Argument structure in HPSG as a lexical property: Evidence from English purpose infinitives *

Vanessa Metcalf
The Ohio State University
vmetcalf@ling.osu.edu

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Abstract

Baxter (1999) posits a posits a class of VP and N' modifiers he refers to as goal infinitives, distinguishing two subclasses with distinct syntactic properties. The subclass he refers to as purpose infinitives are characterized, in his account, by the presence of a gap co-indexed with an argument of modified phrase. HPSG theories generally assume that the selectional properties of modifiers are restricted to the the *synsem* of the sign they modify (via the MOD feature). However, *synsem* objects do not include information about embedded argument phrases, and that information is necessary in order for the gapped infinitive to co-index its gap with one of these non-head daughters of the modified VP or N'. Baxter resolves this problem by introducing ARG_ST as a *head* feature, a modification of the original appropriateness conditions encoded in the HPSG signature. Whether or not argument structure needs to be represented at the phrasal level is an ongoing debate in the field; thus, Baxter's account can be taken as evidence in support of ARG_ST as a feature present on all signs. This paper takes issue with the notion that the so-called goal infinitives constitute a syntactic class of constructions, arguing instead that purpose infinitives occur as optional complements for a restricted class of verbs, nouns, and adjectives. Under this account, co-indexation is enforced via the valence properties of a lexical head, allowing the restriction of argument structure information to the lexical level.

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Contents

1 Introduction

The term *purpose infinitive* is generally used to refer to infinitival *for*-clauses or VPs which express the purpose intended for someone or something; the examples in (1) are taken from Bach (1982). What is exceptional about purpose infinitives is that they must contain a subject or non-subject gap whose antecedent is the entity for which the expressed purpose is predicated. Motivation for this characterization of the data will be provided throughout the paper; see especially section 4.3.3.

(1) a. They hired him $\__i$ **to go over the reports**.
b. I bought War and Peace$_i$ **to read** $\__i$ **to the children**.

c. She brought it$_i$ over **for my brother to review** $\__i$.

In terms of the overt realization of argument structure, then, a purpose infinitive is an infinitival construction either (i) missing its subject as in (1a), (ii) missing both its subject and a non-subject as in (1b), or, (iii) preceded by *for* and missing a non-subject (1c).

In previous research to be addressed here, purpose infinitives are primarily analyzed as modifiers, which presents a problem for implementation in an HPSG framework. Since modifiers select the sign the modify via the feature-value specifications of MOD, and the appropriate value of MOD is a *synsem* object, purpose infinitives can only access certain information about the sign they modify. That information crucially does not include access to arguments embedded within the sign, and this is a problem because of the seemingly mandatory co-indexation of the modified sign and the purpose infinitive-internal gap. That is, how can co-indexation be enforced in the syntax if there is nowhere in the structure of the sign where both the gap and its antecedent are visible? So it has come about that purpose infinitives, while interesting in their own right, have lately been used by researchers as support for the claim that the argument structure of words needs to be visible to syntactic processes throughout the syntactic tree.[1] This paper revisits the claim that purpose infinitives are modifiers. Furthermore, we sketch an alternative treatment of purpose infinitives within the HPSG framework which does not require that argument structure be visible beyond the lexical level, thereby removing purpose infinitives from the inventory of phenomena justifying the extension of argument structure beyond the local level.

2 Overview of purpose infinitives in the literature

In this section we review three papers—Bach (1982), Jones (1991), and Green (1991)—to provide context for Baxter (1999), the work to which this paper will respond at length in section 3.[2] The three papers mentioned above seek

[1] Specifically, the claim is that the feature ARG_ST should be appropriate to objects of type *head*, thereby ensuring that the ARG_ST value of a word is structure-shared along the head path to the word's maximal projection.

[2] A note here about the terminology used in prior research:

Bach distinguishes *purpose clauses* from *in-order-to* clauses. Green (1991) uses the term *purpose infinitive* to cover the cases in (1), differentiating this phenomenon from the cases which may optionally be preceded by *in order*. Instead of calling them *in-order-to* clauses, though, she borrows the term *rationale infinitive* from Sells (1983).

Jones (1991) uses the term *purpose constructions* to refer to "certain phrases in English (which) carry a connotation of purpose." By way of subclassification, he (like Bach) uses the term *purpose clause* (or PC) to refer to what Green would call a purpose infinitive, and *in order clause* (or IOC) to refer to what Green calls a rationale infinitive.

In general, Baxter uses Green's terminology (with capitalization), but introduces the term *Goal Infinitive* to refer to the general class of phenomena which includes both Purpose Infinitives and Rational Infinitives.

to address a number of the same questions about purpose infinitives. What syntactic properties do purpose infinitives have in terms of internal structure? How are the referents of their unexpressed arguments determined? What other constructions share some superficial similarities with purpose infinitives, but need to be considered distinct? How can these constructions be distinguished? How do purpose infinitives relate to other elements within a clause? Are they arguments or adjuncts, and what are the additional restrictions on their distribution? We focus on those aspects of Bach (1982), Green (1991) and Jones (1991) which pertain to these questions.

2.1 Distribution of purpose infinitives

The number of lexical items which support the presence of a purpose infinitive is limited; attempts have been made to define these lexical items as a syntactic and semantic class.

Bach notes that the distribution of purpose infinitives is restricted to co-occurrence with a select class of verbs and adjectives, having three subgroups, citing Faraci (1974). Below are definitions of each of the three subgroups, together with some of his examples.

I. "*have*, *be* (in a place, on hand, available, at one's disposal, inexistence...)"

(2) a. Mary has her mother$_i$ **to consider** $\_i$.
b. *War and Peace*$_i$ is available **to read** $\_i$ **to the students**.

II. "Transitive verbs which involve continuance or change in the states of affairs indicated in (I) and are of a 'positive' sort..."

(3) a. We always keep a fire-extinguisher$_i$ in the kitchen **to use** $\_i$ **in case of fire**.
b. I got it$_i$ **to prop up the porch with** $\_i$.

III. "Verbs of choice and use"

(4) a. I chose *War and Peace*$_i$ **to read** $\_i$ **to the students**.
b. I used it$_i$ **to slice the salami with** $\_i$.

Green also notes that the distribution of purpose infinitives is restricted, claiming that a verb (or adjective) can only support a purpose infinitive if it "affirms or entails availability, possession or control of the entity corresponding to the gap in the purpose infinitive by the inferred controller of the infinitive verb."

2.2 Additional notes on internal structure

In addition to the characteristics described in section 1, Bach notes that purpose infinitives cannot be preposed (5a), and are "always future-oriented with respect to the time of the matrix clause," (5b).

(5) a. * **For my brother to review** $\__i$ I brought it$_i$ over.
b. I bought it$_i$ **to give** $\__i$ **to my sister**.

Purpose infinitives do not seem to allow the obligatory gap to be situated within an embedded finite clause, a fact mentioned briefly by Green but initially pointed out by Hukari and Levine (1987). She cites the example in (6).

(6) a. * Dana bought some wool$_i$ **to show her aunt that she could knit a sweater with** $\__i$.
b. Dana bought some wool$_i$ **to show me how to knit a sweater with** $\__i$.

The internal properties of purpose infinitives are under-investigated, however; to wit, it isn't clear that verbs which select finite clauses can head purpose infinitives at all, as suggested by the examples in (7).

(7) a. I brought \$100$_i$ to the race track **to bet** $\__i$ **on Sid's dog**.
b. * I brought \$100$_i$ to the race track **to bet** $\__i$ **that Sid's dog would win**.

To our knowledge, this fact has not been reported in the literature. Presumably, other internal properties have yet to be described as well. Why, for example does something like *Where did you buy it$_i$ to eat* $\__i$ *for lunch?* sound so bad, on either possible interpretation?

2.3 Purpose infinitives and control

When researchers talk about the issue of *control* in purpose infinitives, they are referring to the question of how the referent(s) of the missing argument(s) in a purpose infinitive is/are determined. In HPSG terms, gaps (licensed by extraction) are *controlled*: an antecedent is syntactically assigned to the gap via co-indexation encoded in syntactic structure, and determined on the basis of information available in syntactic structure. When a missing argument is said to be *uncontrolled*, the valence specification corresponding to that argument position is assumed to be unsaturated, and reference is assumed to be determined outside of syntax; responsibility is usually attributed to (more or less vaguely defined) pragmatic factors.

