A Unidimensional Syntax-Semantics Interface for Supplements

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June 17, 2015

Abstract

I extend the recent unidimensional semantics of supplements due to Martin to a full syntax-semantics interface. The grammar formalism employs a two-component syntax, with one component modeling combinatorics and another for surface form. I show that the syntax-semantics for supplements is relatively uncomplicated, requiring only two new lexical entries. I contrast this with the complex machinery needed to model supplement semantics in other accounts, such as transformations, special-purpose rules, continuations, and monads. This account is also more finely grained and empirically adequate than others because it allows supplements to take scope and be denied.

Keywords: supplements; unidimensionality; syntax-semantics interface; scope

1 Introduction

Ever since Potts's (2005) reexamination of *supplements* (nominal appositives, nonrestrictive relative clauses, *as*-parentheticals, etc.), they have been predominantly accounted for by semantics that are *multidimensional* in the sense that a supplement's content is kept separate from surrounding content. In addition to Potts, multidimensional accounts of supplements have been proposed by Nouwen (2007), Giorgolo and Asudeh (2012), and Martin (2013). Others have crafted accounts without a separate dimension for supplements *per se*, but with a separate mode for supplements to contribute their content; examples include Kubota and Uegaki (2009), AnderBois et al. (2010, 2015), Koev (2012, 2014), and Bekki and McCready (2014). Barker et al.'s (2010) treatment of *expressives* also uses a separate contribution mode.

More recently, both the empirical characterization of supplements as semantically separate and accompanying multidimensional accounts have been questioned by authors citing the possibility of anaphoric interactions with supplement content (Amaral et al., 2007; AnderBois et al., 2010, 2015; Martin, 2013) and the capability of supplements to take scope (Schlenker, 2010, ms; Nouwen, 2014; Martin, in press). The account of the semantics of supplements in Martin in press, hereafter *SU*, uses only a single lexical entry, for the *comma intonation* (Huddleston and Pullum, 2002, 1351), in addition to the usual

mechanisms for modeling quantifier scope ambiguity and dynamic semantics. This paper provides a syntax-semantics interface for SU's account that extends Martin and Pollard's (2014) two-component categorial syntax with lexical entries for the comma intonation. Along the way, I make a case for this straightforward account by critiquing the perspective on supplements that has dominated since Potts's work.

As I discuss below in detail, the move to a two-component syntactic framework allows an analysis of the syntax of supplements that not only generates SU's semantics but is also much more parsimonious and economical than many other accounts. In contrast to the analyses due to McCawley (1998), del Gobbo (2007), and Schlenker (2010, ms), no intricate movement rules are required, nor is it necessary to appeal to *E-type pronouns*. There are no dedicated modes of combination or special-purpose interpretation rules, unlike Potts's (2005) account. And it is not necessary to invoke the *continuation passing* technique, as do Kubota and Uegaki (2009), *monads*, as do Giorgolo and Asudeh (2012), or a specialized operator, as do Bekki and McCready (2014).

The rest of the paper is organized as follows. The conventional wisdom about supplements is reviewed in §2, followed by a proposed recharacterization in §2.2. The syntax-semantics interface is presented in §3, starting with a brief overview of the semantic formalism (§3.1). After treating some basic supplement examples in §3.2, the account examines supplement (non)projection (§3.3), anaphoric links between supplements and other content (§3.5), and supplement stacking (§3.6). Some comparisons with other accounts are discussed in §4, and then §5 concludes.

2 Conventional implicature and conventional wisdom

According to Potts's (2005) characterization, which has been adopted by many others, supplements are semantically inert with respect to surrounding content. The major implications of this claim are the following:

1. Supplements are predicted to be *scopeless* (or, equivalently, to always take widest scope) because they do not interact with truth-functional operators.

2. Unlike regular nonsupplement content, supplements should never be *at-issue*, and therefore should not be capable of denial or contradiction in normal circumstances.

3. Any account of the semantics of supplements must be multidimensional, with supplement content contributed on a separate, dedicated dimension from regular at-issue content.

These implications render dubious the claim that supplements are semantically inert for the simple reason that they do not agree with observations. The following section explores this mismatch by looking at some supplement data.

2.1 A fresh look at the data

The first doubts about Potts's (2005) characterization of supplements were expressed by Amaral et al. (2007), who pointed out that supplements participate in both anaphoric and scopal interactions with other content. Amaral et al. give examples of supplements interacting with the quantifiers *every* and *several*.

(1) a. In each class, several students$_i$ failed the midterm exam, which they$_i$ had to retake later.

b. It seems like every time I turn around, my neighbor with a motorcycle is dating a different woman, who always has one too.

(Amaral et al., 2007, (36) and (38))

For both examples in (1), the supplement must be interpreted in the scope of the relevant quantifier. For (1a), several students *in each class* had to take the exam later; in (1b), there is a different woman *on each occasion* who also has a motorcycle. Amaral et al. also cite the ability of supplements to take on a nonspeaker perspective (experimentally attested by Harris and Potts (2009)) as further evidence that supplements can scope narrow, since nonspeaker perspective shift involves a supplement in the scope of an attitude verb.

