BACKWARD CONTROL IN ANCIENT GREEK – SUBSUMPTION OR LINEARIZATION?

Dag Trygve Truslew Haug
University of Oslo

Proceedings of the LFG11 Conference

Miriam Butt and Tracy Holloway King (Editors)

2011

CSLI Publications

http://csli-publications.stanford.edu/

Abstract

This article discusses control of adjunct participle clauses in New Testament Greek. I present data from two corpus studies which show that the phenomena cannot be dealt with in a subsumption approach to control. Instead I argue for a c-structure based approach to constraining control, retaining the classical equality at f-structure but imposing linearization constraints on the overt realization of the shared argument. I discuss the characteristics of adjunct participle control and how it differs from complement control, arguing that we might need different approaches to the two phenomena.

1 Introduction

Many syntactic relations are asymmetric and among these is also the relation between controller and controllee. In derivational frameworks, syntactic asymmetries are typically captured by c-command constraints ensuring that controllers outrank a coindexed PRO, or that moved constituents outrank their traces (given the existence of raising but not lowering rules).

In contrast, LFG and other non-derivational frameworks typically model structure sharing using the equality relation, which is symmetrical. Asymmetry is instead ensured by c-structural mechanisms, such as controlled, typically non-finite, clauses being of category VP rather than S (or IP) and therefore not allowing an overt realization of the controlled subject.

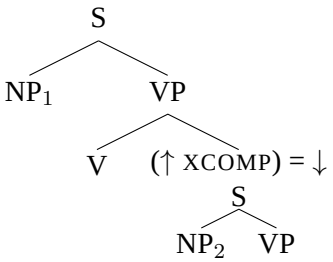
The recent surge of interest in so-called 'backward control' (see e.g. Polinksy and Potsdam, 2002; Potsdam, 2009) has shown that controller-controllee relations do not always exhibit the expected asymmetry. Although forward control, where a structurally higher clause contains the overt controller, is clearly the most widespread, 'unmarked' case in the world's languages, there are several languages which appear to attest backward control, where the controller appears overtly in the embedded clause and controls an empty position in the structurally more prominent clause. The two possibilities are illustrated schematically in (1) (from Sells 2006):

(1) a. Kim$_i$ hopes [Δ_i to be singing]. (forward)
b. Δ_i hopes [Kim$_i$ to be singing]. (backward)

If information flows freely between the two subject positions at f-structure, c-structure must determine where the subject actually appears. Consider the phrase structure in (2).

[†]I thank Miriam Butt, Mary Dalrymple, Tracy Holloway King and John Maxwell for comments and discussion.

(2)



If we suppress NP_2 (by making the embedded clause a VP) we get a forward construction and if we suppress NP_1 we get a backward construction – but as pointed out by Sells (2006), it is not clear that we *can* suppress NP_1 in a natural way.

However, there is a very natural way of modelling asymmetric information flow at f-structure, namely by using subsumption rather than equality, as explored e.g. by Zaenen and Kaplan (2002, 2003) and Sells (2006). Generally speaking, subsumption allows us to constrain the directionality of information flow through f-structures: if f-structure *f* subsumes f-structure *g*, then all the information present in *f* is also present in *g*, but not vice versa.[1] Using the subsumption mechanism, then, languages (or even invididual predicates) can force both backward and forward control on the level of f-structure, depending on the control equations:

(3) a. $\uparrow$ SUBJ $\sqsubseteq \uparrow$ XCOMP SUBJ enforces forward control
b. $\uparrow$ SUBJ $\sqsupseteq \uparrow$ XCOMP SUBJ enforces backward control

Although Zaenen and Kaplan (2002, 2003) argue that equality rather than subsumption is the correct analysis for some structure sharing phenomena, they raise the question 'whether subsumption might not be the default way to model relations between f-structures where one f-commands the other'. Sells (2006) takes this further and argues that subsumption might be removed from the options in Universal Grammar altogether.

The literature on subsumption and control in LFG has so far focused exclusively on structure sharing in complementation and its interaction with topicalization. In this paper I take a closer look at control into adjunct clauses in Ancient Greek and show that a subsumption theory cannot handle the facts, and that a c-structure solution, based on precedence relations rather than category differences, is more appropriate.

In section 4 we then review the earlier evidence for a subsumption approach. If subsumption is sometimes needed, the question arises what separates subsumption-based control from linearization-based control. We suggest that there might be two different classes of structure sharing phenomena, which might warrant separate treatments.

[1] See Zaenen and Kaplan (2003) for a formal definition of subsumption.

2 The Greek data

2.1 Ancient Greek participles

Ancient Greek (AG)[2] is a 'free word order' language, where all permutations of the major constituents are found with some frequency, and phrases can be discontinuous. The word order is obviously influenced by information structure, and the syntactic function of phrases is indicated by case. Although there is no worked out formal grammar of AG, it is the kind of language that would seem to lend itself well to a constructive case analysis (Nordlinger, 1998).[3]

In this paper we will focus on control of participles. AG participles can be used as attributes (*the running boy*), heads in argument position (*the running (ones)*), complements (*stop running*) and as free adjuncts. The latter come in two types, absolute participles (4), which have their own subject that need not be coreferent with a matrix argument,[4] and conjunct participles (5)-(6), whose subject is also a matrix argument.[5]

(4) hautê apographê egeneto prôtê
this.NOM.SG.F taxing.NOM.SG.F happened.PFV.PST.3S first.NOM.SG.F
hêgemoneuontos tês Surias
govern.IPFV.PTCP.GEN.SG.M DEF.GEN.SG.F Syria.GEN.SG.F
Kurêniou.
Cyrenius.GEN.SG.M
'This taxing was first made when Cyrenius *was governing* Syria.' (Lk. 2:2)

(5) **hoi andres hoi sunekhontes**
DEF.NOM.PL men.NOM.PL DEF.NOM.PL guard.IPFV.PTCP.NOM.PL
auton enepaizon autôi *derontes*
him.ACC.SG mock.PST.IPFV.3P him.DAT.SG flog.IPFV.PTCP.NOM.PL
'The men guarding him were mocking him, *flogging* (him).' (Lk. 22:63)

(6) *exelthonti* de **autôi** epi tên
walk out.IPFV.PTCP.DAT.SG but him.DAT.SG on DEF.ACC.SG
gên hupêntêsen anêr tis
earth.ACC.SG meet.PST.PFV.3S man.NOM.SG some.NOM.SG
'As he *stepped* ashore, a man met him' (Lk. 8:27)

[2] As will become clear, this paper uses evidence from New Testament Greek and it is debatable whether that constitutes Ancient Greek. But NT Greek does not seem to differ from Classical Greek in its participle system, so I will just refer to the language as AG.