Bach's take on control in purpose infinitives can be summed up as follows: purpose infinitives must have one gap, which can occur anywhere. If there is a second missing argument, it must be the subject of the infinitive, and it is uncontrolled.

Bach's argument that the unexpressed subject of a purpose infinitive with a VP-internal gap is uncontrolled rests on data where a referent can be provided by context even when it is not present in the sentence. Furthermore, he cites other examples where "a possible overt controller is mentioned" but the actual referent is still provided by the context: "Or suppose I hand my host a bottle of wine and say *I bought this miserable Morgon to enjoy with our dinner*; I'm surely not suggesting that I alone enjoy the wine." I will not summarize his discussion of how the "most natural controller" in such a case is determined.

Like Bach, Green notes that purpose infinitives "always exhibit at least one unexpressed argument", and that a single gap may be a subject or a non-subject, while two gaps must consist of a subject and a non-subject. Green claims that the gap in a purpose infinitive, whether occurring in a subject or non-subject position, is always co-referential with a preceding patient NP. Some of Green's examples are given in (8), shown with gaps and co-indexing consistent with her assumptions.

(8) a. The book$_i$ Kim bought is available **to read** _$_i$ **to the kids**.
b. Cpl. Jones$_i$ is here _$_i$ **to file the offprints**.
c. A student$_i$ seems to have been hired by Kim _$_i$ **to file the offprints**.

Like Bach, Green claims that the missing subject in a VP-gapped purpose infinitive is uncontrolled. Two of the examples she cites in support of this claim are given in (9).

(9) a. John$_i$ bought a book$_j$ **to distract him$_i$ with** _$_j$.
b. They hired Sandy$_i$ **to talk to** _$_i$ **about Charlie**.

Both of the purpose infinitives in (9) lack an overt subject, which cannot be claimed to have an overt obligatory antecedent within the clause. Whoever is meant to distract John with his new book, it cannot be John, and it isn't clear who all might be talking to Sandy about Charlie.

Jones' analysis does not line up with this characterization, because he assumes that every purpose infinitive has a subject gap. That is, Jones analyzes strings like *for John to enjoy with his dinner* as a PP (*for John*) followed by a infinitive clause missing both its subject and object (*to enjoy with his dinner*). Like Bach and Green, Jones claims that a missing non-subject is always controlled. Missing subjects, on the other hand, are (i) controlled when a PP[for] is present, and, (ii) uncontrolled in the absence of a PP[for]. This amounts to the same pattern of control as that suggested by Bach and Green. Jones' argument that PP[for] should be considered an independent phrase rests on the claim that it can stand alone (10b).

(10) a. I brought this wine$_i$ over <u>for John$_j$</u> _$_j$ **to enjoy** _$_i$ **with dinner**.
b. I brought this wine over <u>for John</u>.

However, the *for John* in (10a) is not the same as the *for John* in (10b), since both can occur in the same sentence, as in (11).

(11) I brought this wine$_i$ over for John **for his kids to enjoy** $\__i$ **with dinner when they come home**.

Benefactive PPs like the one in (10b) above or (12a) below, do not have the restricted distribution of purpose infinitives, illustrated by (12b).

(12) a. John read *War and Peace* for Ursula.
b. * John read *War and Peace* **for Ursula to talk to him about** $\__i$.

Jones seeks to account for the pattern of control characteristic of purpose infinitives by appealing to semantic roles: "the argument that invariably controls the (purpose infinitive) is called the 'Theme' argument." He notes that while the "grammatical function" of the controller may vary, this semantic role does not. He points out that sometimes this controller may be a PP, something that neither Bach nor Green mention.

2.4 What purpose infinitives are not: in-order infinitives and infinitival relatives

Purpose infinitives are generally distinguished in the literature from what we will refer to as *in-order infinitives*: ungapped infinitive *for*-clauses or VPs which can (optionally) be preceded by *in order*. The examples in (13) are taken from Bach (1982).

(13) a. He bought a piano **(in order) to please his grandmother**.
b. She hired a nurse **(in order) for her daughter to learn Swedish**.

Despite "superficial similarities" between purpose infinitives and in-order infinitives, Bach points out a number of differences between the two phenomena. Unlike purpose infinitives, in-order infinitives cannot have a non-subject gap (14a), may be preposed (14b), need not be future-oriented (14c), and have a much more unrestricted distribution (14d).

(14) a. * She brought it$_i$ over **in order for my brother to review** $\__i$.
b. **In order to please his grandmother**, he bought a piano.
c. I bought it **in order to use up my money**.
d. I read it **in order to impress Sid**.

In-order infinitives, Green says, can only have a subject gap (if any), and that subject gap must be co-referential with "the (agentive) matrix subject." She notes that the *in order* phrase is alway optional, but the gap restrictions are constant. *Contra* Green, Jones claims that an in-order infinitive need not have a controller for its subject.

Bach, Green, and Jones also differentiate purpose infinitives from infinitival restrictive relative clauses, like those in (15).

(15) a. I saw the book **to give to your sister**.

b. * I saw it **to give to your sister**.

Bach notes (without explanation) that the way to distinguish a purpose infinitive from a infinitival relative is to replace the NP associated with the purpose infinitive gap with a pronoun. This follows from the common observation that restrictive relative clauses cannot modify pronouns or proper nouns.

Similarly, Green distinguishes purpose infinitives from infinitival relatives which "have the interpretation of restrictive relative clauses . . . and as one would expect do not co-occur with definite pronoun heads."

Jones provides more discussion of the distinction between purpose infinitives and infinitival restrictive relatives than Bach or Green, but the gist is the same: restrictive relatives "cannot be predicated of full NPs or pronouns...(w)here possibilities of ambiguity arise, we will use the pronoun/NP distinction between (infinitival restrictive relative clauses) and (purpose infinitives) in order to force the (purpose infinitive) reading."

2.5 Adjuncts or arguments?

Bach assumes (with minimal discussion) that purpose infinitives occur either as optional complements of certain verbs, "or as optional modifiers of certain verbal constructions."

Like Bach, Jones' take on purpose infinitives is that they are adjuncts.[3] He explains the fact that purpose infinitives cannot be preposed by claiming that while adjunction is free in general, purpose infinitives can only adjoin to a VP, since "obligatory control must be established at S-structure." A clause-initial purpose infinitive involves topicalization "not free adjunction." And, while he notes that purpose infinitives are not iterable,[4] he takes this only as evidence that "(a purpose infinitive) adjoins under circumstances different from those that attend (in-order infinitives)."

Jones argues that the case for treating purpose infinitives as arguments is weakened by the fact that no verb seems to select a purpose infinitive as a non-optional complement, and that the selection of purpose infinitive is not lexically idiosyncratic: verbs which support purpose infinitives fall into some sort of semantic class, and no verb fitting this description just so happens not to support the presence of a purpose infinitive.

In terms of the differences between purpose infinitives and in-order infinitives, both adjuncts in this account, Jones analyzes in-order infinitives as clausal, while purpose infinitives are assumed to be phrasal. And while an in-order infinitive normally adjoins to S, a purpose infinitive adjoins to VP, as mentioned. In addition to the contrast between the two classes in terms of preposability, Jones supports this claim with data showing that purpose infinitives must always precede in-order infinitives when both are present, that in-order infinitives

[3] However, he does not rule out the possibility that some verbs may select purpose infinitive arguments, in concurrence with Bach.

[4] He is careful to point out that what looks like iterated purpose infinitive can instead involve infinitival relatives or a purpose infinitive-internal purpose infinitive.

can remain when a VP is deleted while purpose infinitives cannot, and that in-order infinitives can occur outside the scope of negation, "while (purpose infinitives are) always within it." These arguments seem equally convincing, if not more so, as evidence that purpose infinitive should be analyzed as arguments, rather than VP adjuncts.

Green's argumentation that purpose infinitives cannot be accounted for by appeal to lexical selection, and should instead be analyzed as adjuncts, is extensive enough that it deserves its own section(s).