Context: Joan is delusional, believing that a chip has been installed in her brain allowing her to speak multiple languages.

(2) Joan believes that her chip, which she had installed last month, has a twelve year guarantee. (Amaral et al., 2007, (27))

In (2), the implication that Joan's chip was installed last month does not survive into the matrix, speaker-anchored utterance, holding only in the context of what Joan believes.

Nouwen (2014) shows that supplements can sometimes be outscoped by negation, in addition to other quantifiers.

(3) a. It's not the case that a boxer, a famous one, lives in this street.

b. Every boxer has a coach, a famous one.

(Nouwen, 2014, (25) and (32))

Though a wide-scope supplement reading is also available, both examples in (3) have a reading where the operator outscopes the supplement. For (3a), this reading is equivalent to *It's not true that a famous boxer lives in this street.* For (3b), it is equivalent to *Every boxer has a famous coach.*

There is also evidence that supplements participate in scope interactions based on their behavior in conditionals, as Schlenker (ms) points out.

(4) a. If tomorrow I call the chair, who in turn calls the dean, we'll be in deep trouble. (Schlenker, ms, (66))

b. If tomorrow I call the chair, who has had it out for me for a long time, we'll be in deep trouble.

These examples show an interesting contrast, with (4a) only implying that the chair will call the dean provided I call her, i.e., the supplement is interpreted in the scope of *if*. On the other hand, the supplement in (4b) scopes wide relative to the conditional, so that the entire utterance implies that the chair has long had it out for me whether or not I call her.

SU gives evidence not only of negation and quantifiers outscoping supplements, but also of discourse binding within a supplement and cases where a quantifier seems to outscope a supplement.

(5) a. Every famous boxer I know$_i$ has a devoted brother, who he$_i$ completely relied on back when he$_i$ was just an amateur.

b. But there would always be some student, a photographer or a glassblower, who would simply have taken a piece of newspaper and folded it once and propped it up like a tent and let it go at that.

c. No Tibetan Buddhist$_i$ thinks the Dalai Lama, his$_i$ spiritual mentor, would ever cave to Chinese pressure tactics.

(Martin, in press, (16), (17) and (27))

The supplement in (5a) is obligatorily interpreted in the scope of the quantifier *Every* because of the discourse-bound pronoun *he*. A naturally occurring narrow-scope supplement is given in (5b). SU analyzes examples like (5c), which implies that the Dalai Lama is every Tibetan Buddhist's spiritual mentor, as instances of *telescoping* (Roberts, 1989, 2005).

The examples in (1) and (5) show that a pronoun in a supplement can take its antecedent outside the supplement. The following example shows that supplements can also introduce antecedents for anaphora in outside content:

(6) Kim$_i$'s bike$_j$, which used to have reflectors$_k$ on it$_j$, was pretty safe to ride at night until she$_i$ decided to take them$_k$ off. (Martin, in press, (35))

Taken together, these examples argue for an approach to supplements that allows them to interact with surrounding content, both anaphorically and in term of scope. Amaral et al. (2007) show that these interactions extend to presuppositions, e.g. cases where *too* is licensed by content inside a supplement, such as (1b).

AnderBois et al. (2010, 2015), Koev (2012), and Schlenker (ms) all point out that the linear position of a supplement within its containing utterance can influence its deniability.

(7) a. i. He told her about Luke, who loved to have his picture taken.

ii. No, he didn't like that at all.

iii. No, he told her about Noah.

b. i. Luke, who loved to have his picture taken, was his son.

ii. ?? No, he didn't like that at all.

iii. No, Luke was his nephew.

(AnderBois et al., 2010, (48) and (50))

(8) a. i. Jack invited Edna, who is a fearless leader.

ii. No, she isn't. She is a coward.

b. i. Edna, who is a fearless leader, started the descent.

ii. # No, she isn't. She is a coward.

(Koev, 2012, (4) and (5))

These contrasts show that both of the utterance-final supplements in (7a) and (8a) can be felicitously denied, whereas their respective utterance-medial counterparts in (7b) and (8b) are less straightforwardly denied. Examples like these show that supplement content can sometimes be at-issue, at least when it occurs utterance-finally.

There is also evidence that an utterance-medial supplement can address the *question under discussion (QUD)* (Roberts, 2012a,b), and therefore be at-issue.

Context: The interlocutors are participants at a math conference.

(9) a. Do you know whether the axiom of Choice is independent of ZF?

b. Well, Paul Cohen, who proved it is back in 1963, is sitting in the back row. So you can go ask him.

(Martin, in press, (84))

The supplement in (9b) is directly addressing the question raised in (9a).

2.2 Recharacterizing supplements

Examples like those in (1)–(5) offer strong evidence that supplements are not, in fact, scopeless, as they clearly interact with quantifiers, negation, and conditionals. And (5) and (6) further erode the contention that supplements are inert, since anaphora appears to work for them in basically the same way as it does for nonsupplement content. Lastly, examples like (7)–(9) cast doubt on the idea that supplements are never at-issue, with (7) and (8) showing that they can be denied and (9) showing that they can address the QUD.

