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Complex Predication: How did the child pinch the elephant?

MIRIAM BUTT, TRACY HOLLOWAY KING, GILLIAN RAMCHAND

1.1 Introduction

It is an acknowledged truth that some of the most productive linguistics is done in pubs or restaurants. And that a linguist, when in the happy situation of being in the company of other linguists, might write on a paper napkin something like the Urdu sentence in (1) and triumphantly and expectantly turn to the other linguists and say: "And what do you make of that?!"

(1) tara=ne ɑmu=ko (bɑcce=se) hat^{h}i
Tara=Erg Amu=Dat child.Obl=Inst elephant.M.Sg.Nom
pɪnc kɑr-va le-ne di-ya
pinch do-Caus take-Inf.Obl give-Perf.M.Sg
'Tara let Amu have the elephant pinched (by the child).'[1]

In the particular situation we are reporting on here, the linguists around the table all were students of KP Mohanan during the late 1980s. This means they know quite a bit about the structure of Malayalam and South Asian languages in general and have all written papers at some point in their careers on the complex predicates of a South Asian language. And this means they can now delve immediately into a discussion on how to analyze (1). However, the reader is presumably not necessarily in this enviable position and so some

[1] All examples in this paper were checked with native speakers of Urdu. Furthermore, no elephants were harmed in the writing of this paper. Anyone found pinching an elephant will be forced to write an Optimality Theory (OT) section of this paper for us.

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basic background knowledge is provided in section 1.2.

The three linguists, though all students of Mohanan at the same time, went on to pursue quite different frameworks. MB and THK have very firmly developed analyses within Lexical-Functional Grammar (LFG) and have both worked on large computational grammars. THK almost exclusively works in computational linguistics now, while MB continues to pursue both theoretical and computational perspectives. GR, on the other hand, works equally firmly within the Minimalist Program and has never shown signs of finding computational linguistics even remotely interesting. All three are highly opinionated and all three see themselves as simply continuing the kinds of debates one used to have as a matter of course in any of Mohanan's classes, who encouraged lively discussions and used them to arrive at a high level of abstraction.

Sections 1.3–1.5 present the debate in the pub (minus the beer (MB), cider (THK), wine (GR) and insults (all)). Section 1.6 charts the morning after.

1.2 Language and Structural Background

South Asian languages are generally verb final. This is true for Urdu, which is structurally identical to Hindi and is spoken mainly in Pakistan and India. There are only about 500 simplex verbs in Urdu, so the language makes productive use of complex predication. The following combinations are possible: N+V, A+V, V+V. (2) is a noun-verb complex predicate (*pınc ki-ya*).

(2) bɑcce=ne hat^{h}i pınc ki-ya
child.Obl=Erg elephant.M.Sg.Nom pinch do-Perf.M.Sg
'The child pinched the/an elephant.'

There is no simplex verb for 'pinch' in Urdu;[2] if one did not press an English noun into service, as in (2), a different kind of N-V complex predicate would be used instead. Urdu has also borrowed extensively from Persian with respect to nouns for N-V complex predicates. For ease of exposition, we use the borrowed English noun here. As Mohanan (1994) has shown, these N+V predications are monoclausal and must be analyzed as complex predicates. Thus, (2) is equivalent to a simple transitive clause in terms of argument structure.

South Asian languages also generally have a morphological causative. Urdu has two: one with an *-a* morpheme and one with *-va*. The former is used for more direct causation, the latter for indirect causation (a.o. Saksena (1982), Butt (1998), Ramchand (2006)). Almost any verb in Urdu can be causativized, as shown in (3), including N+V complex predicates, as they are predicationally essentially equivalent to a simplex verb.

[2] We leave aside the discussion of why Malayalam feels strongly enough about pinching that it encodes the notion via a simplex verb (*ṇulli*), whereas Urdu does not.

(3) ɑmu=ne (bɑcce=se) hatʰi pınc kɑr-va-ya
Amu=Erg child.Obl=Inst elephant.M.Sg.Nom pinch do-Caus-Perf.M.Sg
'Amu had the elephant pinched by the child.'

(3) is an example of indirect causation (hence the English translation with 'have'). The pattern of causativization across verb classes is quite complex (see Butt (1998) for a summary and references). For our purposes it is sufficient to know that when a canonical transitive is causativized, the causee is instrumental. There is some question of whether this instrumental causee ('child' in (3)) is syntactically an adjunct or whether it is parallel to the oblique *by*-phrases found in passives. Bhatt (2003) and Butt (1998) suggest the latter (though in different ways); Ramchand (2006) treats the instrumental as a syntactic adjunct.

Beyond causativization, other types of complex predication exist in Urdu. The existence of light verbs that convey some kind of aspectual information, as shown in (4), is another feature of South Asian languages.

(4) a. nadya=ne xɑt lıkʰ **li-ya**
Nadya.F=Erg letter.M.Nom write take-Perf.M.Sg
'Nadya wrote a letter (completely).'

b. nadya=ne mɑkan bɑna **di-ya**
Nadya.F=Erg house.M.Nom make give-Perf.M.Sg
'Nadya built a house (completely, for somebody else).'

These V+V predications can also be shown to be monoclausal (see Butt (1995)). The first verb is always the main content bearing verb and is always in what appears to be the stem form, but is actually an old pefect participle (this becomes relevant in section 1.4). The second verb is always form-identical to a main verb in the language (e.g., 'take' and 'give' in (4)), but is 'light' in the sense that it does not add its full argument structure to the predication: instead it conveys semantic information as to the completeness of the action, benefaction, forcefulness, etc. (a.o. Butt and Geuder (2001), Hook (1974)).

Every simplex verb in Urdu can be used in a V-V complex predicate as in (4), though there are selectional restrictions. The same selectional restrictions (for example, light verbs based on (di)transitives select agentive predications) hold for N-V and causativized verbs when used as the main V in V-V complex predicates. Example (5) shows the N-V complex predicate in combination with an aspectual light verb, (6) shows the causativized version of (5) in combination with the same aspectual light verb.

(5) bɑcce=ne hatʰi pınc kɑr li-ya
child.Obl=Erg elephant.M.Sg.Nom pinch do take-Perf.M.Sg
'The child pinched the/an elephant (completely).'

(6) ɑmu=ne (bɑcce=se) hatʰi pınc kɑr-va
Amu=Erg child.Obl=Inst elephant.M.Sg.Nom pinch do-Caus
li-ya
take-Perf.M.Sg
'Amu had the elephant pinched by the child (completely).'