[3] In the c-structures in this paper, I will nevertheless put functional annotations about grammatical functions on phrasal nodes, as if they were contributed by the c-structure. This makes the trees easier to read and grammatical function assignment is in any case not central to the paper.

[4] In fact, most standard grammars claim that the subject of absolute participles *cannot* be coreferent with a matrix argument although it is well known that there are exceptions to this which are not understood.

[5] The glossing in the examples follows the Leipzig standard, but may omit unimportant details. Participles and their English translations are italicized and their subjects are bold-face.

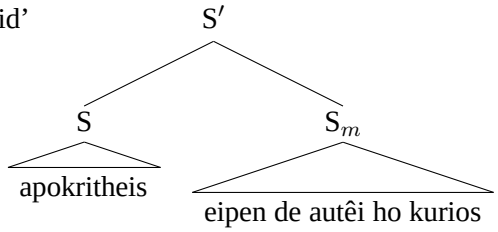
As the examples show, absolute participles get genitive case and so do their subjects. Conjunct participles, on the other hand, agree in case with their subjects, which in turn are assigned case in the matrix clause. By far the most common case is that participle's subject is also the matrix subject and thus gets nominative case, but as (6) shows, control by elements with other grammatical functions (at least OBJ and OBJ_θ) is possible. For absolute participles the control issue obviously does not arise.

I have argued elsewhere (Bary and Haug, 2011; Haug, forthcoming) that free adjunct participles have three different functions which are distinguished at c-structure, although the string is often ambiguous. **Frame** participles appear in the specifier of the matrix S′,[6] refer to events that have been previously mentioned or are easily inferrable and serve to locate the matrix clause in time: they are often translated with adverbial clauses, but also by fronted *ing*-adjuncts. **Independent rheme** participles are adjoined to the matrix S, refer to new information events, often ones that 'lead up to' the matrix event, but are otherwise information structurally on a par with it: they are typically translated with a coordinated main clause. **Elaboration** participles appear inside the matrix S and typically express manner, instrument or accompanying circumstances: they are the ones most likely to be translated with an *ing*-adjunct in English.

A sentence-initial participle will be ambiguous between a spec-S′ position and an adjunction to S: if there is no material following that must clearly be outside the matrix, the participle could even be inside the matrix S. (7) (from Lk. 10:41) is just such an ambiguous example, and (8)-(10) show the possible analyses and the translations they imply.

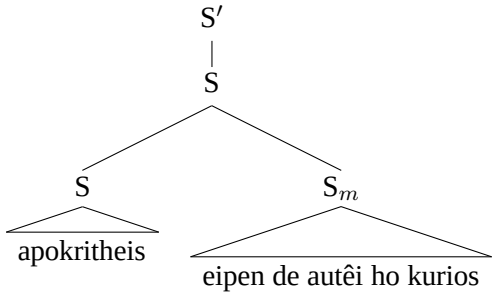
(7) *apokritheis* de eipen autêi **ho kurios**
answer.PFV.PTCP.NOM but said.PST.PFV.3S her.DAT the lord.NOM

(8) 'When the Lord *answered*, he said'

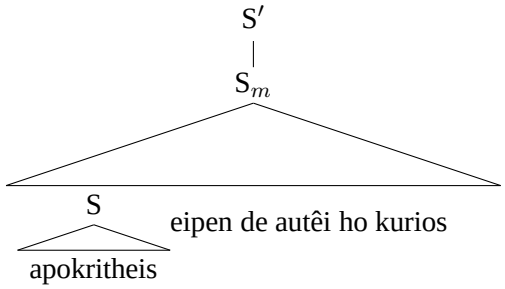


[6] In order not to preempt a category-based approach to control, we assume here that all verbs, finite and non-finite, project S; but only finite verbs project S′.

(9) ‘The Lord *answered* and said’



(10) ‘The Lord said *in answer*’



Let us note in passing that the independent rheme analysis (9) is out because independent rhemes seem always to denote sequential events, i.e. it would imply that the Lord first answered and then said. The analyses as frame and elaboration are both possible, but as we will see, the control facts support the analysis in (10).

Finally, notice that independent rheme participles can be ‘stacked’, i.e. there can be several of them, typically describing events leading up to the event of the matrix clause, in what we will refer to as a ‘serial construction’, e.g. in (11).

(11) *dramôn* de **tis** kai *gemisas*
running.PFV.PTCP.NOM but some.NOM and filling.PFV.PTCP.NOM
spoggon oxous *peritheis* kalamôi
sponge.ACC vinegar.GEN putting.PFV.PTCP.NOM stick.DAT
epotizen auton legôn:
give-to-drink.PST.IPFV.3S him.ACC saying.IPFV.PTCP.NOM
Someone *ran* and *filled* a sponge with sour wine, *put* it on a stick, and gave him a drink, saying … (Mk. 15:36)

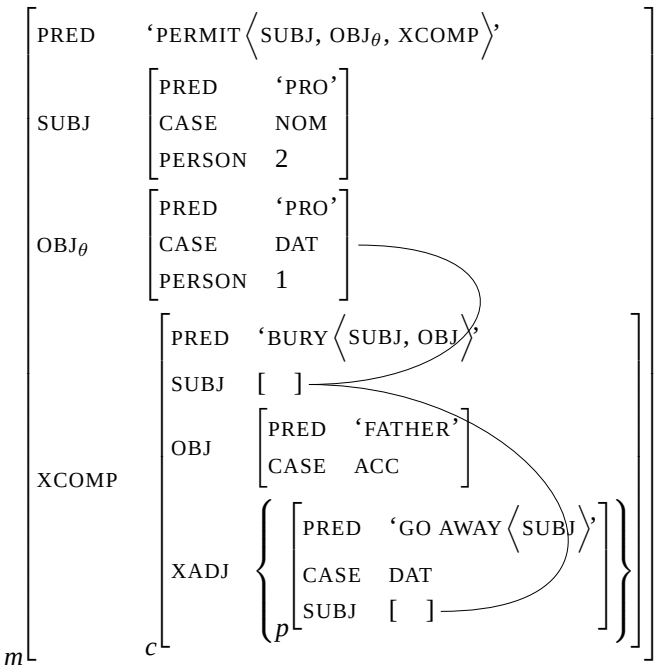
2.2 Control and phrase structure

The subject of AG participles is functionally controlled, as witnessed among other things by long-distance agreement in case (Andrews, 1982).