2.5.1 Green's arguments against lexical selection

Green argues extensively against the Hukari and Levine (1987) analysis of purpose infinitives, which treats them as "subcategorized complements of the verbs that support them." She questions the possibility of (i) defining the class of lexical items that co-occur with purpose infinitives, and (ii) ensuring that the obligatorily controlled gap in a purpose infinitive gets co-indexed with the right argument in the matrix clause.[5]

However, neither (i) nor (ii) should be a problem for a lexically driven framework like HPSG. With respect to (i), selection of complements is determined by the valence specifications of individual lexical entries: it is not necessary to define a lexical class having identical selectional properties (though generalizations may be encoded via type constraints). With respect to (ii), the co-indexation of one argument with a gap in another can be enforced within the selector's lexical entry, encoded as selectional specifications in the value of the feature VAL(ENCE). Again, if generalizations about such co-indexation can be made across lexical entries, they can be encoded via constraints, but generalizations (however appreciated by the grammar writer) are not necessary for descriptive adequacy.

Contextually determined distribution? Green anticipates an appeal to the lexicon, it seems, asserting that "whether or not a particular verb will support a purpose infinitive is not a lexical property, but a pragmatic and contextual one." As (putative) support for the pragmatically/contextually determined distribution of purpose infinitives, she provides the examples in (16), involving the verb *redline* ("to refuse to insure property in a certain area"). By definition, *redline* does not fit the semantic profile of a verb that should support the co-occurrence of a purpose infinitive.

(16) a. They redlined it$_i$ **to build high rises on** _$_i$.
b. * They redlined it$_i$ **to force the owners to deed** _$_i$ **over to them**.

Only in the special context where, for example, "an insurance company redlined an area in order to buy investment property there cheaply" can it support a purpose infinitive, Green says. I would object that never having heard

[5] The term *co-occur with* is intended here to mean "has as a dependent", remaining agnostic about whether the dependence is a result of selection or modification.

the word before, I will accept whatever selectional properties it is presented to me with, and, furthermore, speakers are able to construct on-the-fly lexical entries when presented with a novel (or semantically extended) use of a familiar word. Here, *redline* seems to mean "get by means of redlining."

In any case, the ungrammaticality of (16b) has to do with the ill-formedness of the purpose infinitive itself, which is equally unacceptable with a canonical purpose infinitive supporting verb, as in (17).

(17) * They bought it$_i$ **to force the owners to deed** $\__i$ **over to them**.

This serves to highlight the fact that the internal properties of purpose infinitives are under-investigated, as suggested in section 2.2.

The problem of passivized and raised antecedents Green seems to assume that purpose infinitives cannot be embedded within a complement VP or clause, claiming that passivized and raised subjects which are co-indexed with a purpose infinitive gap are problematic, since the matrix verb in examples like (18) cannot ordinarily co-occur with a purpose infinitive.

(18) The book$_i$ seems to have been bought **to read** $\__i$ **to the kids**.

That is, *seems*, on its own, cannot occur with a purpose infinitive, and Green apparently assumes that *to read to the kids* is a dependent of *seems*, since she says that, "to support a purpose infinitive, they must embed the passive counterpart of a transitive purpose infinitive-supporting verb or one of the experiencer-oriented adjectives–a non-local property." Thus, Green posits the bracketing in (19a), but it is unclear why she makes this assumption rather than positing the bracketing in (19b), in which the purpose infinitive is a dependent of *bought*. In this case, the putative co-indexation problem disappears.

(19) a. The book seems [to have been bought] [to read to the kids].
b. The book seems [to have been [bought to read to the kids]].

It certainly seems to be the case that purpose infinitives can occur in embedded constituents selected by verbs which cannot alone co-occur with a purpose infinitive, as illustrated by (20).

(20) Sid knows [that Ursula brought *War and Peace*$_i$ on the plane **to read** $\__i$ **to the children**].

Restrictions that cannot be explained by lexical selection? Green claims that "the adjectives which support purpose infinitives with traces bound to their subjects seem to be those that allow or imply an experiencer argument ... the referent of the (implied) experiencer will be understood as the individual that will (be supposed to) 'have' the referent of the subject, and will use it for the purpose described in the purpose infinitive." To illustrate what she means here, consider one of her examples, given in (21).

(21) A book$_i$ is available to us **to read** $\__i$ **on the train**.

That is, *us* is the experiencer of *available*, and us will have the book, and us will use the book for the purpose of reading it. Green is suggesting that *us* is the only possible subject of the purpose infinitive in (21), and this fact cannot be enforced by appeal to syntax. For Green, the examples in (22) serve to illustrate that, "to the extent the property of supporting a purpose infinitive is not a lexical property, but a context-bound, intention-bound, pragmatic one" and trying to account for which verbs (or adjectives) can or cannot support purpose infinitives "by means of subcategorization is doomed to fail."

(22) a. These books$_i$ are available to students **to read** $\__i$ **to themselves on the train**.

b. * These books$_i$ are available to students **for Bill to read** $\__i$ **to me on the train**.

Even if we accepted the grammaticality judgments as marked in (22), it is unclear that this restriction could not be accounted for via lexically specified selectional restrictions. But (22b) is not ungrammatical: only imagine that Bill is a sock puppet the students like to read books to me with. And Green's claim that both (22b) and (23) are, stars notwithstanding, "not ungrammatical, but rather pragmatically bizarre," seems wrong. While we can easily construct a context in which (22b) is good, not so for (23).

(23) * Kim paid Sandy$_i$ **to talk to** $\__i$.

The claim that any lexical item can support a purpose infinitive given the right context is unconvincing in light of examples like (23), which seems to be irredeemably ungrammatical.

2.5.2 Green's arguments for adjuncthood

In light of the discussion outlined in the previous section, Green claims that analyzing purpose infinitives is "simpler" than analyzing them as complements, offering an explanation for the oft-noted restrictions on distribution by saying that these cases are "syntactically well-formed but unacceptable if a purpose interpretation cannot be accepted."

While both Bach and Green claim that purpose infinitives cannot be preposed, Green disagrees. Two of her examples involving preposed purpose infinitives are provided in (24).

(24) a. **To keep accounts in** $\__i$ I bought a ledger$_i$.

b. $\__i$ **To clean the disks** Dale hired Kim$_i$.

Insofar as the examples in (24) are grammatical outside the tiny-wispy-haired-Jedi-master community, Jones' suggestion that preposed purpose infinitives are best analyzed as topicalized constituents seems well-motivated.

Furthermore, Green claims that, "like iterating adjuncts generally, (purpose infinitives) can be permuted without affecting truth-conditions," providing the examples in (25).

(25) a. Sandy bought a computer$_i$ [**to sort data with** _$_i$] [**to rent** _$_i$ **to linguists**].
b. Sandy bought a computer$_i$ [**to rent** _$_i$ **to linguists**] [**to sort data with** _$_i$].

But these examples seem to involve (at least one) infinitival relative, not multiple purpose infinitives, given that replacement of *a computer* with a pronoun yields an ungrammatical sentence (26).

(26) * Sandy bought it$_i$ [**to sort data with** _$_i$] [**to rent** _$_i$ **to linguists**].

To the best of our knowledge, purpose infinitives are not, in fact, iterating, and iterability is a core property of adjuncts. Overall, then, Green is unable to provide convincing argumentation that purpose infinitives should be analyzed as adjuncts.

3 Baxter's treatment of purpose infinitives

3.1 Classification of the phenomena

3.1.1 The general class: goal infinitives

Baxter (1999) considers each of the examples in (27) an example of what he refers to as a goal infinitive:

(27) a. Jack went to the market **(in order) (for his friend) to sell the cow**.
b. Jack brought beans$_i$ home **(for his Mom) to plant** _$_i$ **in the garden**.
c. The university hired Sandy$_i$ **to** _$_i$ **teach syntax**.

This (putative) class comprises the previously discussed classes of purpose infinitives and in-order infinitives. Baxter claims that goal infinitives are adjuncts modifying either a VP or an N', and he is the only researcher reviewed here to notice the association of purpose infinitives with certain nouns. Relevant N' examples involve nouns that denote events, and they behave much like their verbal counterparts; compare the examples in (28) to those we saw in (27).

(28) a. Jack's trip to the market **(in order) (for his friend) to sell the cow**
b. Sandy's purchase of beans$_i$ **(for her Mom) to plant** _$_i$ **in the garden**
c. The university's hiring of Sandy$_i$ **to** _$_i$ **teach English**

3.1.2 The subclasses: rationale infinitives vs. purpose infinitives

Baxter subclassifies goal infinitives into rationale infinitives (hereafter in-order infinitives) (27a), and purpose infinitives (27b-27c). As previously noted, the most immediately apparent criterion distinguishing in-order infinitives from purpose infinitives is that in-order infinitives may be preceded by *in order* (29a-29b), while purpose infinitives may not (29c-29f).