Finally, Urdu also has a permissive, as shown in (7). This permissive is formed with the verb for 'give' (*de*). Again, 'give' here is functioning as a light verb (see Butt (1995)). Unlike the aspectual light verbs discussed above, however, it requires the main verb to carry oblique infinitive morphology. Permissives are also monoclausal. One piece of evidence for this is verb agreement: in (7) the finite verb 'give' agrees with the nominative object 'note', showing that this argument is not just an argument of 'write', but of the whole complex predicate and therefore also of the finite verb 'give'. See Butt (1995) and Butt and Ramchand (2005) for details and argumentation.

(7) hɑsɑn=ne ram=ko **cɪṭṭʰi** lɪkʰ-ne **d-i**
Hassan.M=Erg Ram.M=Dat note.F.Nom write-Inf.Obl give-Perf.F.Sg
'Hassan let Ram write a note.'

Again, permissives can be formed with any verb in the language and therefore also with any complex monoclausal verb. Example (8) shows the permissive in combination with the simple N-V complex predicate, (9) is the permissive of the causativized N-V complex predicate and, finally, (10) is the the example on our paper napkin: a permissive of a causativized N-V complex predicate that has been supplemented with an aspectual light verb.

(8) tara=ne bɑcce=ko hatʰi pınc kɑr-ne
Tara=Erg child.Obl=Dat elephant.M.Sg.Nom pinch do-Inf.Obl
di-ya
give-Perf.M.Sg
'Tara let the child pinch the/an elephant.'

(9) tara=ne ɑmu=ko (bɑcce=se) hatʰi pınc
Tara=Erg Amu=Dat child.Obl=Inst elephant.M.Sg.Nom pinch
kɑr-va-ne di-ya
do-Caus-Inf.Obl give-Perf.M.Sg
'Tara let Amu have the elephant pinched by the child.'

(10) tara=ne ɑmu=ko (bɑcce=se) hatʰi
Tara=Erg Amu=Dat child.Obl=Inst elephant.M.Sg.Nom
pınc kɑr-va le-ne di-ya
pinch do-Caus take-Inf.Obl give-Perf.M.Sg
'Tara let Amu have the elephant pinched (by the child) (completely).'

Tests from agreement, control and anaphora resolution show that (10) is a monoclausal predication (see Butt (1995)). So in (10) we have five predicational elements (the noun *pinch*, the light verb *kar*, the causative *-va*, the aspectual light verb *le-ne*, and the permissive light verb *di-ya*) that combine to form a monoclausal predicational structure. Having established this, the question now is — how can we best analyze these combinatorial predicational possibilities?

1.3 Linking Theory

Linking Theory within LFG was developed to deal with regularities in the expression of case, arguments and grammatical relations (see Butt (2006), Chapter 5 on linking theories in general and LFG's in particular). Linking theory does not assume a one-to-one or a strict hierarchical mapping between thematic roles and grammatical relations — rather, the theory allows just the right kind of flexibility to be able to account for argument alternations as well as non-canonical subjects (e.g., experiencer subjects or the non-canonical case marking of Icelandic) and objects. This stands in stark contrast to the Uniformity of Theta Assignment Hypothesis (UTAH) formulated as part of Government-Binding (GB), by which identical thematic relationships between items must be represented by identical structural/syntactic relationships (Baker 1988).

In the 1980s, linking theory was applied to complex predication in Bantu, Romance and South Asian languages. The basic system is pleasingly simple and yet powerful enough to deal with a large range of complex predicate types. It is therefore a prime candidate for dealing with (10).

LFG is a theory which assumes several distinct *projections*. The c(onstituent)-structure models constituency, linear order and hierarchical embedding. The f(unctional)-structure encodes the basic predicate-argument relations of the clause in terms of grammatical functions, adjuncts, etc. The f-structure is part of syntax and grammatical functions encoded here are related to a more semantically based predicate-argument structure that encodes just the core arguments required by the verb. A simple example based on Bresnan and Zaenen (1990) is given in (11).

(11)

a-structure:	*pinch* <	agent	theme	>
		[−o]	[−r]	
		|	|	
f-structure:		SUBJ	OBJ	

Grammatical functions (GF) are related to thematic roles at a-structure via just two features: [±r(estricted)] and [±o(bjective)]. The features reflect crosslinguistic tendencies as to the properties of the thematic roles. For example, agents tend not to be realized as objects and themes tend to be subject

to few restrictions. Similarly, subjects are not objects and tend to be related to all kinds of thematic roles, hence a subject is characterized by the feature complex [−o, −r]. The full correspondences are given in (12).

(12)

Grammatical Functions	**Features**
SUBJ	[−r, −o]
OBJ	[−r, +o]
OBJ_θ	[+r, +o]
OBL_θ	[+r, −o]

Approaches within LFG have differed with respect to how thematic roles are connected up with the [±o,r] features. Due to space constraints, we do not discuss these here, but assume the standard approach of Bresnan and Zaenen (1990), which formulates basic principles determining the unmarked choice of features for thematic roles: patientlike roles are [−r], secondary patientlike roles [+o] (e.g., goals) and all others are [−o]. On the basis of this feature assignment, a set of mapping principles connects thematic roles with grammatical functions. For our purposes, no distinctions will be made between themes and patients, both are [−r], and goals are [+r]. As in Bresnan and Zaenen (1990), the highest role classified as [−o] should be mapped to SUBJ; if that is not available, then the [−r] role is mapped to SUBJ. Deviating from Bresnan and Zaenen, all other thematic roles are mapped to grammatical functions according to a combination of the feature specification of thematic roles and constraints coming from case markers. For example, the dative case contributes the feature [+o], resulting in a mapping to OBJ_θ (rather than OBL_θ, cf. (25)).

1.3.1 Argument Merger

With respect to complex predicates, a few extra pieces are needed for the analysis. One is the idea that light verbs have a variable in their argument structure that calls for another predicate to be substituted in. For example, take the information associated with the light verb 'do' (as in 'pinch do').[3]

(13) DO $<$ ag %Pred $>$

The %Pred signals that the argument structure is incomplete: the argument structure of another predicate must be substituted in before the predication is complete (cf. Alsina (1996), who first proposed this idea). In our example, the a-structure of *pinch* would be substituted in.

Linking Theory was originally intended to apply only within the lexicon. Alsina (1996) and Butt (1995) showed that for syntactically formed complex predicates, argument structure combinations and linking also had to be allowed within the syntax. Alsina (1996) further argued that morphological

[3] ag=agent, pt=patient, th=theme, go=goal.

and syntactic complex predication should be analyzed at the same abstract level of representation: at a-structure via a-structure merger.