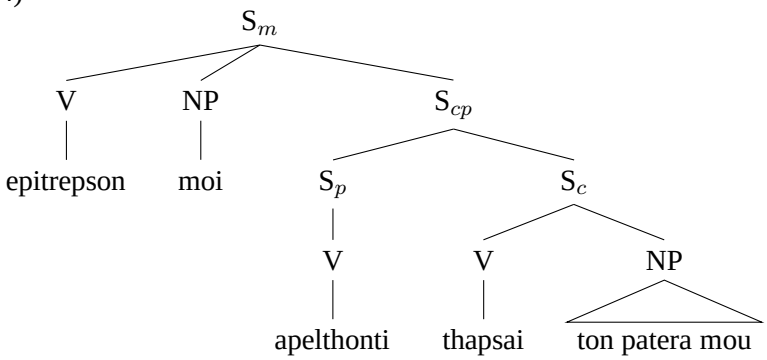
(12) epitrepson **moi** *apelthonti* thapsai
permit.IMP.PFV.ACT me.DAT go.PFV.PTCP.DAT.SG bury.INF.PFV
ton patera mou
DEF.ACC.SG father.ACC.SG my
‘Let me *go* and bury my father’ (Lk. 9:59)

The f- and c-structure of this example are given in (13) and (14).

(13)



(14)



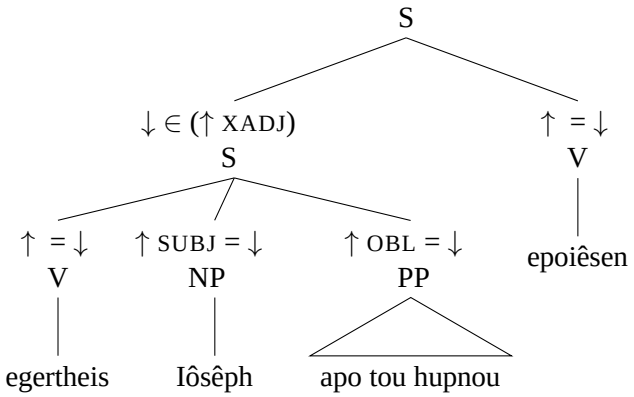
The dative case on *apelthonti* is due to subject-predicate agreement with *moi*, indicating that we have functional control.

From an f-structure information flow perspective, it would seem natural to say that CASE and PRED information flows from (*m* OBJ_θ) to (*c* SUBJ) to (*p* SUBJ), i.e. from a position in the outer f-structure *m* to positions in the embedded f-structures *c* and *p*, corresponding in effect to a chain of three c-commanding sentences S_m, S_c and S_p. But as we saw in the introduction, nothing in LFG's traditional, equality-based structure sharing actually forces this directionality of information flow. This raises the question of how to deal with sentences like (15).

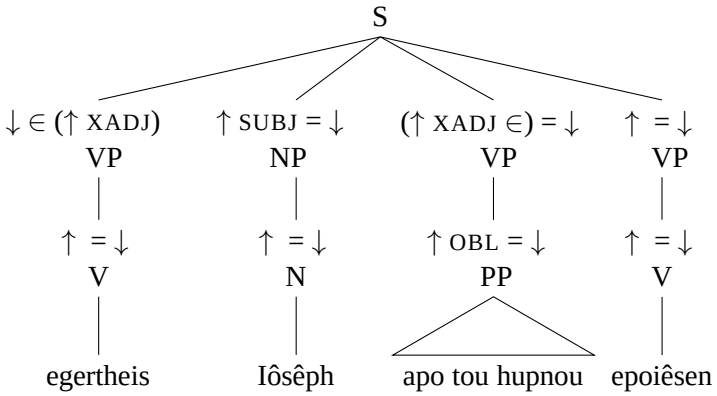
(15) *egertheis* de **Iôsêph** apo tou hupnou
wake up.PFV.PTCP.NOM but Joseph.NOM from DEF.GEN dream.GEN
epoiêsen
did.PST.PFV.3S
'When he woke up from the dream, Joseph did . . . '

Here *Iôsêph*, which is the shared argument, seems to sit in the participle clause, since it appears between the participle and its governed PP *apo tou hupnou*. There are in principle two ways we can deal with this in the c-structure: either the shared argument does in fact appear in the participle clause (16), or AG word order is free to the point that participles and their governing matrix form flat S-domains (17). To deal with the freedom of word order implied by the second option, we would assume headless VPs, much like discontinuous NPs can be dealt with using headless NPs.[7]

(16)



(17)



[7]However, when the discontinuous phrase has a non-argument function as here, functional uniqueness does not enforce identity of the f-projection of two nodes with the same annotation. For this reason, the constraint on the headless VP must be different (non-constructive rather than constructive) than that on the VP containing the head.

Both these analyses are prone to over-generation in that they allow the shared argument to appear indiscriminately in the participle clause and the matrix, a problem we will adress in section 2.4, but apart from that they make strikingly different predictions. (17) predicts that any matrix constituent can intervene between participle clause constituents: there is nothing special about the shared argument. (16), on the other hand, predicts that are no clausal discontinuities (except as may arise from other processes such as unbounded dependencies).

2.3 First corpus study: projectivity across categories

To decide between these two hypotheses, we performed a corpus study based on the PROIEL corpus data on New Testament Greek.[8] For the study, we selected the four Gospels, which amount to 64529 words.