(29) a. Jack went to the market **in order to sell the cow**.
b. Jack's trip to the market **in order to sell the cow**.
c. * Jack brought beans$_i$ home **in order (for his Mom) to plant _$_i$ in the garden**.
d. * Sandy's purchase of beans$_i$ **in order (for her Mom) to plant _$_i$ in the garden**.
e. * The university hired Sandy$_i$ **in order to _$_i$ teach syntax**.
f. * The university's hiring of Sandy$_i$ **in order to _$_i$ teach English**.

Baxter makes the same assumptions as Green with respect to the pattern of missing arguments and control: a purpose infinitive has one true gap, which can occupy either a VP-internal position (30a) or a subject position (30b). The missing subject of an in-order infinitive or purpose infinitive with a VP-internal gap, however, is uncontrolled (30c).

(30) a. Jack brought beans$_i$ home **(*in order) to plant _$_i$ in the garden**.
b. The university hired Sandy$_i$ **(*in order) to _$_i$ teach syntax.**
c. Jack went to the market **(in order) to sell the cow.**

In cases like (30b), in which the purpose infinitive is missing only its subject, Baxter assumes that the antecedent of the missing subject is syntactically determined. In cases like (30c), where the in-order infinitive is missing its subject, and (30a), where the purpose infinitive is missing both a complement and its subject, Baxter assumes that the referent of the subject is pragmatically determined. (Baxter notes, however, that the subject of a subjectless in-order infinitive is, in many cases, most naturally associated with the subject of the clause or NP.)

3.2 Evidence for adjuncthood

In support of the claim that goal infinitives are adjuncts, Baxter invokes their optionality, their replaceability by *do so* (41), and their iterability (31b).

(31) a. Dana [spiked the ball] **to impress Sandy**, and Chris [did so] **to impress Pat**.
b. Jack went to the market **to sell the cow to please his mother**.

3.3 Structure of purpose infinitives

Baxter follows the Sag (1997) analysis of infinitive constructions, in which both *to* and *for* are complementizers specified as $\left[\textsc{vform}\ \textit{inf}\right]$. The lexical entry for *to*, shown in figure 1, selects a VP[inf] and structure-shares its non-empty SUBJ specification, while *for*, shown in figure 2, has an empty SUBJ list and selects two complements: a CP[inf] and an NP structure-shared with the single element on the CP's SUBJ list.

$$\left[\textsc{synsem|loc|cat}\ \left[\begin{array}{ll}\textsc{head} & \left[\begin{array}{ll}\textit{comp} & \\ \textsc{vform} & \textit{inf}\end{array}\right] \\ \textsc{val} & \left[\begin{array}{ll}\textsc{subj} & \langle \boxed{1} \rangle \\ \textsc{comps} & \left\langle \textsc{vp}\left[\textsc{synsem|loc|cat}\ \left[\begin{array}{ll}\textsc{head|vform} & \textit{inf} \\ \textsc{val|subj} & \langle \boxed{1} \rangle\end{array}\right]\right] \right\rangle\end{array}\right]\end{array}\right]\right]$$

Figure 1: Lexical entry for Sag (1997) *to*

$$\left[\textsc{synsem|loc|cat}\ \left[\begin{array}{ll}\textsc{head} & \left[\begin{array}{ll}\textit{comp} & \\ \textsc{vform} & \textit{inf}\end{array}\right] \\ \textsc{val} & \left[\begin{array}{ll}\textsc{subj} & \langle\ \rangle \\ \textsc{comps} & \left\langle \boxed{1}\ \textsc{np},\ \textsc{cp}\left[\textsc{synsem|loc|cat}\ \left[\begin{array}{ll}\textsc{head|vform} & \textit{inf} \\ \textsc{val|subj} & \langle \boxed{1} \rangle\end{array}\right]\right] \right\rangle\end{array}\right]\end{array}\right]\right]$$

Figure 2: Lexical entry for Sag (1997) *for*

Baxter posits a special purpose infinitive *to* (which he calls PI-*to*), shown in figure 3, which selects a VP[inf] with a non-empty SLASH list, and binds one element of that list. He does not constrain the number of gaps, or the position of the bound gap within the VP (ignoring the apparent constraint on gaps within embedded clauses mentioned in section 2.2). The significance of these aspects of his treatment will be discussed below.

$$\left[\textsc{synsem}\ \left[\begin{array}{ll}\textsc{loc|cat|val|comps} & \left\langle \textsc{vp}\left[\textsc{synsem|nonloc|slash}\ \boxed{2} \uplus \boxed{1}\right] \right\rangle \\ \textsc{nonloc} & \left[\begin{array}{ll}\textsc{slash} & \boxed{2} \\ \textsc{bind} & \{\boxed{1}\}\end{array}\right]\end{array}\right]\right]$$

Figure 3: Nonlocal feature specifications of Baxter's PI *to*

More problematic, however, is Baxter's claim that this lexical entry licenses purpose infinitives with a gap in subject position, as in Baxter's example shown in (32).

(32) Jack hired Dana$_i$ $\_\_i$ **to tend the bean plant**.

In Baxter's analysis of (32), *to* selects an infinitival complement with a non-empty SLASH list (as expected), but also, crucially, and unexpectedly, an empty SUBJ list. This is in direct contradiction to the specifications depicted in his lexical entry for PI-*to* (figure 1), which inherits the subject of its complement. The SUBJ value is explicitly shown as a non-empty list.

Baxter says, "(t)he 'SUBJ ⟨ ⟩' specification on the VP *tend the bean plant* ... indicates that *tend the bean plant* cannot combine with a subject phrase, even though it has no overt subject." This is true, but it begs the question: how did the VP[inf] come by this [SUBJ ⟨ ⟩] specification? Given that the VP has a singleton list as its SLASH value, it is tempting to assume that this so-called VP has undergone subject extraction; in other words, we have here a VP[inf] with a subject gap. It is unclear what differentiates a VP from a clause in Baxter's terminology, or whether he simply uses VP as a general term to cover any sign whose lexical head is a verb.

And yet, Baxter refers to the VP in question as "gapless":

> If the unexpressed subject of a gapless PI (where the subject refers to the entity for which and intended purpose is being predicated) were treated as being on the SUBJ list instead of in the SLASH set, then a separate lexical type would be required: i.e., one whose instances shared their SUBJ value with an entity in the modified phrase.

If we then assume that Baxter intends PI-*to* to optionally select a subject-gapped infinitive as its complement, then he must (i) prevent the VP[inf] from realizing an overt subject, or he will license ungrammatical sentences like (33a) (where *his mother* is the subject of *plant*), and (ii) rule out multiple gaps in the purpose infinitive, or he cannot guarantee the right co-indexation in examples involving a subject and non-subject gap. This problem is illustrated by the ungrammatical co-indexation in (33b).

(33) a. * Sid bought beans$_i$ **to his mother plant** $\__i$ **in the garden**.

b. * I thought it was Ursula$_i$ that the school hired Sid$_j$ **to** $\__i$ **tutor** $\__j$.

It is possible to constrain the Head-Subject schema such that infinitive verbs cannot realize subjects, which would take care of (i). However, an adequate treatment of purpose infinitives needs to license multiple gaps, in order to account for examples like (34), the grammatical version of (33b).

(34) I thought it was Ursula$_i$ that the school hired Sid$_j$ **to** $\__j$ **tutor** $\__i$.

On the one hand, it is clear that Baxter does not intend to license multiple gaps in a purpose infinitive, since he says that, "(f)or purpose infinitives that have both their subject and a complement unexpressed... only the complement, and not the subject, appears in the SLASH of the VP[inf]." On the other hand, he does not enforce this intent, ill-advised as it may be.

3.4 Purpose infinitives as adjuncts: Baxter's account of control

As previously stated, Baxter assumes that purpose infinitives are adjuncts, modifying either a VP or an N', and as such, can impose selectional restrictions on the modified sign via HPSG's MOD feature.[6] Baxter claims that the gap in a purpose infinitive is always co-referential with "some" argument of the modified verb or noun. Assuming that Baxter has the facts right, there is a visibility problem: when a purpose infinitive has a gap identified with an argument realized within the VP or N' it modifies (i.e. a complement), it has no access to information about that complement, given traditional HPSG (Pollard and Sag, 1994) assumptions about the value of the MOD feature (*synsem*), and information encoded in *synsem* objects. Baxter's solution is to include ARG_ST as a *head* feature, thereby giving the purpose infinitive headed by *to* access to all arguments at the VP or N' level, as shown in figure 4.