Furthermore, when a-structures are combined, *argument identification* must take place. That is, one of the matrix arguments must be identified with one of the embedded arguments (Alsina and Joshi 1991, Mohanan 1994, Butt 1995, Alsina 1996). The assumption that argument identification exists and plays a significant role in the realization of grammatical functions and the distribution of case marking is not one generally shared by work within GB or the Minimalist Program (MP). A recent exception is Ramchand (2006) (section 1.4) and it is to be suspected that some crosstheoretical crossfertilization has taken place due to late night discussions over paper napkins.

Rather than spending more time on abstractly describing how argument structures are merged, the next few sections chart how the analyses work out within LFG's Linking Theory with respect to our paper napkin example. For presentational convenience, the analyses work outwards from the inside, i.e., by beginning with the N-V complex predicate 'pinch do'.

1.3.2 N-V Complex Predicates

That the noun contributes to the overall a-structure of a N-V complex predicate is shown by examples such as (14), where 'story' is licensed by the noun 'memory', not by the verb 'do'; see Mohanan (1994).

(14) bɑcce=ne kahani yad k-i
child=Erg story.F.Sg.Nom memory do-Perf.F.Sg
'The child remembered a/the story.'

There are thus two separate a-structures involved in the predication that are combined as part of argument merger. We assume, following Butt (1998) and Mohanan (1994) that argument identification functions in parallel to syntactic control in that the lowest matrix argument is always identified with the highest embedded argument. Thus, the a-structure for 'do', repeated in (15a), is combined with the a-structure for 'pinch' in (15b), resulting in the merged a-structure in (16). The sole matrix argument, an agent, is identified with the highest embedded argument, also an agent.

(15) a. DO < ag %Pred > b. PINCH < ag th >

(16) DO < ag PINCH < ag th > >
[−o] [−r]
| |
SUBJ OBJ

The complex a-structure thus provides two arguments to be linked into the syntax. This is done via the standard linking relations, as also shown in (16). Themes are classified as [−r] and the agent is classified as [−o] by default.

The highest (and only) [−o] argument is linked to SUBJ by the mapping principles. The theme could in principle be linked to SUBJ or OBJ, but given that the clause already contains a subject (linked to the agent), the theme is linked to OBJ. There is thus exactly one subject ('child') and one object ('elephant') in the clause. The noun 'pinch' does not function as an object. This is illustrated more clearly with respect to (14), where the finite verb 'do' agrees with the object 'story', but not with 'memory'. The nouns 'memory' and 'pinch' must thus be analyzed as part of the predicate, but not as syntactic arguments.[4]

A further nice aspect of Linking Theory is that it allows one to express generalizations in terms of the distribution of case marking. In Urdu (and in South Asian languages more generally), the ergative is generally associated with agents (selects for [−o]), the instrumental with 'demoted' agents (selects for [−o,+r]) and the dative with goals (selects for [+r]).[5] The ergative in (14) thus marks the merged agent argument, the nominative marks the theme.

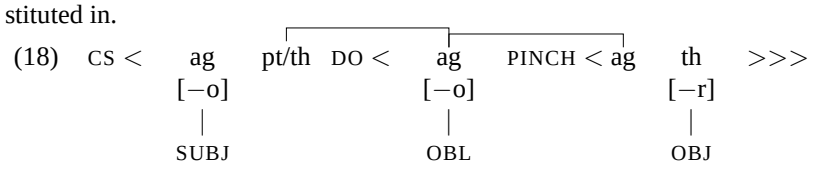
1.3.3 Causativization

As first proposed by Mohanan (1988) and taken up by Alsina (1996) for Romance, a three-place causative is assumed for direct causation, as in (17). The causee is labeled pt/th (for the sake of simplicity, no distinction is made between these roles). The cause predicate, CS, requires another predicate.

(17) CS < ag pt/th %Pred >

This other predicate could be any simplex or any complex verb in the language. In (18), the complex a-structure of the previous section has been substituted in.

(18)



Via the rule of argument identification the lowest matrix argument (the pt/th causee) has been identified with the sole embedded argument. The new merged argument, namely the causee, has both the properties of a patient/theme and those of an agent. In our example, repeated in (19), the causee is realized in the instrumental. Given that the instrumental (among other things) selects for 'demoted', or in this case, merged agents, the case marking is consonant with the [−o] feature of the agent part of the merged argument.

[4] The wider set of data with respect to N-V complex predicates and agreement are more complex. See Mohanan (1994) for a detailed discussion.

[5] Direct objects can either be marked with *ko*, the dative/accusative marker, or carry no marking. The latter is glossed as nominative. The *ko*/∅ alternation correlates with definiteness/specificity; see Butt (2006) Chapter 7 for discussion of this phenomenon.

(19) ɑmu=ne (bɑcce=se) hatʰi pɪnc kɑr-va-ya
Amu=Erg child.Obl=Inst elephant.M.Sg.Nom pinch do-Caus-Perf.M.Sg
'Amu had the elephant pinched by the child.'

However, the dual nature of a merged argument can result in different case marking across languages. With respect to some verbs, the causee in (19) can be realized alternatively in the instrumental or in the accusative/dative. An example from Urdu is shown in (20).

(20) a. ɑnjʊm=ne sɑddɑf=**ko** masala cɑkʰ-va-ya
Anjum.F=Erg Saddaf.F=**Acc** spice.M.Nom taste-Caus-Perf.M.Sg
'Anjum had Saddaf taste the seasoning.'

b. ɑnjʊm=ne sɑddɑf=**se** masala cɑkʰ-va-ya
Anjum.F=Erg Saddaf.F=**Inst** spice.M.Nom taste-Caus-Perf.M.Sg
'Anjum had the seasoning tasted by Saddaf.'

The different linking possibilities associated with merged arguments thus account for wider patterns associated with causatives.[6]

1.3.4 Aspectual Light Verbs

Aspectual light verbs give a sense of completion of the event. Additionally, Butt (1995) shows that while aspectual light verbs make only a very subtle contribution to the predication, they determine the case marking of the subject. Light verbs based on (di)transitive verbs like the 'take' in our example require an ergative subject in the perfect. Light verbs based on intransitives require a nominative in the perfect (see Butt (1995) for details).