The PROIEL corpus is annotated with dependency structures and the annotation is conservative, so shared arguments are consistently made dependents of the matrix in control structures. On the other hand, the control relation is made explicit through secondary edges, making it possible to automatically transform the dependency structure to make the shared argument dependent on the participle in the cases where it occurs adjacent to, or intermingled with, material from the participle clause.

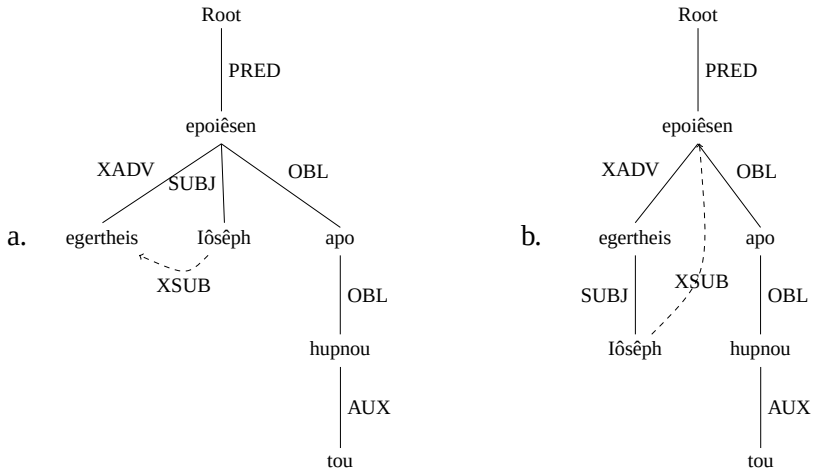
For the first study, we converted the original dependency structures into c-structures using a simple algorithm described in Haug (2011). We then counted the projectivity of all branching phrasal nodes[9] in the c-structure data, sorting them into three groups: continuous phrases, where no material that is functionally dependent on the head appears outside the functional head's phrase; phrases with long-distance dependencies, where material that is functionally dependent on the head appears outside the functional head's phrase, in a left-peripheral position of a finite clausal projection; and scrambled phrases, where material that is functionally dependent on the head appears outside the functional head's phrase and not in a left-peripheral position in a finite clausal projection. For free adjunct participles, we did these counts both on phrase structures derived from the original dependency tree and on those derived from the transformed dependency tree.[10]

[8]The corpus is browseable on http://foni.uio.no:3000, where it is also possible to download the source files.

[9]Participle phrases with overtly realized subjects but no other dependent were counted as branching, since they would potentially be branching in the transformed structure.

[10]The grammatical functions are similar to those used in LFG; XADJ is called XADV and AUX is used for words that do not contribute their own PRED feature. XSUB marks the external subject in a control construction.

(18)



(18) shows the original (a.) and transformed (b.) dependency trees for (15). When these dependency trees are transformed into c-structures, they yield (17) and (16) respectively. Table 1 shows the projectivity data for the various categories.

Type	LDD	Scrambling	Projective
NP	42	210	5170
AdjP	4	44	337
Adv	2	12	222
PP	2	11	4423
finite S	27	6	9849
absolute ptcp.	0	0	166
conjunct ptcp.	3	48	1253
conjunct ptcp. (transformed)	0	0	1304

Table 1: Projectivity across categories

As these numbers show, it is not at all uncommon for lexical phrases (headed by N, Adj, Adv or in some instances even P) to show discontinuities that are not due to unbounded dependencies. Finite clauses, on the other hand, rarely show such discontinuities.[11] The same holds for absolute participle clauses (i.e. those with an internal subject), but conjunct participle clauses seem to be different – until, that is, one considers the data from the transformed sentences, which are all continuous. This shows that in the 51 apparently discontinuous participle phrases, it is always the participle's subject which intrudes, as in (15). In other words, the predictions of the internal-subject hypothesis are borne out, against those of the free word order hypothesis.

One is led, then, to the conclusion that AG has backward control in participle

[11]The six apparent exceptions are in fact due to complex constructions such as internally headed relative clauses, where the automatic transformation of the dependency analysis produces a discontinuous phrase, but other analyses are possible.

adjuncts. If we assume that participles project S, the classical, equality-based analysis of functional control would predict random variation between forward and backward control, as information would flow in both directions. However, as it turns out, the distribution is not at all random.

2.4 Second corpus study: the distribution of control types

To study the distribution of the control types, we again looked at the phrase structure trees. As we saw in section 2.1, there are essentially three positions where adjunct participles can occur: in the specifier of S′, adjoined to S, or inside the S. Since it is not always possible to decide the actual position, cf. example (7) and the possible analyses in (8)-(10), we noted the highest possible analysis, so the participle in (7) was counted as occurring in spec,S′. For participles that were adjoined to S, we also noted whether they were left- or right-adjoined, and for S-internal participles, we noted whether they were to the left or the right of their verbal head.

In addition, we noted the type of control relation, dividing participles into six categories: **ambiguous** control are cases where the shared argument occurs at the edge of the participle phrase, so that it could form a constituent with both the participle and with the matrix, without giving rise to a discontinuity. **No controller** cases are the ones without an overt controller present in the sentence. **Backward** control are the cases where the participle subject occurs between constituents of the participle clause; since the previous study had already made the backward control analysis plausible, we slightly extended the definition to also include cases where a forward control analysis would lead to discontinuity of a coordination, such as (19).

(19) … *prosdramôn* **heis** kai *gonupetêsas*
run.PFV.PTCP.NOM.SG one.NOM.SG and kneele.PFV.PTCP.NOM.SG
auton epêrôta auton
him.ACC.SG asked.IPFV.PST.3S him.ACC.SG
'One man ran up to him, kneeled to him and asked him' (Mk. 10:17)

If *heis* belongs to the matrix, the coordination becomes discontinuous, so *prosdramôn* was counted as backward controlled and correspondingly, *gonupetêsas* was treated as **companion controlled**, meaning that its subject unambiguously occurs inside another XADJ participle. It should be noted that discontinuous coordiations are possible, though marked, in AG, but in view of the apparent normality of backward control, the analysis seems improbable here. If the position of *prosdramôn* and *heis* were swapped, *prosdramôn* would be counted as ambiguously controlled, and *gonupetêsas* as a case of **ambiguous companion** control.