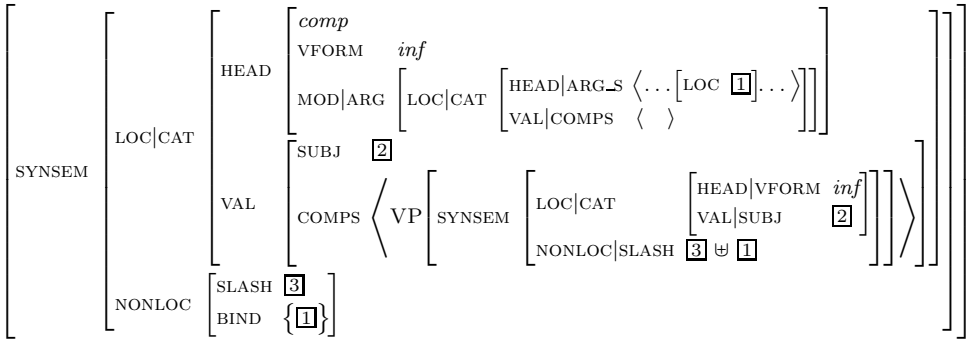

Figure 4: Lexical entry for Baxter's PI *to*

Assuming purpose infinitives are in fact adjuncts, this account predicts that the gap in a purpose infinitive can be identified with anything on the ARG_ST list of the modified sign. However, nowhere in the data Baxter presents is a purpose infinitive gap identified with anything other than an NP which is the so-called theme of the transitive verb or noun (examples given in (35a) and (35c)).[7]

Trying to construct an example wherein a purpose infinitive gap is associated with an agent (35b) or goal (35d) NP results in ungrammaticality.

(35) a. Jack carried a cell phone$_i$ **for his mother to call him on** $\__i$.
b. * Jack$_i$ carried a cell phone **for his mother to call** $\__i$ **on it**.
c. Jack handed a sweater$_i$ to his mother **to take** $\__i$ **on the plane**.

[6] Baxter does not discuss how *for*-clauses functioning as purpose infinitives license modification; presumably he would need to posit an additional PI-*for* lexical entry that inherits its MOD value from its CP complement.

[7] That this is the correct condition was pointed out to me by Bob Levine, p.c.

d. * Jack handed his mother$_i$ a sweater **to make** $\__i$ **comfortable on the plane**.

Baxter's restriction of possible antecedents for the purpose infinitive gap to an argument of the modified phrase is insufficient: further semantic restrictions apply, which are not easily encoded in the MOD specifications of a purpose infinitive. A save of this analysis relying on case mismatch (requiring that the antecedent must have accusative case) will not work, since case-mismatched examples involving co-indexation of gaps with passive subjects are grammatical (Bob Levine, p.c.), as shown by (36).

(36) A sweater$_i$ was handed to Jack's mother **to take** $\__i$ **on the plane**.

Thus, making information about argument structure available at the phrasal level does not immediately solve the problem of control in purpose infinitives, a problem inherent to an adjunct analysis.

4 A reanalysis and reclassification of the data

The purpose of this section is to re-investigate several of the conclusions made by Baxter and others about purpose infinitives, most importantly, whether or not they should be considered adjuncts.

4.1 Goal infinitives

Baxter offers little argumentation for his assumption that goal infinitives constitute a syntactic class. Both subclasses are infinitive constructions which may or may not include and overt subject NP preceded by *for*, and Baxter contends that both are adjuncts, but support for this claim relies primarily on evidence from in-order infinitives, as will be shown below. As noted earlier, Baxter cites optionality, replacement by *do so*, and iterability to show that these constructions should be analyzed as adjuncts. Optionality alone is not an argument for adjuncthood, given that many verbs have optional complements (consider *bet*, for example).

I argue in the following sections that Baxter's argumentation conflates two constructions with very different distributions:

1. Ungapped infinitival adjuncts, which may be phrasal or clausal
2. Gapped infinitival complements, which may be phrasal or clausal

4.2 Class 1: Ungapped infinitival adjuncts

Again, the so-called in-order infinitives are ungapped infinitival phrases or *for*-clauses, which may be preceded by *in order*, associated with (some projection) of verbs or event-denoting nouns (37).

(37) Jack went to the market **(in order) (for his friend) to sell the cow**.

There is ample and uncontroversial evidence that in-order infinitives are adjuncts. In-order infinitives have a relatively unrestricted distribution (38), they can remain when a VP is replaced by *do so* (39a), they can appear after other VP modifiers (39b), and they can (possibly) be iterated (39c), though there is always the question of whether multiple in-order infinitives should be analyzed as iterated, as illustrated by figure 5, or nested one within another, as illustrated by figure 6.

(38) a. Jack slapped Sandy **(in order) to insult him**.
b. a visit to the market **(in order) to sell the cow**

(39) a. Dana [spiked the ball] **to impress Sandy**, and Chris [did so] **to impress Pat**.
b. Jack went to the market (in the morning) (wearing new jeans and a stylish cap) **to sell the cow**.
c. Jack went to the market **to sell the cow to please his mother**.

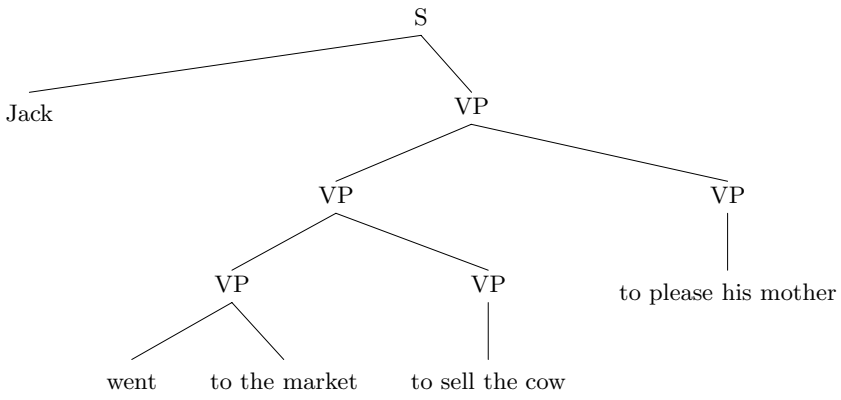

Figure 5: One possible structure for example (39c)

4.3 Class 2: Gapped infinitival complements

4.3.1 Evidence for purpose infinitives as complements

Unlike in-order infinitives, there seems to be little evidence that purpose infinitives should be analyzed as adjuncts, and good evidence that they should be analyzed as complements. Evidence is discussed test by test below.

The *do so* test: Purpose infinitives cannot remain when a VP is replaced by *do so* (40).

(40) * Sandy [bought tomato seeds$_i$] **to plant $\__i$ in the back yard**, and Dana [did so] **to grow $\__i$ in pots**.

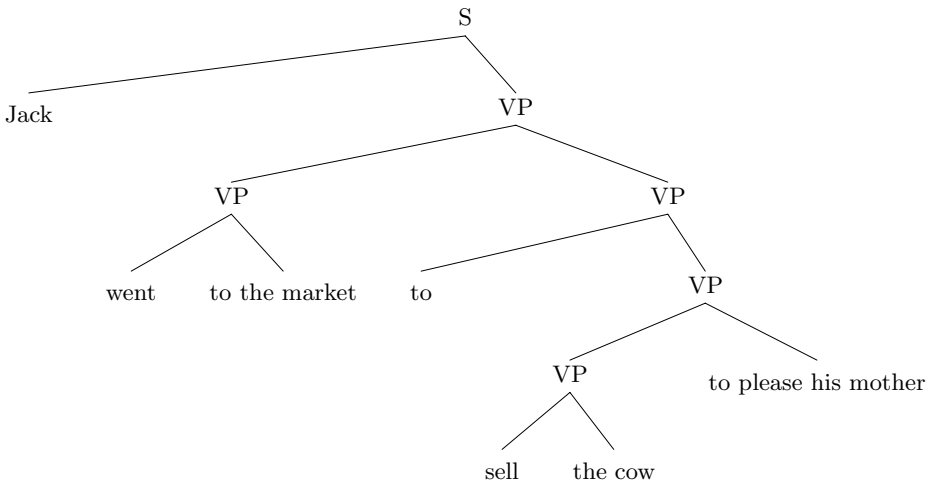

Figure 6: Another possible structure for example (39c)

Baxter addresses this discrepancy in his argument, noting what he calls a contrast in the possibility of a "purpose reading" in the examples in (41).[8]

(41) a. Dana bought *War and Peace*$_i$ **to give** $\_i$ **to Chris**.
b. Dana did so **to give** $\_i$ **to Chris**.