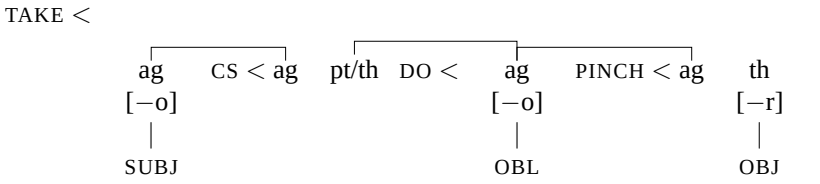
(21) ɑmu=ne (bɑcce=se) hatʰi pɪnc kɑr-va
Amu=Erg child.Obl=Inst elephant.M.Sg.Nom pinch do-Caus
li-ya
take-Perf.M.Sg
'Amu had the elephant pinched by the child (completely).'

Within Linking Theory, this falls out from the effects of argument merger if the a-structure of an aspectual light verb consists of just one argument plus a variable standing for another predicate. In (23) the complex a-structure of (18) has been substituted in for the variable.

(22) TAKE < ag %Pred >

[6] There is more to be said here, of course. Alsina and Joshi (1991), for example, propose to capture the crosslinguistic variation found in causativization via two different causative predicates, one 2-place and one 3-place (based on original argumentation by Mohanan (1988)) combined with parameters on argument identification, where different arguments of the matrix and embedded a-structures can be combined with one another. The analysis here follows proposals by Butt (1998) which allow for only one type of argument identification: that of the lowest matrix argument with that of the highest embedded argument. In addition, only a three-place causative predicate is assumed here.

(23)



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Because argument identification applies to merge the sole argument of 'take' with the highest argument of 'cause', there is no net increase in the number of GFs. The contribution of the aspectual light verb lies within the aspectual event semantics, which is not standardly part of Linking Theory. The linking in (23) confines itself to statements about morphosyntactic properties of a clause, such as the realization of GFs and the distribution of case marking. While some semantic properties are factored in via the semantic interpretation of thematic roles, Linking Theory per se is not about event semantics. This contrasts with the approach in section 1.4.

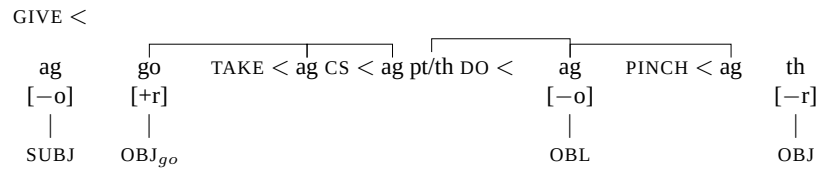
1.3.5 Permissive

The Urdu permissive is based on the verb 'give' and as such it is natural to assume a three-place predicate for the light verb as well, as in (24).

(24) GIVE < ag go %Pred >

In (25) the complex a-structure of (23) has been substituted in. Via argument identification, the lowest argument of the matrix a-structure (the goal) is identified with the highest argument of the complex embedded a-structure. This results in a net increase of one GF, the permitter. The goal is classified with [+r] by the basic classification principles and links to a dative object (OBJ_{go}). All other linkings have already been discussed.

(25)



>>>>>

(26) tara=ne ɑmu=ko (bɑcce=se) hat^{h}i
Tara=Erg Amu=Dat child.Obl=Inst elephant.M.Sg.Nom

pinch kar-va le-ne di-ya
pinch do-Caus take-Inf.Obl give-Perf.M.Sg
'Tara let Amu have the elephant pinched (by the child) (completely).'

Thus, even though we have eight arguments at the level of a-structure for (26), due to argument identification, these arguments corresponds to only four GFs. Linking Theory makes exactly the right predictions as to the types of GFs involved and, furthermore, the case marking is consonant with the types of arguments linked at a-structure. In (26), the permittee 'Amu' has dative case because it is linked to a goal. The causee 'child' is analyzed as an oblique. In the following section, it is treated as an adjunct. If the instrumental causees indeed turn out to be syntactic adjuncts, rather than oblique agents like those found in passives, then this linking approach would need to be revised and the agent arguments would have to be suppressed rather than merged. However, argument suppression with respect to argument merger as part of complex predication is not predicted within Linking Theory.

1.4 First Phase Syntax

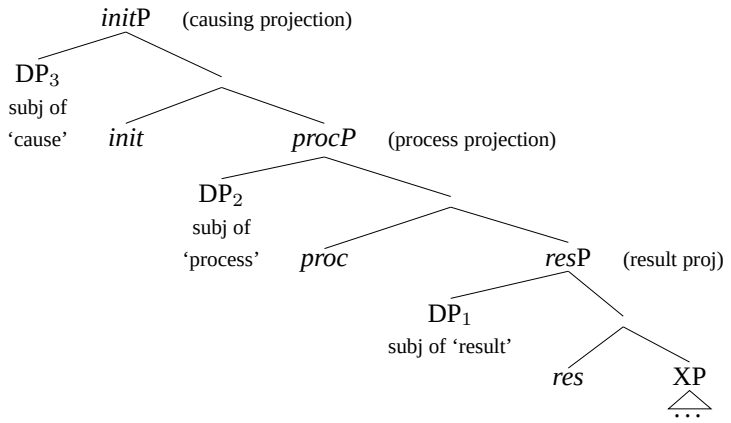
From the perspective of a minimalist architecture, complex predications are an important source of evidence for the internal structure of events and verbal lexical items. Ramchand's work on the syntactic decomposition of event structure makes a number of claims that distinguishes it from LFG (Ramchand (2006)). Most importantly, it shares with a general minimalist approach the desire to have only one module in the grammar where systematic patterns and generalizations are stated.[7] This is called the 'narrow syntax' (Chomsky (1995) inter alia) and in particular, no rules or transformations can be stated in 'the lexicon'. In this theory, while the lexicon must exist in the sense of memorized associations between meaning and sound, and perhaps also syntactic features, it is not an encapsulated module and no rules can be stated to take place there. In this system, the equivalent of the argument structure module of LFG is an articulated syntax in the lowest portion of the clause. This architectural decision is justified by the fact that structures and mechanisms independently argued to be necessary for the narrow syntax are enough to account for the generalizations about argument structure relationships and predication.

Specifically, with regard to complex predications in a language like Urdu, independent lexical items and visible pieces of morphology give evidence of the structure that must exist even for more morphologically stingy languages like English where one word lexicalizes highly complex meanings.

[7] Here, we put aside generalizations that might have to be stated in a phonological module, or at a discourse level; these can be handled at the interfaces between the computational system and the articulatory/perceptual or conceptual/intentional modules of the mind respectively.