The results of the classification are seen in table 2. We observe a significantly different distribution of backward and forward control ($p < 0.1 \times 10^{-9}$, Fisher's exact test). The first impression is that backward control is limited to specifiers and left-adjoined participles, except in (20).

Control type	Spec.	L-adj.	S-int.(L)	S-int.(R)	R-adj.
Ambiguous	366	39	1	22	90
No controller	285	50	1	12	110
Backward control	51	7	1	0	1
Forward control	8	10	11	18	129
Companion control	10	8	0	7	1
Ambig. comp. control	7	9	1	0	49

Table 2: Control type across positions

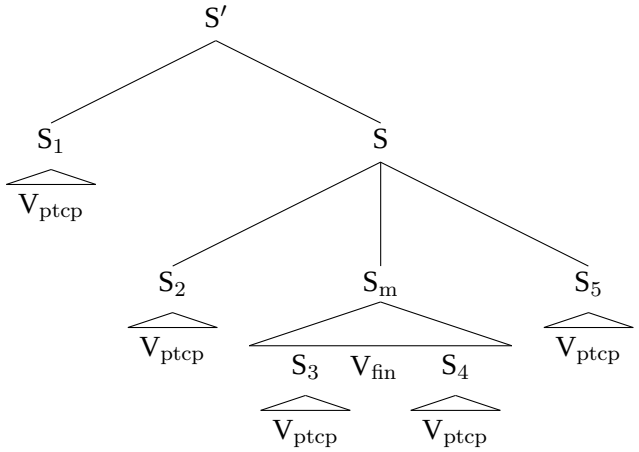
(20) ekraxen oun en tôi hierôi *didaskôn* **ho**
shout.PST.PFV.3S then in the temple teaching.IPFV.PTCP.NOM.SG DEF
Iêsous kai legôn
Jesus.NOM.SG and saying.IPFV.PTCP.NOM.SG
'Then cried Jesus in the temple as he *taught* saying' (John 7:28, King James Version)

However, we see that this example is actually one which has been counted as backward control because of the coordination. Given the lack of other examples of backward controlled participles in this position, it seems reasonable to analyse (20) as a discontinuous coordination instead.

Forward control, on the other hand, appears to distribute over all positions. But as we noted above, the position assigned in the counting is the highest possible: a lower analysis is always possible, and in fact, from inspection of the examples, likely, although we will spare the reader the philological details here.

The correct statement of the control facts, then, seems to be that participles in the specifier of S′ or left-adjoined to S′ have backward control: and if there are several such participles sharing the same argument, the shared argument appears in the leftmost one. Right-adjoined participles, on the other hand, do not allow backward control: their subject must appear in the matrix (or in a left-adjoined participle clause if there is one). Finally, participles that appear inside the matrix clause (i.e. the manner adjuncts) do not allow backward control, irrespective of whether they appear to the left or the right of the matrix verb. The situation can be summarized on the basis of the tree in (21).

(21)



If all the participles in (21) are present, the shared argument must be realized in S_1. If S_1 is not present, it must be in S_2. If neither S_1 or S_2 are present, the shared argument must be in the matrix clause, since neither S_3, S_4 or S_5 allows backward control.

3 Analysis

3.1 Subsumption

If we wanted to capture the set of facts discussed in the previous section in a subsumption based approach, a natural approach would be to use rules like in (22) for clause-internal participles and (23) for adjoined participles.

(22) $$\begin{array}{lcccccc} \text{S} & \rightarrow & \text{S} & , & \text{V} & , & \text{XP*} \\ & & \downarrow \in (\uparrow \text{XADJ}) & & \uparrow = \downarrow & & \uparrow \text{GF} = \downarrow \\ & & \downarrow \text{SUBJ} \sqsupseteq \uparrow \text{GF} & & & & \end{array}$$

(23) $$\begin{array}{lcccc|cc} \text{S} & \rightarrow & \text{S} & \text{S} & & \text{S} & \text{S} \\ & & \downarrow \in (\uparrow \text{XADJ}) & \uparrow = \downarrow & & \uparrow = \downarrow & \downarrow \in (\uparrow \text{XADJ}) \\ & & \downarrow \text{SUBJ} \sqsubseteq \uparrow \text{GF} & & & & \downarrow \text{SUBJ} \sqsupseteq \uparrow \text{GF} \end{array}$$

(22) says that the subject of the embedded S should be subsumed by some GF in the matrix.[12] Conversely, (23) says that the subject of the left-adjoined S should subsume some grammatical function in the adjoined-to S.

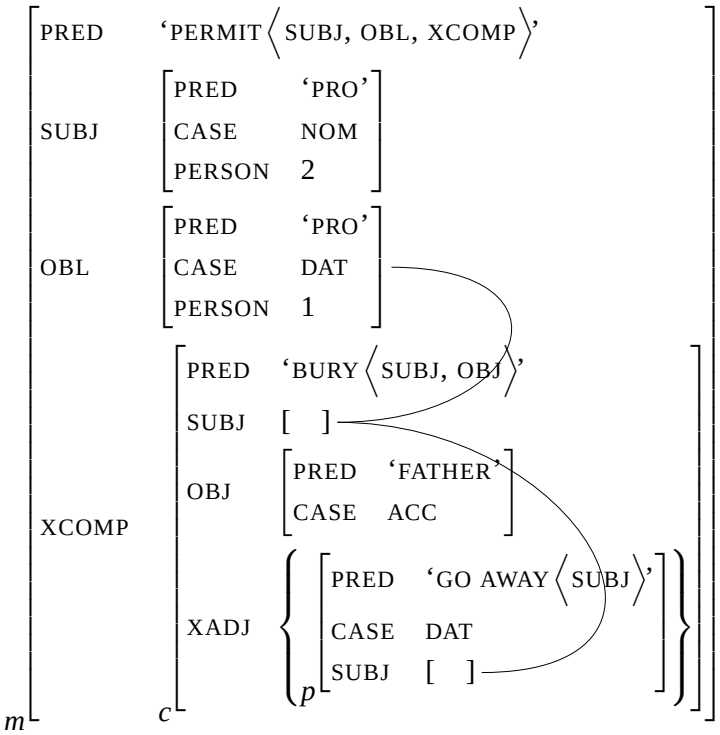
However, this approach runs into several problems. First, it would imply that participles can have pro-dropped subjects. In the case where the shared argument is only implicit, completeness could only be guaranteed by an optional (↑ PRED = 'PRO') on the participle, since the information would otherwise not flow from the matrix to the participle. This is not a serious problem, however, since it is certainly possible, if not usual, to assume that participles have pro-dropped subjects.