Of these examples, Baxter says, (41a) "has a purpose reading that (41b) lacks, because the element for which the PI would predicate an intended purpose does not correspond to a syntactic constituent in the modified phrase."

However, Levine (ms.) points out that both pseudo-gapping (42a) and full gapping constructions (42b) support purpose infinitives.

(42) a. Robin bought more seeds$_i$ **to plant** $\_i$ **in the garden** than Leslie did **to scatter** $\_i$ **around the lawn**.
b. Terry bought bulbs$_i$ **to plant** $\_i$ **in the garden** and Sandy seeds$_j$ **to scatter** $\_j$ **around the lawn**.

Levine argues that, particularly in the gapping case, "there is no possibility of any actual head appearing in the gapped 'clause' that could bear an ARG_ST specification co-indexed with the BIND of the purpose clause." In fairness to Baxter, he would probably answer that his characterization of sufficient conditions for grammaticality depends on an overt *antecedent* for the gap in the purpose infinitive, not an overt *lexical head* of the "modified phrase," as Levine is suggesting.

In fairness to Levine, he would probably reply in turn that, given the details of Baxter's account, how is it that the appropriate antecedent gets co-indexed

[8] (41b) is simply ungrammatical according to my own judgment.

with the gap in a purpose infinitive without the presence of a modified lexical head bearing the ARG_ST value (through which the purpose infinitive crucially has access to the antecedent)? In fact, Levine says:

> The only way Baxter's claim can be compatible with the pseudo-gapping data is to assume that all of the auxiliaries which can show up in pseudo-gapping constructions have alternative lexical entries in which arbitrary proper sublists of their ARG_ST specifications are missing from their COMPS lists. And Baxter offers no arguments to support such an analysis.

If Baxter would claim that the syntactic representations of gapped and pseudo-gapped clauses involve reconstruction of argument structure information, a reasonable supposition, then the same assumption should apply to the syntactic representation of *do so* clauses. *Do so* clauses only occur in the presence of a prior clause which supplies the VP replaced by *do so*, including a possible antecedent for the gap in a purpose infinitive. Thus, a possible antecedent for a purpose infinitive gap is "a syntactic constituent" in the same sense (realized in a prior clause) in both (ungrammatical) *do so* clauses (43), and (grammatical) pseudo-gapping clauses (42a).

(43) * Dana bought *War and Peace*$_i$ **to give** $\__i$ **to Chris**, and Sid did so **to give** $\__i$ **to Ursula**.

The point is that what is good for the goose must be good for the gander: there is no obvious reason on Baxter's account why pseudo-gapped and gapped clauses can support the presence of purpose infinitives and *do so* clauses cannot, and this calls into question Baxter's contention that purpose infinitives are adjuncts.

Order of purpose infinitives relative to modifiers: In most cases, purpose infinitives must precede VP modifiers (44a), evidence that they should be analyzed as complements. Exceptions to this generalization seem to involve those modifiers that also allow so-called heavy NP shift (Erhard Hinrichs, p.c.) (44b).

(44) a. * Jack brought some beans$_i$ to Phil's house (wearing new jeans and a stylish cap) **to plant** $\__i$ **in his garden**.

b. Jack brought some beans$_i$ to Phil's house (on Sunday) **to plant** $\__i$ **in his garden**.

Examples of (grammatical and ungrammatical) heavy NP shift involving the same modifiers as those in (44) are shown in (45).

(45) a. * Jack brought to Phil's house (wearing new jeans and a stylish cap) [some beans that he'd gotten at the farmer's market].

b. Jack brought to Phil's house (on Sunday) [some beans that he'd gotten at the farmer's market].

Thus, I assume that purpose infinitives have the same distribution as other "heavy" elements in terms of optional clause-final position.

Restricted distribution: Purpose infinitives have a much more restricted distribution than in-order infinitives, as has been noted and described elsewhere (46).

(46) a. * Jack slapped Sandy$_i$ **to insult** _$_i$.
b. Jack slapped Sandy **in order to insult him**.
c. * Jack visited the market$_i$ **to burn** _$_i$ **down**.
d. Jack visited the market **in order to burn it down**.
e. * a visit to the market$_i$ **to burn** _$_i$ **down**
f. a visit to the market **in order to burn it down**

Since relatively unrestricted distribution within the appropriate syntactic environment is characteristic of adjuncts, this data does not support an adjunct analysis of purpose infinitives (in contrast to in-order infinitives). That the presence of a purpose infinitive is only supported by a select class of lexical heads suggests, instead, lexical selection via the COMPS feature of the lexical head. In other words, purpose infinitives are (optional) complements.

Multiple purpose infinitives: Multiple purpose infinitives cannot occur in the same clause or NP, unless the lexical head of the first purpose infinitive can itself support a purpose infinitive; this suggests a nested structure, not iterated adjunction. As such, the evidence supports a complement analysis of purpose infinitives, not an adjunct analysis (47).

(47) a. * Jack brought *The Farmers Almanac$_i$* on the plane [**to read** _$_i$] [**to bring** _$_i$ **to his hosts**].
b. * Jack read The Farmers Almanac$_i$ **to bring** _$_i$ **to his hosts**.
c. Jack brought beans$_i$ home [**to give** _$_i$ **to his mother** [**to plant** _$_i$ **in the garden**]].
d. Jack gave beans$_i$ to his mother **to plant** _$_i$ **in the garden**.
e. Sandy brought a really expensive dress$_i$ [**to wear** _$_i$ **to dinner** [**to impress everyone with** _$_i$]].
f. Sandy wore a really expensive dress$_i$ to dinner **to impress everyone with** _$_i$.

This data suggests that a purpose infinitive should be analyzed as an optional complement: once the selectional requirement for a purpose infinitive clause or VP is met, the lexical head of the clause or NP does not license the presence of another.

4.3.2 Extraposition of infinitival relatives?

One possible analysis of purpose infinitives is that they are postnominal modifiers (specifically, infinitival relatives) that can be extraposed. This would take care of the visibility problem, because the infinitive can now see the thing its gap is associated with, since it is modifying it, as shown in figure 7.

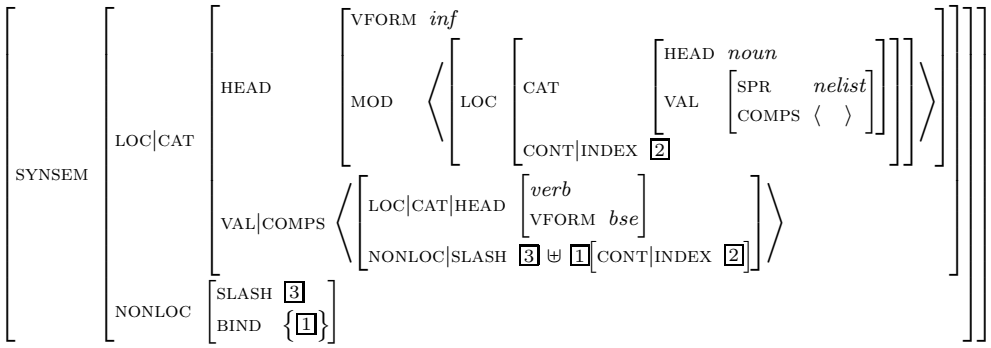

Figure 7: Lexical entry for infinitival *to* as a nominal modifier

Clearly, gapped infinitives can modify an N' (48a), but as pointed out in the research summarized earlier, not all instances of purpose infinitive can be reduced to extraposition.

(48) a. Jack brought [some beans$_i$ **to plant** $\__i$ **in the garden**] home.
b. Jack brought some beans$_i$ home **to plant** $\__i$ **in the garden**.
c. [Some beans$_i$ **to plant** $\__i$ **in the garden**] were brought home by Jack.

Extraposition cannot explain the well-formedness of (49a) since the non-extraposed version (49b) is ungrammatical.