In Ramchand (2006), the event structure syntax contains three important subevental components: a causing subevent, a process denoting subevent and a subevent corresponding to result state. Each of these subevents is represented as its own projection, ordered in the hierarchical embedding relation in (27).

(27)



The label *init* (for initiation) represents the outer causational projection that is responsible for introducing the external argument; in many ways it is similar to the external argument introducing *v* (Hale and Keyser (1993), Harley (1995), Kratzer (1996)). The central projection that represents the dynamic process is called *proc*P (for process phrase). The lowest projection has been labelled *res* for result. (27) represents the maximal possible decomposition, and a dynamic verbal projection may exist without either the *init* or *res* elements. Under this view, *proc*P is the heart of the dynamic predicate, since it represents change through time, and it is present in every dynamic verb. The *init*P exists when the verb expresses a causational or initiational state that leads to the process. The *res*P only exists when there is a result state explicitly expressed by the lexical predicate; it does not correlate with semantic/aspectual boundedness in a general sense.

In addition to representing subevental complexity, as motivated by work on verbal aktionsart (Vendler (1967), Parsons (1990), Pustejovsky (1991)), this structure captures a set of core argument roles, as defined by the predicational relations formed at each level. In some sense, each projection forms its own core predicational structure with the specifier position filled by the 'subject' or 'theme' of a particular (sub)event, and the complement position filled by the phrase that provides the content of that event. The complement position is also complex and contains another mini-predication. In this way, the participant relations are built up recursively from successively embedded

event descriptions and 'subject' predications.

- *init*P introduces the causation event and licenses the external argument ('subject' of cause = INITIATOR)
- *proc*P specifies the nature of the change or process and licenses the entity undergoing change or process ('subject' of process = UNDERGOER)
- *res*P gives the 'telos' or 'result state' of the event and licenses the entity that comes to hold the result state ('subject' of result = RESULTEE)

The other important thing is that DP arguments can move (or remerge) in more than one predicational position in the tree, accumulating relevant entailments as they do so. This means that thematic relations are often composite, and that the Theta Criterion as found in most versions of GB Theory is not in force (see Hornstein (2000) for arguments from control that the Theta Criterion in its original form should be dispensed with). The generalizations that the Theta Criterion was designed to account for are restated in terms of macro roles. This is one of the issues that lies at the heart of the problem of complex predications.

The challenge is to use this system to analyse the morphosyntactically complex monoclausal sentence on the paper napkin, namely (10). The tools are our disposal will be (i) the more finely decomposed structure of the event which separates the contributions of different lexical items to the larger predication and (ii) the possibility of phasal recursion. Recursion is generally available in syntactic organisation, provided we have a lexical item of the appropriate category that is syntactically specified to combine with something smaller than a fully tensed clause. In the cases considered here, causative recursion will obtain when an *init*P structure is selected for. Since the recursion is at the level of *init*P, before the case checking and tense-aspect functional structure of the clause is built, these complex predications are monoclausal from the point of view of LFG's grammatical functions or GB's Case theory.

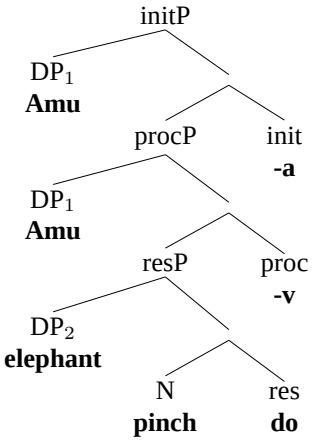
Starting with the most deeply embedded piece of morphology, Ramchand (2006) analyses the causative morpheme in Urdu as the spell out of an *init* head that provides the semantics of generalized causation. When *-a* spells out the *init* head, the root spells out the *proc* and *res* portions of the event. The difference between the *-a* and *-va* causative marker lies in how much of the first phase is spelled out by the root. The *-va* causative marker spells out both the *init* and *proc* heads and the root identifies only the *res* portion. This gives the semantics of indirect causation because the processual subevent that the clause asserts is distinct from the lexical encyclopedic content of the root. Thus, the initiator exerts an act of will to initiate a process (which remains vague and open) to achieve the result of pinching.

Ramchand further argues that the existence of an instrumental marked adjunct interpreted as the causee is correlated directly with the suppression of

a process subevent in the root. This always happens with *-va* causatives, because the root is forced into the *res* position. The lexically identified process of pinching remains implicit, since the *-va* causative simply asserts that some process (perhaps bribing a small child to do so) brought about the elephant's being pinched. The adjunct *-se* phrase is attached freely and its meaning describes information that is cotemporaneous with a process subevent; it must also be facilitating, and not in volitional control. Because of this analysis, the 'causee' is not placed within the argumental decomposition of a causative in *-va*. I will assume that it is an adjunct, freely adjoined at the *proc*P level.

Thus, (28) represents the *va* causative version of 'pinch-do' with 'Amu' as the subject and 'the elephant' as the holder of result. In the tree, the *va* morpheme has been further decomposed into a *process* suffix *-v* and the already identified *init* suffix *-a*. However, nothing crucial hinges on this decomposition, as long as the combined suffix *-va* spells out both *init* and *proc*. The nominal complex predicate 'pinch do' is represented as a head complement structure. In addition to the specifiers, complement positions have a role in building up the event. Complement positions are 'rhematic': they co-describe the eventuality expressed by the eventive head, in this case *res*. The combinatoric semantics of the system thus accounts for the semantics of a Noun-Verb complex predicate in Urdu: provided that we merge the Noun in complement position, the semantics will interpret the 'doing' event as one that was characterized by being a 'pinching' (Hale and Keyser (1993) propose much the same thing for their conflation verbs such as *dance* in English (which is derived from DO-dance)).

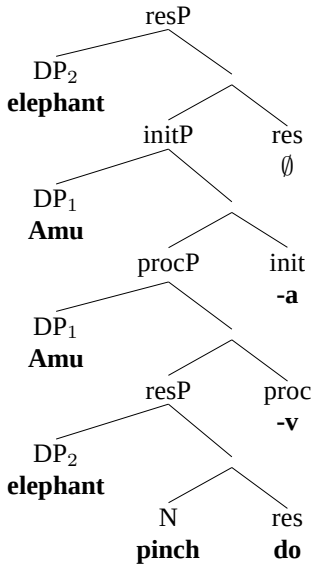
(28)



One final point should be made about (28). The DP_1 'Amu' is in spec, procP in addition to spec, initP. Ramchand (2006) argued that continuous dynamic involvement or psychological involvement allows causers to be interpreted as

composite INITIATOR-UNDERGOERS, and DP_1 accounts for the volitionality associated with the *-va* causative.