[12]The range of possible grammatical functions might be limited to SUBJ, OBJ and OBJ_θ but for simplicity we use just GF in our rules in this and the next section.

A more serious problem is due to the rule in (23) being too local. This means it will not interact correctly with a rule which makes the participle's matrix a complement clause, such as in (12) with the f-structure in (13), both repeated here for convenience. The clause structure is indicated by brackets.

(24) [$_m$ epitrepson **moi** [$_c$ [$_p$ *apelthonti*]
permit.IMP.PFV.ACT me.DAT go.PFV.PTCP.DAT.SG
thapsai ton patera mou]]
bury.INF.PFV DEF.ACC.SG father.ACC.SG my
'Let me first go and bury my father' (Lk. 9:59)

(25)



In this case, the overt controller appears in m, and from there it can only flow to c, since the complement rule does not 'know' that there is an adjunct participle. But given (23), information would not flow from c to p.

Another problem related to locality arises when there are multiple adjuncts, as in (11). In this case, the shared argument should appear in the left-most clause, which would be captured by (26).

(26) S → S S* S
$\downarrow \in \uparrow$ XADJ $\downarrow \in \uparrow$ XADJ $\uparrow = \downarrow$
$\downarrow$ SUBJ $\sqsubseteq \uparrow$ GF $\downarrow$ SUBJ $\sqsupseteq \uparrow$ GF

However, it is not obvious how to extend this approach to frames appearing in the specifier position of S′, since it would require the rules for adjunction to S to be

different whenever there is a participle in spec,S′.

Notice also that the intuitive appeal of the subsumption approach is weak in the multiple adjunction cases: for an example like (11), it requires that information flows from the first participle clause in the sequence to the matrix and then 'back again' to the second participle clause. Although this gives the right results when there is no frame, it seems more reasonable to explore a linearization based analysis, where the shared argument simply has to appear in the first S (not counting clause-internal participles) in which it has a function. In the next section, we develop such an analysis.

3.2 A linearization based account

In a linearization-based account, we model the AG control facts through constraints on the c-structural realization of shared arguments, rather than constraints on the information flow through the f-structure. Essentially we need to ensure that only the leftmost S in a serial construction can dominate a node whose ϕ-projection is shared between several clauses. Intuitively, then, an S-node admits a shared argument node if and only if its f-structure f-precedes all f-structures containing the f-structure of the shared argument in some grammatical function.

However, it is clear that when we talk about f-precedence relations between f-structures which share an argument function, we cannot use a notion of f-precedence based on the all c-structure nodes corresponding to the f-structures (e.g. Dalrymple 2001, p. 172): when the shared argument is overtly realized in the c-structure, there would be no precedence relation in such cases. Instead, we need the edge-based f-precedence relation from Bresnan (2001, p. 195):

(27) F-structure f f-precedes f-structure g ($f <_f g$) iff the rightmost node in $\phi^{-1}(f)$ precedes the rightmost node in $\phi^{-1}(g)$.

Under this definition of f-precedence, we can capture the AG control facts through the rule in (28).

(28)
$$\begin{array}{lcccccc} \text{S} & \rightarrow & \text{NP} & , & \text{V} & , & \text{XP*} \\ & & \uparrow \text{SUBJ} = \downarrow & & \uparrow = \downarrow & & \uparrow \text{GF} = \downarrow \\ & & @\text{SHARED} & & & & \end{array}$$

@SHARED here refers to the template in (29).

(29) $@\text{SHARED} = (\text{GF} \downarrow) \not<_f \uparrow$

$(\text{GF} \downarrow)$ is an inside-out functional uncertainty which matches any f-structure in which the shared argument has a grammatical function. Inside the scope of negation, it gets a universal interpretation (Crouch et al., 2008), so that the end effect is that for all f-structures containing the shared argument, it must be true that they do not f-precede $\uparrow$. This yields the desired effect: $\uparrow$ itself matches $(\text{GF} \downarrow)$, but

trivially does not f-precede itself. All other f-structures containing $\downarrow$ must have a right edge to the right of the right edge of $\uparrow$: since we use a notion of f-precedence based on the right edge, unbounded dependencies, which are the only discontinuities allowed for clausal f-structures, do not affect the f-precedence relations.

In (28), we marked only the subject NP with @SHARED since that is the only function shared arguments can have in the participle clause; but in the matrix, other functions are possible and we need to mark those too with @SHARED. This of course creates a potential for unwanted interaction with other sorts of structure-sharing for which we might not want @SHARED to apply, especially, in our context, the clause-internal participles: recall that these never allow backward control. Going back to our example (7), we want to disallow the analyses in (8) and (9), as these imply forward control of clause-external participle subjects; but we want to allow (10), as the participle is clause-internal on this analysis, and therefore should have forward control.

As the analysis stands, however, the subject *ho kurios* would be marked with @SHARED, disallowing (10) because the participle clause f-precedes the matrix. We therefore need a feature EXTERNAL + to mark clause-external participles and amend (29) to (30).[13]

(30) $$@\text{SHARED} \;=\; \big(\underset{\leftarrow\ \text{EXTERNAL}=_c +}{\text{GF}}\ \downarrow\big) \not<_f \uparrow$$

In comparison with the subsumption approach, using linearization constraints does away with the need to have optional pro-drop on participles and generalizes directly to cases with multiple adjunction. Also, unlike a subsumption approach, it does not interfere with control in complementation, since it does not alter the information flow in the f-structure.