(49) a. Sandy gave *War and Peace*$_i$ to Kim **to read** $\__i$.
b. * Sandy gave [*War and Peace*$_i$ **to read** $\__i$] to Kim.
c. * [*War and Peace*$_i$ **to read** $\__i$] was given to Kim by Sandy.

4.3.3 Structure of purpose infinitives revisited

In line with previous research, I posit a general class of purpose infinitives on the basis of distributional and semantic unity in the data: a purpose infinitive predicates an intended purpose of the constituent co-indexed with its subject or non-subject gap, and (on my account) is selected as an optional complement by certain verbs, adjectives, and nouns. In terms of internal structure, some generalizations hold for the class as a whole: every purpose infinitive is headed by an infinitive verb and contains a subject or non-subject gap.[9]

[9] A complete description of additional restrictions on internal structure is beyond the scope of this paper, though the necessity for such an investigation is noted earlier in the paper.

In other respects, however, purpose infinitives are heterogeneous, and can be subdivided into three subclasses on the basis of internal structure: (i) *for*-clauses with a VP-internal gap, (ii) gapped infinitive VPs (i.e., the missing subject is not co-indexed with an antecedent), and (iii) subject-gapped infinitive clauses (i.e., the missing subject is co-indexed with an antecedent). This characterization is in line with the fact, noted in prior research, that purpose infinitives missing both subject and some non-subject exhibit a consistent pattern: it is the missing non-subject whose referent is syntactically and predictably determined, while the referent of missing subject is determined outside of syntax (pragmatically/contextually). Thus, in a purpose infinitive satisfying the description in (ii), the missing non-subject is assumed to be a gap, and the missing subject is assumed to reflect an unsaturated valence requirement (specifically, the SUBJ specification).

This analysis of internal structure is hardly revolutionary; ignoring terminological differences and various theoretical details (the definition of clause, whether *to* is an auxiliary or complementizer, etc.), it is identical to much of previous research. However, I would like to do two things in this section: (i) provide a clear and concise inventory of the data motivating this analysis, and (ii) discuss data brought to my attention by Carl Pollard (p.c.), which call into question whether this is the right characterization after all.

Motivating the standard analysis of internal structure and subclassifications: On the basis of Baxter's data alone, it initially seems as though there is little motivation for positing a general class of purpose infinitives, characterized by the presence of a gap in either a subject or non-subject position. Only and all examples of purpose infinitives purportedly containing a subject gap (subclass (iii) above) involve the verb *hire*. My first look at the data led me to analyze *hire* as a control verb (see figure 8), selecting an optional VP[inf] complement, as in (52).

(50) The university hired Sandy$_i$ **(*in order) _$_i$ to teach English classes**.

$$\left[\text{SS|LOC|CAT}\ \left[\begin{array}{ll}\text{HEAD} & \textit{verb}\\ \text{VAL|COMPS} & \left\langle \text{NP}_i,\ \text{VP}\left[\text{LOC|CAT}\ \left[\begin{array}{ll}\text{HEAD|VFORM} & \textit{inf}\\ \text{VAL|SUBJ} & \langle \text{NP}_i \rangle\end{array}\right]\right]\right\rangle\end{array}\right]\right]$$

Figure 8: Example of a lexical entry for an object control verb

Having excluded all subject-gapped examples from the pool of Baxter's data, it would seem that the general class of purpose infinitives is characterized by the presence of a VP-internal gap, and heterogeneity is limited to the disjunction between *for*-clauses having overt subjects, and VPs (in which the SUBJ specification is unsaturated, and reference is determined outside of syntax).

This is not, however, the correct characterization of the data. *Hire* can co-occur with infinitives containing either a subject or non-subject gap, as can

other canonical purpose infinitive-supporting lexical items.

For example, Jones provides data in which *brought* occurs with a purpose infinitive containing either a subject gap (51a), or a non-subject gap (51b).

(51) a. Mary$_i$ brought John$_j$ along **(*in order) _$_j$ to talk to her$_i$**.
b. Mary brought John$_i$ along **to talk to _$_i$**.

Furthermore, Green provides data in which *hire* co-occurs with an infinitive having a non-subject gap (52a). I include similar examples of my own in (52b) and (52c).

(52) a. They hired Sandy$_i$ **(*in order) to talk to _$_i$ about Charlie**.
b. I hired her$_i$ **(*in order) to talk to _$_i$ about my financial problems**.
c. Ursula hired her$_i$ **for her children to speak French with _$_i$**.

Thus, *hire* cannot be an object control verb, since it is not an unexpressed subject of the VP[inf] that is co-referential with *hire*'s NP complement, but an unexpressed complement.

In terms of the semantic generalization made of purpose infinitives, the infinitive associated with *hire* is consistent: it expresses the purpose (aka job description) intended for the hiree, the argument co-indexed with the purpose infinitive gap. Note the semantic distinction between a purpose infinitive, like that in (53a), and an in-order infinitive: the gapped infinitival clause whose (unexpressed) subject is identified with the direct object of *hire* describes the hiree's job description, and not the hirer's purpose in hiring him/her.

(53) a. The university hired Sandy$_i$ _$_i$ **to teach English**.
b. The university hired Sandy (to teach English) **in order for him to spy on the other instructors**.
c. The university hired Sandy (to teach English) **in order to spy on him**.

Infinitive *for*-clauses and VPs preceded by *in order* express the intent or rationale underlying an act, in this case, the purpose of hiring, as illustrated by the examples in (53b) and (53c).

In all respects, then, the infinitives optionally occurring with *hire* pattern with other purpose infinitives, and should be counted as such.

In light of the data presented piecemeal so far, then, the description of purpose infinitives can be summarized as follows. Certain verbs (54), nouns (55), and adjectives (56) select optional infinitive complements that express the purpose intended for another of the selector's arguments. The purpose relationship is expressed via co-indexation between the relevant argument, and a gap in the infinitive complement. The gap may be in either subject position, as illustrated by (54a), (55a) and (56a), or a non-subject position, as illustrated by (54b-54c), (55b-55c), and (56b-56c). The purpose infinitive itself may be a *for*-clause or a VP[inf], and the referent of the unexpressed subject in a gapped phrasal purpose infinitive is determined pragmatically, as illustrated by (54c), (55c), and (56c).

(54) a. Jack$_i$ brought a puppy$_j$ home $\_j$ **to keep him$_i$ company**.
b. Jack brought beans$_i$ home **for his mother to plant $\_i$ in the garden**.
c. Jack brought beans$_i$ to the potluck **to have $\_i$ as a side dish**.

(55) a. Jack's purchase of a bird bath$_i$ $\_i$ **to stand in the middle of the front garden**
b. Jack's purchase of a cotton sweater$_i$ **for his mother to wear $\_i$ on cool summer nights**
c. Jack's last minute purchase of red wine$_i$ **to drink $\_i$ at Sid's going-away party**

(56) a. Copies of the report$_i$ are available $\_i$ **to be read by the public**.
b. Only one copy of the book$_i$ is available **for students to read $\_i$**.
c. Several artists were available **to talk to $\_i$ at the opening**.

With respect to a purpose infinitive, the antecedent of its gap, and their status relative to one another within a clause or NP, the generalization posited by Baxter differs in several respects from the one argued for in this paper. On both accounts, the antecedent is an argument of a lexical head, of which the purpose infinitive is also a dependent. The accounts differ according to the nature of that dependence: adjunction on the one hand, complementation on the other. In the HPSG framework, as in others, adjuncts select heads, while heads select complements, and this has consequences for licensing the pattern of co-indexation described in section 4.3.3. If purpose infinitives are considered adjuncts, it is the purpose infinitive that must enforce the relationship between its own gap and the sign it modifies. If, on the other hand, purpose infinitives are considered complements, it is the lexical head which must enforce a relationship between two of its arguments: the purpose infinitive and another which will function as the antecedent.

As discussed in section 3.4, Baxter introduces argument structure information on the phrasal level (of the "modified sign") to give the purpose infinitive access to possible antecedents for its gap. Remembering that ARG_ST is a list, it would be difficult for Baxter to explain the fact that what the antecedent is seems to vary according to lexical properties of the head of the "modified" phrase. Selection by adjuncts has a "one size fits all" flavor: we do not expect adjuncts to behave differently depending on which lexical item they adjoin to. So, we would not expect a convincing account of purpose infinitives to include a listing of the lexical items they can modify, along with which argument of the lexical entry must be the antecedent. On the contrary, in so far as purpose infinitives are supposed to have selectional restrictions, they should be expressible as non-disjunctive feature descriptions.