(29)



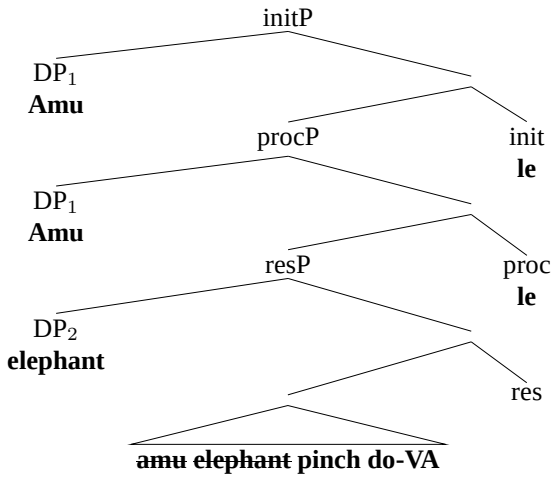
Once the causative of 'pinch-do' has been built, the next element in the structure turns the phrase into a perfect participle. This is our first use of recursion. There is no overt morphology for this, although the form in question is non-finite, and is used in perfective non-finite adjunct clauses. In other South Asian languages (e.g., Bengali), the morpheme is overt. The assumption here is that Urdu has a listed lexical item with the required categorial feature, but with null phonological exponence. In this system, null heads should be restricted to cases where such null lexical items are learnable in a particular language, and are not freely available. The merging of the null *res* head is a required next step for convergence because the light verb *le*-'take' selects a verb in this form.

Since the semantics of this participle is perfective, the morpheme converts a full *init*P into a result projection, which predicates over the internal argument of the *initP*. This causes the internal argument 'the elephant' to move into the specifier of the newly created *res*P. The addition of the null result phrase creating morpheme is shown in (29).

Now we can combine this structure with the light verb *le*. Butt and Ramchand (2004) analyse complex predicates of this type within a Ramchandian decomposition structure, and argue that the light verb *le* is a morpheme that identifies *init* and *proc*. This forces the root (in this case, the complex structure built up) to be a *resP* and gives the construction completive semantics.

The lexical content of *le-* only identifies the initiation and process vaguely since it has very abstract lexical semantics, but it says that the result state (of Amu having made the elephant be pinched) is brought about by somebody.[8]

(30)



The light verb *le-* creates new specifier positions for the subevents that it identifies. These must be filled. The argument in its specifiers must either be Moved from a lower position or Merged in from the lexical store. Merging in new DPs will cause trouble since only a maximum of three arguments can be licensed by the Case assigning functional structure in the next stage of sentence building. Attracting 'elephant' will also cause a crash because failing to move 'Amu' will leave it too far down in the structure for Case licensing.[9] Thus, 'Amu' is moved to fill the spec, procP and spec, initP positions.

It can be seen that the arguments are gradually accumulating entailments:

(31) 'elephant' : RESULTEE of pinched state; RESULTEE of someone's forceful action
'Amu': INITIATOR-UNDERGOER of the wilful causing of the elephant's pinched state; INITIATOR-UNDERGOER of forceful action.

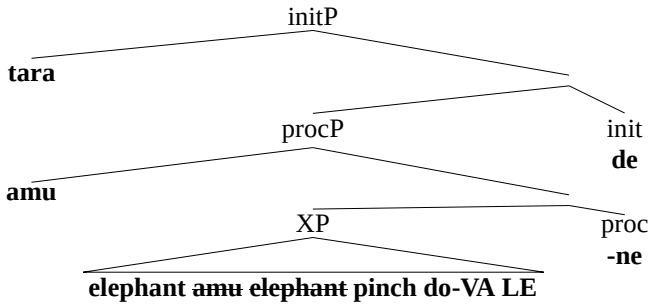
The derivation is still not complete. The structure needs to be embedded under the permissive light verb *di-* 'give' which requires a particular morphological form of the verb to combine with. Butt and Ramchand (2004) argued that the permissive complex predicate was like the *-a* causative in that the

[8] Different light verbs that select for a *res*P can also carry different nuances of meaning, such as suddenness, or forcefulness, but I assume that this is part of the lexical encyclopedic semantics of the individual light verb roots and should not be represented in the structure.

[9] Elements are syntactically accessible within the same 'phase' or if they are at the edge of the previously constructed phase (cf Adger (2003)). If we assume that *init*P is a phase, this allows us to move 'Amu' to the higher predicational positions.

light verb only filled the *init* position, identifying an initiational state of giving permission. The lexical encyclopedic content of the *give* light verb provides this content to the causing state, while the lexical encyclopedic content of the main verb identifies the content of the process that has been allowed. Before this can be done, the structure that has been built up must be converted into a *proc* category. This is the function of the *-ne* 'infinitival' morphology. The *-ne* morpheme takes a full blown verbal structure and creates a derived process out of it, one predicated crucially over the original external argument. The structure is now ready to combine with the light verb *de* to give the permission construction.

(32)



The light verb *de* introduces its own specifier which is filled by a new merged argument, 'tara'. Embedding under the Case assigning functional parts of the clause assigns ergative case to the argument in spec, *init*P, dative/accusative to the argument in spec, *proc*P and accusative to 'elephant'. Since the Case properties of the complex predicate do not seem to be any different from those found in a normal ditransitive, the same mechanisms apply. Here we leave open whether Case can be assigned in situ via higher functional structure, or whether covert movement is required in this language for any of the three relevant arguments here. The strike-throughs in the diagram show copies of the DPs which will not be pronounced. Reading the tree from left to right (and assuming head movement in the case of the causative morphemes), we get the default word order in (10). The accumulated entailments after movement look like (33):

(33) 'elephant' : RESULTEE of pinched state; RESULTEE of someone's forceful action
'amu': INITIATOR-UNDERGOER of the wilful causing of the elephant's pinched state; INITIATOR-UNDERGOER of forceful action; UNDERGOER of act of permission
'tara': INITIATOR of act of permission.