But how do we treat the clause-internal participles, which never allow backward control? In this case, a linearization approach is not very attractive: we want to prevent the shared argument from being realized in the adjunct clause at all, so we would have to supply some impossible constraints. A c-structural analysis is still possible, just as it is for English, if clause-internal participles are of category VP rather than S. Alternatively, we could use a subsumption-based approach to force forward control. Which analysis is appropriate depends partly on whether

[13]Note that (30) will not be interpreted in the intended way by the XLE (beside the fact that XLE does not implement f-precedence, only head precedence). The negation will scope over the off-path constraint, which means that the interpretation will be as in 2 rather than the intended 1:

1. $\forall f.((f\ \text{GF}) = \downarrow\ \wedge (f\ \text{EXTERNAL}) =_c +) \rightarrow f \not< \uparrow$
2. $\forall f.(f\ \text{GF}) = \downarrow \rightarrow ((f\ \text{EXTERNAL}) \neq + \wedge f \not< \uparrow)$

The polarity of the EXTERNAL constraint is easy to fix, but the intended scope of $\rightarrow$ cannot be expressed. From the perspective of theoretical LFG, both constraints should be expressible and 1 would not seem to extend the complexity of the formalism (which is already NP-complete). But from a computational perspective, verifying 1 would interfere with the current implementation of functional uncertainty and disjunction in the XLE and possibly increase parsing time (John Maxwell, personal communication).

subsumption (or VP constituents) are needed in other parts of the AG grammar, such as control into complements. But it also depends on the status of subsumption in the general framework, which of course depends on the cross-linguistic evidence. In the next section, we briefly review the evidence that has been put forward in support of subsumption and discuss what similarities and differences there are compared to what we have observed in the Greek data.

4 Subsumption vs. linearization constraints

Although coming from a dead language, the data used in this paper are in fact exceptionally clear compared to the data used in other discussions of 'non-standard' structure sharing.

Zaenen and Kaplan (2003) discuss French. The central discussion revolves around the realization of the shared argument in object control and raising. As they note, however, the control cases could equally well be analysed as anaphoric control, so let us focus on raising. The basic contrast is the following (examples (59) and (60) in Zaenen and Kaplan 2003):

(31) Ce professeur russe que je crois sincèrement persuadé de devoir
this professor Russian that I believe sincerely convinces to have-to
enseigner cette version de l'histoire à ses étudiants
teach this version of the history to his students
'This Russian professor that I think sincerely persuaded to have to teach this version of history to his students'

(32) *Voilà la version de l'histoire récente que je crois persuadé de
see-here the version of the history recent that I believe persuaded to
devoir enseigner ce professeur russe à ses étudiants, encore
have-to teach this professor Russian to his students even
aujourd'hui.
now.
'This is the version of recent hisotry that I think this Russian professor is sincerely persuaded to have to teach to his students even now.'

In (31) the object of *croire* and subject of *persuadé* is realized as a relative pronoun in an operator position in the matrix. In (32), the shared argument is unsuccesfully realized in the embedded clause. In contrast, realization of the shared argument in the embedded clause is possible in some cases of subject control, so Zaenen and Kaplan (2003) conclude that subject control involves structure sharing with equality whereas raising to object involves structure sharing with subsumption.

However, Zaenen and Kaplan (2003) also note that object raising is only possible with relative clauses, or for some speakers also with clitic objects. This restriction is in fact crucial, since many ways of enforcing that distinction will automatically also rule out (32). In fact, although we cannot go into the details of

the conditioning of this construction here, it is possible that a version based on linearization will fare well, at least for the grammars that allow a clitic object preceding *croire*.

Zaenen and Kaplan (2002) discuss German partial VP fronting (PVPF). The crucial evidence here comes from the interaction between PVPF and raising and control, in the contrast in (33) ((25) in the original paper).

(33) a. *Ein Aussenseiter zu gewinnen versuchte hier noch nie.
an outsider to win tried hier still never
'An outsider never tried to win here.'

b. Ein Aussenseiter zu gewinnen schien hier eigentlich nie.
an outsider to win seemed here actually never
'An outsider never actually seemed to win here.'

Control and raising verbs thus contrast in the latter, but not the former accepting fronting of the embedded infinitive with its subject:[14] according to Zaenen and Kaplan (2002) this would follow from control involving subsumption so that information only flows from the matrix to the embedded clause. This approach relies on control in German being treated as functional rather than anaphoric control, which is of course not the only option. If German equi is anaphoric control, the embedded subject position can be made unavaible by an equation $(\text{COMP PRED}) = \text{'PRO'}$.[15]

Finally, Sells (2006) relies on the cross-linguistic evidence for backward control and raising that has been brough forward most notably by Eric Potsdam and Maria Polinsky. All of these examples involve structure sharing between positions with different case marking.[16] Here I give the example from Tzez, where the verbalizer *-oqa* ('begin') is ambiguous between a control and a raising use. As a raising predicate it requires forward raising (34-a), while as a control predicate it is backward (34-b):

(34) a. kid$_i$ [t$_i$ ziya b-išr-a] y-oq-si
girl.II.**ABS** [cow.III.ABS III-feed.INF] II-begin.PAST.EVID
'The girl began to feed the cow.'

b. Δ_i [kid-b$\bar{a}_i$ ziya b-išr-a] y-oq-si
[girl.II.**ERG** cow.III.ABS III-feed.INF] II-begin.PAST.EVID
'The girl began to feed the cow.'

The crucial argument for the analysis in (34-b) is the generalization that the verb agrees with the absolutive, not the ergative. But this implies a case mismatch between the two positions. There are various ways of overcoming the difficulty, e.g.

[14] A complication here is that many German speakers find (33-b) at least dubious, although better than (33-a).

[15] In fact, as pointed out by Sells (2006), it would be possible to generalize this treatment even to raising, if one accepts that raising is always 'Copy Raising' (Asudeh, 2004). But at that point all but the most ardent opponents of subsumption would probably back off.

[16] This is not evident from the Malagasy examples in Sells (2006), but clearly emerges from the discussion of Malagasy in Potsdam (2009).

by restricting out CASE from the subsumption equation, or by not having CASE as an f-structure feature at all. However, the case difference makes the argument for structure sharing weaker and suggests an anaphoric control treatment. This weakens the general case for treating cross-linguistic phenomena like backward control and raising in terms of subsumption.

