow \text{OBJ}_\theta)_\sigma = (\uparrow_\sigma \text{ARG}_3)$

$$\lambda P.\lambda y.\lambda x.\lambda e.let(x,y,P(y,e)) :$$
$$[(\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma] \multimap$$
$$(\uparrow_\sigma \text{ARG}_3) \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$$

According to this lexical entry, the light verb *de* does not contribute a PRED to its f-structure, but does contribute a feature <PERMISSIVE,+>, which can serve to identify the complex predicate in the f-structure. The lexical entry also requires that the light verb's f-structure contain a SUBJ and an OBJ_θ (corresponding to subcategorization for these arguments in the standard LFG approach). The SUBJ and OBJ_θ are associated with the semantic structure attributes ARG_1 and ARG_3 respectively.

The crucial issue is now how the meaning constructors for the lexical predicate and light verb combine, so that an appropriate meaning results, with each argument filling the appropriate role. Given the

[5]This representation can be further complicated in order to deal with argument structure alternations such as the passive, under the proposals of Findlay (2016); this is shown in §3.3. For the present illustration I abstract away from these details, and retain the simpler system of Asudeh and Giorgolo (2012).

f-structure in (13) and the lexical entry in (14), we appear to have a problem: in (14) the agent of the act of writing is associated with ARG_1, which is linked with the SUBJ, but in (13) the SUBJ of the complex predicate is not the writer, but the permitter. The appropriate argument merger of the two predicates is accomplished by the meaning constructor for the light verb. This requires a predicate P which takes an argument, y, associated with the semantic structure ARG_1, and returns P embedded within the predicate *let*, but with y now associated with ARG_3 instead of ARG_1, and ARG_1 now associated with the role of permitter (i.e. x, the first argument of *let*). Effectively, then, the SUBJ=ARG_1 argument of the embedded predicate has been 'merged' with, or rather redefined as, the OBJ_θ=ARG_3 of the light verb, and thereby of the complex predicate as a whole. The resulting meaning is precisely as desired:

(16) $\lambda z.\lambda y.\lambda x.\lambda e.let(x, y, [write(e) \wedge agent(e, y) \wedge theme(e, z)])$:
$(\uparrow_\sigma \text{ARG}_2) \multimap (\uparrow_\sigma \text{ARG}_3) \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

3.3 Argument alternations

I now return to the examples in (1) and (2). The analysis of (1) is unproblematic under the present model. The lexical entries for the noun *bahas* 'quarrel' and *kar* 'do' are given in (17) and (18) respectively (cf. Lowe, 2015, 437–438).[6]

(17) 'quarrel' $(\uparrow \text{PRED}) = \text{'quarrel'}$
$(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG}_1)$
$(\uparrow \text{OBL}_\theta)_\sigma = (\uparrow_\sigma \text{ARG}_4)$

$\lambda y.\lambda x.\lambda e.quarrel(e) \wedge agent(e, x) \wedge comitative(e, y)$:
$(\uparrow_\sigma \text{ARG}_4) \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

(18) 'do' $(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG}_1)$

$\lambda P.\lambda x.\lambda e.P(x, e)$:
$[(\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma] \multimap$
$(\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

Under the assumption that 'quarrel' selects for both a subject and object argument, as shown in (17), the contribution of the light verb in this case is relatively trivial; it requires a subject argument associated with an ARG_1 attribute in the s-structure, but exactly the same constraint appears in the lexical entry of 'quarrel', so the light verb adds

[6]The use of ARG_4 rather than ARG_2 for the second argument of 'quarrel' is based on Kibort's (e.g. 2007) argument structure model, adopted below.

nothing new. In this way the subject of the light verb and the subject of 'quarrel' are effectively 'merged'. The meaning contribution of the light verb is also trivial: it requires a predicate P with an argument x associated with ARG$_1$ (as well as an event variable e associated with a semantic structure EV, but this is not important for the present purposes), and returns the same predicate unchanged. This reflects the fact that fundamentally the function of the light verb *kar* in complex predicates like this is to license nouns and adjectives as clausal predicates, and no more. The result of combining the two meaning constructors in (17) and (18) will therefore be the following, which in combination with the f-structure in (11) and relevant meanings for the two arguments, will give the desired meaning:

(19) $\lambda y.\lambda x.\lambda e.quarrel(e) \wedge agent(e,x) \wedge comitative(e,y) : (\uparrow_\sigma \text{ARG}_4) \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