This analysis has a number of advantages. It derives the correct word order and entailments over the argument positions, using a single syntactic mode

of representation and operations that are independently attested in the grammar. In particular, it exploits the possibilities of recursion present in syntactic computation, and the hierarchy assumed on semantic grounds for subevent decomposition makes the right predictions for syntactic positioning of morphemes. The analysis also gives a concrete proposal for the interpretation and function of the morphemes *-ne* and *-va*, and for the null morpheme that creates perfect participles. Moreover, under a theory that has no lexical or argument structure module, no paradox arises from complex predications which behave as if they were embedded as a single clause under tense. The only difference between Urdu and other languages which do not exhibit the complex predicate phenomenon is that in Urdu there is more of a one-to-one correspondence between individual heads in the representation and lexical items/morphemes. In English, a single lexical item nearly always moves to identify more than one syntactic head in the structure, giving the illusion of simplicity. In fact, it is the English simple verb that is complex, in the sense of carrying more than one category feature in any particular structure.

1.5 A Computational Perspective

As was shown in section 1.3, the Urdu complex predication data fall out nicely within LFG's Linking Theory. The expectation would therefore be that this well-organized system of mapping between a-structure and GFs should be straightforward to implement given that LFG was designed with computation in mind. However, several problems present themselves. For one, from a computational linguistic perspective, *anything* involving complex argument composition is difficult. This is because information specified by the PRED(icate) is used to check that all and only the subcategorized arguments are present. Thus, operations which change the information specified by the PRED are difficult.[10] However, given the pervasive use of productive complex predicate formation, it is essential to find an efficient way to compose predicates, including the deeply nested compositions as in (10).

For another, computational accounts have generally shied away from implementing the linking relations posited by theoretical analyses of syntactically formed complex predicates such as those in sections 1.3 and 1.4. This is because when one looks closely, there is no standard version of Linking Theory, Theta-Assignment or Case Theory that is practiced. With respect to LFG, there is a core part of Linking Theory, described in Bresnan and Zaenen (1990); however, attempts to make it 'scale up', i.e., apply it to a large

[10] In LFG lexical rules are standardly used for simple argument deletions and renaming of grammatical functions (passives). However, they are not powerful enough to deal with complex predication because they do not provide complex ways of merging predicates. Even the addition of simple arguments to a predicate is complicated in that there must be a way of stating which argument slot is to be added and what happens to the existing arguments.

body of varied phenomena, has resulted in many differing versions of Linking Theory, rather than a steadily expanding body of common assumptions. The analyses presented in section 1.3, while containing a core of Linking Theory that everybody agrees on, is highly colored by ideas Butt has advanced on the basis of her work on Urdu, but which have not necessarily been widely adopted. In addition, some well-formedness checks, like Coherence and Completeness, have to be performed both at f-structure and at a-structure, thus duplicating the efforts at well-formedness checking (see also Dalrymple (2001) on how glue semantics accounts for completeness and coherence). Alsina (1996) therefore proposes to abandon checking at f-structure and to perform well-formedness checks only at a-structure (see also Alsina et al. (2005) for a discussion along these lines).

This state of affairs has led to a general perception among LFG computational linguists that a-structure and its relation to f-structure and c-structure are not theoretically well enough understood to warrant the effort of maintaining an extra projection; extra projections are computationally expensive and complex to maintain from the point of view of grammar engineering, see, e.g., Butt et al. (1999). Analyses of complex predicates thus reveal an interesting tension between computational and theoretical approaches.

Eschewing the use of a separate projection for a-structure, Kaplan and Wedekind (1993) introduced an account of V-V complex predicates that employed the *Restriction Operator*, which manipulates f-structure representations and operates within the lexicon. However, Butt (1994) showed that this initial solution requires a large amount of undesirable lexical stipulation and cannot account for the full combinatorial power of complex predicate formation, which is a major drawback.

Subsequent developments then allowed the Restriction Operator to operate within the syntax as well as the lexicon. In particular, Butt et al. (2003) show that it is possible to implement the restriction analysis of complex predicates for Urdu in a way that seems to capture the original observations of Alsina and Butt satisfactorily. In light of the theoretical work showing the parallels between syntactic and morphological causatives, reflected in the data in section 1.2, Butt and King (2006) argue that the Restriction Operator can apply to morphologically formed complex predicates, such as the Urdu causative. Morphological causatives are usually assumed to comprise a single lexical item and hence a single constituent-structure node. The key to this analysis lies in the structure of the sublexical component and in the morphology-syntax interface assumed in computational grammars. In some ways this is similar to the analysis in section 1.4, but the morphemes are not identified as such, instead being features, and the posited structure is not as hierarchical. As with theoretical analyses, the output of one restriction operation can act as the input to another, allowing for exceedingly complex predication.

The difference between theoretical LFG analyses of complex predicates and causatives and the one outlined here lies in the fact that the Restriction Operator analysis eschews any reference to a separate a-structure projection. The difference from the First-phase syntax account lies in less nesting, the positing of a separate functional-structure, and a different view of morphology.

The functional-structures for the relatively simple N-V complex predicate in (2), its causative in (3), and the permissive causative (9) are shown in (34). The core N-V complex predicate is represented here as a simple verb.

(34) a. N-V: The child pinched the elephant.

$$\begin{bmatrix} \text{PRED} & \text{'pinch<SUBJ, OBJ>'} \\ \text{SUBJ} & [\ \text{PRED 'child'}\ ] \\ \text{OBJ} & [\ \text{PRED 'elephant'}\ ] \end{bmatrix}$$

b. N-V Caus: Amu had the elephant pinched by the child.

$$\begin{bmatrix} \text{PRED} & \text{'Cause<SUBJ, 'pinch<OBL-AG, OBJ>'>'} \\ \text{SUBJ} & [\ \text{PRED 'Amu'}\ ] \\ \text{OBL-AG} & [\ \text{PRED 'child'}\ ] \\ \text{OBJ} & [\ \text{PRED 'elephant'}\ ] \end{bmatrix}$$

c. N-V Caus Perm:
Tara let Amu have the elephant pinched by the child.

$$\begin{bmatrix} \text{PRED} & \text{'Perm< SUBJ, 'Cause<OBJ-GO, 'pinch<OBL-AG, OBJ>'>'>'} \\ \text{SUBJ} & [\ \text{PRED 'Tara'}\ ] \\ \text{OBJ-GO} & [\ \text{PRED 'Amu'}\ ] \\ \text{OBL-AG} & [\ \text{PRED 'child'}\ ] \\ \text{OBJ} & [\ \text{PRED 'elephant'}\ ] \end{bmatrix}$$

The question is how to form these functional-structures from the surface string given that there is no lexical entry for the complex predicates: that is, how are the complex PRED values formed?

The Restriction Operator takes well-formed functional structures and allows them to be used for "restricting out" certain features. With complex predicates the structures are identical except for the grammatical functions of some of the arguments and the form of the predicate. For example, modifiers (e.g., *on Tuesday*, *silently*) are not affected, nor is the internal structure of the arguments, which may be quite complex.[11] Formally, this is done in LFG by annotated constituent-structure rules like in (35).