In contrast, the AG data that have been considered in this article are perfectly clear cases of functional control. On the other hand, they are different from the data typically considered in the subsumption literature, because although the participle is non-finite and syntactically dependent on its finite verb, it is not clear that it is semantically dependent, except for the clause-internal participles, but precisely these do not allow backward control.

In particular, there is a generalization often found in the control literature that the controlled clause is temporally dependent on the controlling clause. By this generalization we do in fact expect clause-external participles to control their matrix: Bary and Haug (2011) argue in an LFG + Glue setting that although the temporal morphology appears on the matrix verb, the semantics of finiteness applies to the leftmost verb whether it is finite or a (clause-external) participle, in the sense that it is the leftmost verb that must be anchored in the discourse context – each subsequent verb is then related temporally to its preceding 'host'.

A result of this is that for clause-external participles, sequence matters. If we change the sequence, we change the temporal interpretation of the discourse. In contrast, a clause-internal participle may be moved around for pragmatic reasons, but the temporal interpretation is the same, namely overlap with the matrix event. This also holds for complement control: when complement clauses are topicalized, as in (33-a) and (33-b), topicalization does not alter their temporal interpretation.

An often observed difference between subordination and coordination is the fact that subordinated elements can be embedded in their governor whereas coordinated elements cannot generally be embedded inside each other. From this perspective, it is interesting to note that exactly the participles that are embedded in their matrix and thus more clearly subordinated, cannot have backward control. The non-embedded and more coordinate-like participles do have backward control. Nevertheless, it seems impossible to analyze these as actual syntactic coordination, since the shared argument gets its case in the matrix, cf. (6).

From a discourse perspective, however, clause-external participles in AG often behave like coordination; it is interesting to note that the direction of information flow is the same as we find in VP coordination.[17] If two coordinated VPs share an argument, that argument is typically expressed only in the first conjunct, unless there is strong focus on the shared argument.

(35) exele auton kai bale apo sou
remove.IMPV it.ACC and throw.IMPV from you
'Take it out and throw (it) away from you.' (Mt 18:9)

[17] Or S-coordination: since AG allows pro-drop, the difference between VP- and S-coordination can be hard to establish.

Similarly, if a clause-external participle has the same object as its matrix, that object is only realized in the participle clause.

(36) kai labôn tous hepta artous eukharistêsas
and taking.PFV.PTCP.NOM the seven bread.ACC blessing.PFV.PTCP.NOM
eklasen kai edidou tois mathêtais
break.PST.PFV.3S and give.PST.IPFV.3S DEF.DAT.PL disciples.DAT.PL
autou hina paratithôsin
his that put forth.3.PL
'Taking the seven bread and blessing (them), he broke (them) and gave (them) to his disciples, that they may serve (them)' (Mk 8:6)

Structurally, of course, this phenomenon is different and must be anaphoric control, since it is in fact possible to realize a different object. But it is another case of information flow between constituents that are information structurally on a par, and shows the same tendency for information to flow from the left to the right. This makes intuitive sense from a processing perspective.

5 Conclusion

We have seen that AG offers a particularly clear example of backward control. 'Backward', naturally, is taken in a structural sense (so 'upward' could have been more appropriate) and the defining feature of this type of control in AG is in fact that it is linearly forward and therefore appropriately handled by linearization constraints in the c-structure rather than subsumption at f-structure (or a category-based approach).

Corresponding to the importance of linearization for their control, these participles also rely on linearization for their temporal interpretation and this sets them apart from many other typical control phenomena. So even if subsumption cannot deal with Greek adjunct control and although the case for subsumption is perhaps not all that solid at the moment, it could still turn out to be the right way of dealing with control in complemenation.

References

Andrews, Avery. 1982. Long distance agreement in Modern Icelandic. In Pauline Jacobson and Geoffrey Pullum (eds.), *The Nature of Syntactic Representation*, pages 1–33, Dordrecht: D. Reidel.

Asudeh, Ash. 2004. *Resumption as Resource Management*. Ph. D.thesis, Stanford University.

Bary, Corien and Haug, Dag. 2011. Temporal anaphora across and inside sentences. *Semantics and Pragmatics* Accepted subject to revisions.

Bresnan, Joan. 2001. *Lexical-Functional Syntax*. Oxford: Blackwell.

Crouch, Dick, Dalrymple, Mary, Kaplan, Ron, King, Tracy, Maxwell, John and Newman, Paula. 2008. XLE Documentation, available at `http://www2.parc.com/isl/groups/nltt/xle/doc/xle_toc.html`.

Dalrymple, Mary. 2001. *Lexical Functional Grammar*. San Diego: Academic Press.

Haug, Dag. 2011. The relationship between the PROIEL dependency annotation and LFG, available from `http://www.hf.uio.no/ifikk/english/research/projects/proiel/Activities/proiel/publications/phrase_structure.pdf`.

Haug, Dag. forthcoming. Open verb-based adjuncts in New Testament Greek and the Latin of the Vulgate. In Cathrine Fabricius-Hansen and Dag Haug (eds.), *Big Events and Small Clauses*, Mouton de Gruyter.

Nordlinger, Rachel. 1998. *Constructive Case*. Stanford: CSLI Publications.

Polinksy, Maria and Potsdam, Eric. 2002. Backward control. *Linguistic Inquiry* 33, 245–282.

Potsdam, Eric. 2009. Malagasy backward object control. *Language* 85, 754–784.

Sells, Peter. 2006. Using subsumption rather than equality in functional control. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of LFG06*, Stanford: CSLI Publications.

Zaenen, Annie and Kaplan, Ron. 2002. Subsumption and equality: German partial fronting in LFG. In Miriam Butt and Tracy Holloway King (eds.), *Proceedings of LFG02*, Stanford: CSLI Publications.

Zaenen, Annie and Kaplan, Ronald M. 2003. Subject inversion in French. In Claire Beyssade, Olivier Bonami, Patricia Cabrede Hofherr and Francis Corblin (eds.), *Emprical Issues in Syntax and Semantics*, volume 4, pages 190–205, Paris: Presses Universitaires de Paris Sorbonne.