The resultative complex predicate with 'intransitivizing' *hu* 'become' is more interesting. To account for this, we need to adopt Findlay's (2016) augmentations to the model of Asudeh and Giorgolo (2012), mentioned in fn. 5. Findlay (2016) integrates Asudeh and Giorgolo's proposals with the model of argument structure developed by Kibort (2001, 2004, 2006, 2007, 2008), introducing flexibility into the associations between grammatical functions and s-structure ARG$_x$ features, in order to account for argument alternations such as passivization. For example, the equation $(\uparrow \text{SUBJ})_\sigma = (\uparrow_\sigma \text{ARG}_1)$ would, in Findlay's model, be rewritten as follows:

(20) $\{ \ (\uparrow \{\text{SUBJ} \mid \text{OBL}_\theta\})_\sigma = (\uparrow_\sigma \text{ ARG}_1) \mid (\uparrow_\sigma \text{ ARG}_1)_{\sigma^{-1}} = \emptyset\}$

This still permits the s-structure feature ARG$_1$ to be associated with the SUBJ grammatical function, but licenses other possibilities as well: ARG$_1$ may alternatively be associated with the grammatical function OBL$_\theta$ (as in the passive), or ARG$_1$ may be associated with no grammatical function (e.g. in the passive with unrealized agent). Findlay (2016) shows that redefining the f-structure—s-structure argument specifications in this way efficiently captures a range of argument structure alternations and results in no undesired ambiguity. All such specifications given above could be rewritten in this way, with no technical problems arising for the analyses already presented.

We must therefore revise the lexical entry for *bahas* 'quarrel':[7]

[7] In a slight modification of the Findlay-Kibort argument structure model, I assume that ARG$_4$ can be mapped to OBL$_\theta$ or OBJ$_\theta$, that is in Kibort's (2007) terms ARG$_4$ can be specified as +R. Butt et al. (2010) likewise assume that argument slots may be prespecified as +R.

(21) 'quarrel' $(\uparrow \text{PRED}) = \text{`quarrel'}$
$\{ (\uparrow \{\text{SUBJ} \mid \text{OBL}_\theta\})_\sigma = (\uparrow_\sigma \text{ ARG}_1) \mid (\uparrow_\sigma \text{ ARG}_1)_{\sigma^{-1}} = \emptyset \}$
$\{ (\uparrow \{\text{OBL}_\theta \mid \text{OBJ}_\theta\})_\sigma = (\uparrow_\sigma \text{ ARG}_4) \mid (\uparrow_\sigma \text{ ARG}_4)_{\sigma^{-1}} = \emptyset \}$

$\lambda y.\lambda x.\lambda e.quarrel(e) \wedge agent(e,x) \wedge comitative(e,y) :$
$(\uparrow_\sigma\text{ARG}_4) \multimap (\uparrow_\sigma\text{ARG}_1) \multimap (\uparrow_\sigma\text{EV}) \multimap \uparrow_\sigma$

In combination with the light verb *kar*, this will produce exactly the same output as the lexical entry in (17). It is now possible, however, for *bahas* to surface in alternative configurations, including configurations in which the agent is unexpressed. Consider now the following lexical entry for the light verb *hu* 'become':

(22) 'become' $(\uparrow \text{RESULTATIVE}) = +$

$\lambda P.\exists x.P(x) : [(\uparrow_\sigma\text{ARG}_1) \multimap \uparrow_\sigma] \multimap \uparrow_\sigma$

Once again, the light verb does not contribute a PRED to the f-structure, but does contribute an identifying feature <RESULTATIVE,+>. The crucial feature of *hu* is its meaning constructor, which existentially quantifies the variable associated with the s-structure ARG_1 in the meaning of the lexical predicate. In the case of 'quarrel', this is the agent argument. Since the argument is existentially quantified by the light verb, it must remain unexpressed on the surface, else there would be a resource surplus in the glue. Of the disjunction in the second line of (21), then, the final disjunct must be taken: ARG_1 is associated with no grammatical function in the f-structure ($(\uparrow_\sigma \text{ ARG}_1)_{\sigma^{-1}} = \emptyset$). By the disjunction in the third line of (21), ARG_4 may be associated with the f-struture OBL_θ, OBJ_θ, or nothing. Since the meaning constructor requires a meaning associated with ARG_4, the latter option is ruled out, and by standard mapping principles OBL_θ will be chosen over OBJ_θ. The complex predicate will therefore have the meaning shown in (23), associated with the f-structure in (24).[8]

(23) $\lambda y.\lambda e.\exists x.quarrel(e) \wedge agent(e,x) \wedge comitative(e,y) : (\uparrow_\sigma\text{ARG}_4) \multimap (\uparrow_\sigma\text{EV}) \multimap \uparrow_\sigma$

(24)
$$\begin{bmatrix} \text{PRED} & \text{`quarrel'} \\ \text{RESULTATIVE} & + \\ \text{OBL}_{\text{comit}} & \begin{bmatrix} \text{PRED} & \text{`scorpion'} \end{bmatrix} \end{bmatrix}$$

[8]As shown by Kibort (2006), there is strong evidence against the Subject Condition of Bresnan (2001, 311) in the existence of truly subjectless clauses in Polish; under the analysis presented here, the resultative complex predicate in Hindi would constitute a further example of a subjectless clausal construction.