[11] The arguments also differ in the case assignment. Case assignment is only done on non-restricted functional-structures. The rules of case assignment in the Urdu LFG implementation are similar to those described in section 1.3.

(35) Vcomplex → Vmain: ↓\OLDGF\PRED=↑\OLDGF\PRED; (↓OLDGF) = (↑NEWGF); (↑ PRED ARG2)=(↓ PRED)
Vlight: ↑=↓

The annotation ↓\OLDGF\PRED=↑\OLDGF\PRED states that the f-structure corresponding to the complex predicate is identical to that of the heavy verb except for the argument that is not identical (often the subject) and, of course, the predicate itself. The annotation (↓OLDGF) = (↑NEWGF) allows the functional structure of the old argument to be used by the complex predicate as some new argument (for example, the subject might be an oblique agent in the causative (section 1.2)).

For rules like (35) to work, both the light verbs and the causative morphology need to have lexical entries which allow for the predicates to be composed, in particular to expect another predicate as an argument. For example, the entry associated with the causative morpheme is (↑ PRED) = ′Cause<(↑ SUBJ), %PRED2>′. This is very similar to the argument structure proposal in section 1.3. The annotation (↑ PRED ARG2)=(↓ PRED) in (35) provides this predicate argument to the causative, thereby creating a complex predicate.

The restriction analysis treats morphologically and syntactically formed complex predicates identically by associating the same kinds of a-structures with the light verbs and causative morphemes and by composing the complex predications in the syntax (c- and f-structure). This conforms to theoretical LFG analyses so that even though the location of the predicate manipulation is different (syntax for computational implementation and a-structure for theoretical analyses) the uniformity and importantly the productive formation and monoclausal nature of complex predicates is preserved.[12]

1.6 Beyond the Details: The Morning After

Complex predications are some of the most challenging constructions to account for. The purpose of this exercise has been to compare three distinct approaches that have taken the problem seriously. In doing so, certain lessons are learned. The first is that the tools available in each framework can be adapted to do the job, at least descriptively. One of the things Mohanan taught us is that in some cases, ideological rigidity can blind one to the commonalities across frameworks, and obstruct general progress on substantive issues.

[12] Joan Bresnan (p.c.) argues that the restriction operator raises questions about the status of the Principle of Direct Syntactic Encoding: one of the principles of LFG was to avoid the overly powerful transformation architecture of Transformational Grammar (and its successors) and to not allow for the change of grammatical functions in the syntax. However, restriction as used for complex predicate formation does not change syntactic functions. Rather it takes in new content at each level of the c-structure, i.e. as the complex predicate is built up, and uses this content to project an appropriate f-structure.

Therefore, we begin by outlining the core discoveries that we all agree on.

Each framework needs to have a way of "composing" participant relations. In the case of LFG, this is done at a-structure by means of argument identification. In the syntactic decompositional account, participant role semantics are associated with particular positions, and entailments are accumulated by means of movement. In the computational approach, the Restriction Operator selectively modifies the f-structure of the composed predicate, keeping the other properties intact. In each of the three cases, there is evidence for constructional compositionality, where information does not get lost, but is increasingly specified. The constraints on these processes (which arguments can merge with which) are a substantive point of grammatical description with empirical consequences. Discussions at this level are an important area for crossfertilization and sharing of results. In each case, the fact of complex predication has given rise to changes in theoretical machinery, the most important of which is the highly constructional nature of the phenomenon. Modifications have to be made to the views of grammar that build in too much lexical autonomy to argument structure properties. The level of argument structure in LFG is forced to operate over and modify units that were previously seen as lexically autonomous, and then that level as a whole is mapped to the f-structure. The computational approach has to develop a tool that will modify predicate argument information that is present in individual morphemes. The syntactic decompositional account has to argue that participant relations are a property of the way the syntax is built up and not directly of the individual units involved.

Differences remain, particularly at the level of overall architecture. The LFG account relies crucially on an extra level of representation: the argument structure, while the other two accounts prefer a slimmer architecture. Surprisingly then, the syntactic decompositional view advocated by Ramchand is closer architecturally to the computational approach, and is much further away from the LFG account than other currently available theories within the Chomskian framework (particularly those which have an argument structure level that precedes syntax). The LFG and the syntactic decomposition account however, share an interest in the semantic properties of composed argument relations, while the computational approach manipulates grammatical structure information. The syntactic decompositional account differs from the other two in building in event structure information as part and parcel of definition of participant relations, and in not making any explicit statements about case. The view here is that case is a property of the higher functional structure of the clause, thus introducing a kind of hierarchical modularity into the architecture. The modularization is justified if, as is claimed, the internal composition required at the event structure level is logically independent of (and opaque to) subsequent case assignment. The final structures proposed in

section 1.4 do not differ formally from any normal clause, and the arguments are in recognisable positions. Whatever case assignment mechanisms account for case in a simplex Urdu verb should apply here, feeding off the composed structure. This architectural decision, as well as the decision to build in event structure correlates to the syntactic representation, are substantive points of difference, though not necessarily disagreement — crosstheoretical fertilization should lead to a consideration of event structure as part of the linking process (cf. Butt 1998).

In particular, because the syntactic decompositional approach includes a theory of event structure, the predictions with respect to the combinatorial possibilities of complex predicates are much more constrained. With the LFG approaches, especially the computational one, many more combinatorial possibilities are allowed than are actually possible. Within this framework, one could argue that these combinatorial possibilities are ruled out due to semantic factors governing the kinds of complex event predications one can build, but should not be ruled out by the syntax per se.

Beyond the factors discussed here, it is unclear whether the existing architectural differences have further empirical or explanatory bite, but it is possibile that they will, given more research in this area. These are important issues to identify as areas of debate, central to the further development of all three frameworks.

Ramchand sees the construction of grammars as a theory of (a component of) the human mind, and is not at all convinced that we know enough yet to demand computational implementability of our hypotheses, since the very structures being manipulated are still up for discussion. On the other hand, the computational linguists' goals are somewhat different from the pure theoreticians', and because of those more practical constraints, they are held to higher standards of rigour and consistency (something shared with LFG, which is highly consistent and implementable). All three approaches face the challenge of needing to achieve basic descriptive adequacy, and each approach has faced the basic challenges of complex predication head on.

In laying out the architectural differences with respect to one very complex phenomenon, we hope we have set the stage for new and productive debate.

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