Presumably, Baxter expresses the selectional restrictions of purpose infinitives in terms of semantic properties. With respect to co-indexation, he claims that *any* argument of the modified sign can serve as antecedent to the purpose

infinitive gap. Note that since his account only provides the purpose infinitive access to an unstructured list of arguments, it would be difficult (though probably not impossible) for him to account for a more restricted requirement.

However, in section 3.4 I take issue with Baxter's relatively unrestricted take on the control of purpose infinitive gaps, arguing that, given the argument structure of any purpose infinitive-supporting lexical head, only *one* antecedent appears to be possible. Whether or not a generalization can be expressed across lexical entries (e.g. the antecedent is always the theme), the point here is that the lexical head, not the purpose infinitive, seems to be the significant factor in predicting what the antecedent will be. This is a generalization much easier to explain if we assume that the lexical head, not the purpose infinitive, is licensing co-indexation, and this, in turn, is consistent with an account in which the head selects the purpose infinitive, and not vice versa. In other words, co-indexation between (purpose infinitive) gap and (argument) antecedent can be characterized as a valence property of a lexical head: a relationship between arguments licensed by the head that selects them.

Revisiting the claim that co-indexation is a valence property As mentioned earlier, Carl Pollard (p.c.) questions the assumption that every lexical entry selecting a purpose infinitive complement specifies a particular one of its arguments to function as the antecedent for the purpose infinitive gap. To wit, he provides the examples in (57), to be taken in the following context: "Students nowadays slight Nabokov because they think he never wrote anything besides *Lolita*, so. . . "

(57) a. ? We'll send Rozdestvensky$_i$ over with *Invitation to a Beheading* **for them to argue with** $\__i$.

b. We'll send Rozdestvensky over with *Invitation to a Beheading*$_i$ **for them to read** $\__i$.

Presumably the (phrasal) verb *send over* selects an NP, a PP[with], and a purpose infinitive. Depending on one's grammaticality judgments for (57a) and (57b) (which may be ameliorated by some prosodic finessing), it appears that the antecedent for the purpose infinitive gap may be either of the preceding complements. Although it is difficult for me to accept the co-indexation in (57a), this example is grammatical for Pollard and others.

So, assuming this variation is a possibility, what does it mean? Is this a special (disjunctive) selectional property of *send over*, which can be incorporated into the account as such? If we are to generalize from this data, we can revert to an analysis wherein co-indexation is licensed not via valence feature specifications, but on ARG_ST, between a purpose infinitive gap and any other argument. This approach still assumes the presence of a gap in the purpose infinitive, and treats co-indexation between that gap and its antecedent as a lexical property of the selecting head. Another possibility, however, is to assume that the referents of missing arguments in a purpose infinitive are determined outside of syntax:

no gap, no lexically licensed co-indexation. This approach treats all missing arguments in purpose infinitives and in-order infinitives the same. Motivation for this last possibility would ideally include data in which the referent of a missing purpose infinitive argument is not supplied within the larger clause or NP, as can be shown for the unexpressed subjects of phrasal purpose infinitives and in-order infinitives. Given the paucity of relevant data, I leave an account of the variation illustrated in (57) as a matter for future research. Having mentioned the wrinkle, we turn aside from this question, and, in the next section, sketch an HPSG account of purpose infinitives in line with the summary of data outlined above.

5 Licensing the selection of purpose infinitives as complements

The preceding discussion has sought to empirically motivate an analysis of purpose infinitives as a syntactic class, selected as optional complements by certain verbs, adjectives, and nouns. Note that this assumption immediately fixes the visibility problem posed by Baxter, since both the gapped infinitive and the thing associated with its gap occur on the COMPS of the lexical head. There is no need to make argument structure information available at the phrasal level. Ignoring for the moment the disjunctive nature of purpose infinitives in terms of internal structure, a lexical entry selecting a gapped VP[inf] might look something like figure 9.

$$\left[\begin{array}{l}\textsc{synsem}\left[\begin{array}{l}\textsc{loc}|\textsc{cat}\left[\begin{array}{ll}\textsc{head} & \textit{verb}\\ \textsc{val}|\textsc{comps} & \left\langle \textsc{np}\left[\textsc{loc}|\textsc{cont}|\textsc{index}\ \boxed{2}\right],\ \textsc{vp}\left[\begin{array}{ll}\textsc{loc}|\textsc{cat}|\textsc{head} & \left[\begin{array}{ll}\textit{verb}\\ \textsc{vform} & \textit{inf}\end{array}\right]\\ \textsc{opt} & +\\ \textsc{nonloc}|\textsc{slash} & \boxed{3} \uplus \boxed{1}\left[\textsc{cont}|\textsc{index}\ \boxed{2}\right]\end{array}\right]\right\rangle\end{array}\right]\\ \textsc{nonloc}|\textsc{bind}\ \boxed{1}\end{array}\right]\end{array}\right]$$

Figure 9: Example lexical entry of a verb selecting a gapped infinitive VP

This lexical entry, which selects both an NP and an (optional) VP[inf] as complements, binds a member of the VP[inf]'s SLASH list, while also co-indexing it with the NP complement. Note that the referent of the VP[inf]'s unexpressed subject is unconstrained.

Given that any of the structural subclasses constituting the general class of purpose infinitives apparently satisfy the selectional requirements of the lexical heads which select them, some attention should be paid to the question of the feature specifications used to encode selection of a purpose infinitive. That is, we have shown purpose infinitives to function as a syntactic class in terms of distribution (satisfying the selectional requirements of certain lexical heads). But, at the same time, purpose infinitives vary in terms of internal structure, and we

have described that variation in terms of three subclasses: (i) gapped infinitive VPs, (ii) subject-gapped infinitive clauses, and (iii) infinitive *for*-clauses with VP-internal gaps. In order to avoid a disjunctive encoding of purpose infinitive selection, then, the grammar needs to allow for a single feature description characterizing the general class, while filtering out all ungrammatical possibilities.

If the grammar independently guarantees that an infinitive clause having an overt subject (not a gap) must occur with the complementizer *for*, then descriptive disjunction is limited to whether or not the subject requirement is satisfied or not. If the the SUBJ feature is unspecified, the resulting feature description, shown in figure 10, satisfies the generalization outlined above.

$$\begin{bmatrix} \text{LOC}|\text{CAT} & \begin{bmatrix} \text{HEAD}|\text{VFORM} & \textit{inf} \\ \text{VAL}|\text{COMPS} & \textit{elist} \end{bmatrix} \\ \text{NONLOC}|\text{SLASH} & \textit{nelist} \end{bmatrix}$$

Figure 10: Feature description: Purpose infinitive *synsem* value

6 Summary and Outlook

It has been argued that the gapped infinitival constructions known as purpose infinitives should be analyzed as optional complements for a select class of verbs, adjectives, and nouns. We have provided a variety of data to empirically motivate this assumption, which has theoretical implications for HPSG with respect to an ongoing debate in the field, namely, at which levels of syntactic representation should information about argument structure be available? Initially introduced to the HPSG signature as a feature appropriate to objects of type *word*, the list-valued feature ARG_ST encodes information about the argument structure of a lexical head.

The treatment of purpose infinitives as adjuncts has been used in other research (Baxter, 1999) to argue that information about argument structure must be available at the phrasal level. In Baxter's account, purpose infinitives need access to all arguments of the modified sign, in order to license the pattern of gap-antecedent co-indexation which is a distinctive property of the construction. Under the current account, however, co-indexation is licensed by the lexical head which selects both the gapped purpose infinitive and the constituent serving as antecedent, eliminating the need for a representation of argument structure beyond the lexical level.

Thus, while this research does not refute wholesale the contention that ARG_ST should be included in the signature as a *head* feature, it effectively removes purpose infinitives from the inventory of supporting evidence.

Nevertheless, the analysis presented here amounts to a theoretical sketch; as is often the case, much remains to be done before claiming descriptive adequacy. Further empirical investigation is warranted with respect to multiple extractions, restrictions on the purpose infinitive's internal structure (including

possible gap sites), and the conditions governing co-indexation of the gap with an antecedent (assuming the determination of a referent is, in fact, syntactic). Future investigation concerned with this phenomenon should seek to achieve a fuller description and account of its syntactic properties, but it is hoped that this paper provides a foundation for further research.

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