3.4 An alternative

We could alternatively assume, as in the XLE approach, that nouns such as *bahas* ‘quarrel’ do not subcategorize for agent arguments, but that such subcategorization is added, where required, by the light verb. In that case our analysis of the resultative construction with *hu* would be simpler, involving the following lexical entries:

(25) ‘quarrel’ $(\uparrow \text{PRED}) = \text{‘quarrel’}$
$\{ (\uparrow \{\text{OBL}_\theta \mid \text{OBJ}_\theta\})_\sigma = (\uparrow_\sigma \text{ ARG}_4) \mid (\uparrow_\sigma \text{ ARG}_4)_{\sigma^{-1}} = \emptyset \}$

$\lambda x.\lambda e.quarrel(e) \wedge comitative(e, x)$:
$(\uparrow_\sigma \text{ARG}_4) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

(26) ‘become’ $(\uparrow \text{RESULTATIVE}) = +$

$\lambda P.\lambda e.P(e)$:
$[(\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

Here, ‘quarrel’ requires only a single comitative argument, which will surface as the f-structure SUBJ in the absence of other arguments. In contrast to (22), in (26) the light verb *hu* ‘become’ contributes no meaning; its function is parallel to that of *kar* in (18).

Correspondingly, if ‘quarrel’ does not select for an agent argument, the lexical entry for *kar* ‘do’ must be altered, in order to add an agent argument to the meaning of the lexical predicate:

(27) ‘do’ $\{ (\uparrow \{\text{SUBJ} \mid \text{OBL}_\theta\})_\sigma = (\uparrow_\sigma \text{ ARG}_1) \mid (\uparrow_\sigma \text{ ARG}_1)_{\sigma^{-1}} = \emptyset \}$

$\lambda P.\lambda x.\lambda e.P(e) \wedge agent(e, x)$:
$[(\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma] \multimap (\uparrow_\sigma \text{ARG}_1) \multimap (\uparrow_\sigma \text{EV}) \multimap \uparrow_\sigma$

In contrast to the standard LFG analyses of complex predicates, therefore, it is equally possible to assume that nouns like *bahas* are monovalent (as presented in this section) or bivalent (as in §3.3).

4 Conclusion

The standard LFG approach to complex predicates suffers from two main difficulties: the use of restriction, which undermines monoclausality, and a lack of formalization (or avoidance) of the process of argument merger. The LFG+glue approach developed by Lowe (2015) overcomes both these problems. I have shown here that the light verb alternations discussed by Vaidya et al. (2019) can be unproblematically captured by the LFG+glue approach. Crucially, the *kar* vs. *hu* alternation can be modelled without assuming multiple subcategorization frames for the lexical predicate, i.e. without assuming lexical ambiguity. The alternation can also be modelled unproblematically without prejudice as to whether nominal predicates like *bahas* 'quarrel' select for an agent ($\approx$ subject) argument or not.

Note that the agreement phenomena discussed by Vaidya et al. (2019) are unproblematically captured by the LFG+glue analysis proposed here: since lexical predicate and light verb contribute to the same f-structure, if the noun supplies gender and number features to the f-structure, then the verb can agree with those features. Preventing such agreement in the case of nouns like *yaad* 'memory', a feminine noun which occurs with default masculine agreement on the verb, would be relatively trivial. There is no need, as suggested by Vaidya et al. (2019), to require the nominal predicate to somehow serve as the object of the light verb for agreement purposes.

Lowe (2015) acknowledges one significant weakness in his proposal: it provides no account of scope constraints in multiply embedded complex predicate constructions. As noted in Lowe (2015), this is not a weakness of the semantic analysis, but a broader issue with LFG's functional structure, which affects also the treatment of scope in recursive modification (Andrews and Manning, 1999). This issue has been taken up by Andrews (2018), who proposes changes to the standard approach to f-structure within LFG which resolves these issues. As shown for the semantics of adjectival modification by Andrews (2018), it would require only a relatively minor set of changes to the glue terms provided above in order to integrate the present LFG+glue proposal with Andrews's approach to f-structure, eliminating the one major weakness of Lowe's (2015) approach.

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