In view of the data, SU follows Amaral et al. (2007), AnderBois et al. (2010, 2015), Koev (2012, 2014), and Martin (2013) by claiming that supplements should be receive an incremental interpretation in a dynamic system, an interpretation no different from the one afforded to regular, nonsupplement content. SU also adopts the position advocated by Schlenker (2010, ms) that supplements should be represented in a way that allows them to interact with other content at the level of scope. SU's account of supplement scope strengthens Nouwen's (2014) claim that "[t]he scope of the appositive is always at least as wide as that of its anchor, never narrower" by making a supplement's scope *exactly* that of its anchor. As mentioned above, cases where a supplement appears to take wider scope than its anchor, such as (5c), are analyzed as instances of telescoping in the SU model.

SU's account is *unidimensional*, following Kubota and Uegaki (2009), AnderBois et al. (2010, 2015), Koev (2012, 2014), Murray (2014), and Schlenker (ms). But unlike many of these other accounts, supplements, in SU, participate in scope interactions with operators in exactly the same way as other content. They also update the discourse context via the same method as all other content. As for how it is that supplements *project* (Tonhauser et al., 2013), escaping the effects of semantic operators, SU treats projection as an epiphenomenon of supplement scope: supplements anchored to proper names project because their anchors scope widest; supplements exhibit a preference for surface scope in preference to inverse scope because this preference is in effect for their anchors. As a result, SU's treatment of supplements is more empirically adequate than AnderBois et al.'s (2015), who only allow "*one*-asides" like those in (3) to scope narrow, and therefore cannot account for narrow scoping supplements like those in (1), (4), or (5).

The central conceptual difference between SU's account of supplements and nearly all others is that SU treats supplements as just an extra bit of content attached to the restrictor of a generalized quantifier (GQ). By contrast, other accounts claim that a supplement is endowed with special properties that require it to project, forcing widest scope on its anchors in the process. For SU, projection does not arise because of some special property of supplements, but is rather due to the scope of their anchors, which are themselves influenced by independent mechanisms such as anaphora resolution, the preference for surface over inverse scope, and discourse binding.

A notable consequence of SU's approach is that projection and at-issueness are dissociated, so that whether or not a supplement projects is independent of whether it can be directly denied or address the QUD. Instead of prohibiting supplements from being denied, SU follows Koev (2012), AnderBois et al. (2010, 2015), and Schlenker (ms) in treating supplement deniability as being based on recency of mention, cf. (7)–(8). For SU, a supplement constitutes a separate discourse update, and more recent updates are more salient in the same way that more recent antecedents for anaphora are more salient, following Ginzburg (2012). Anaphoric links between supplements and other content, in SU's system, function in exactly the same way as all other instances of anaphora.

3 Analyzing supplements in a two-component categorial syntax

The syntax-semantics interface for supplements proposed below is based closely on SU's supplement semantics. It represents a very minor extension of the grammar formalism presented by Martin and Pollard (2014) because, like SU's semantic account, the only machinery specific to supplements is the lexical entries for the comma intonation, the distinct pattern of intonational pauses that surrounds a supplement in spoken English. Everything else is handled by independently motivated aspects of the grammar, which models anaphora resolution in a dynamic setting, and models quantifier scope by treating all noun phrases as GQs (Barwise and Cooper, 1981; Keenan and Stavi, 1986). Supplement syntax is treated in a parallel way to SU's semantics, with a model of the comma intonation that piggybacks a supplement's syntactic material onto its anchor. Before delving into the analysis, I first give an introduction to Martin and Pollard's two-component grammar.

3.1 Dynamic Categorial Grammar

The formalism developed by Martin and Pollard (2012a,b), Martin (2013), and Martin and Pollard (2014), called *Dynamic Categorial Grammar*, follows the tradition in categorial grammar of dividing the syntactic labor between multiple components (Oehrle, 1994; de Groote, 2001; Muskens, 2007; Mihaliček, 2012; Worth, 2014). In this syntax, one component (*tectogrammar*) handles the combinatorics, and a separate one (*phenogrammar*) handles surface form. This grammar formalism derives *signs*, triples of the form

$$\varphi \,;\, \tau \,;\, \sigma \,,$$

where φ is the phenogrammatical component, τ the tectogrammar, and σ the semantics.

The tectogrammar models syntactic combinatorics in a very streamlined version of linear propositional logic with basic types like NP, N, S, and D representing the atomic syntactic categories of noun phrases, common nouns, sentences, and discourses, respectively. More complex tecto types are formed by the binary linear implication connective $\multimap$. The phenogrammar's surface forms are derived by a simple type theory with a single nonlogical type, s, of *strings*, and an associative binary concatenation operator $\cdot : \mathrm{s} \to \mathrm{s} \to \mathrm{s}$ with a two-sided identity $\mathbf{e}$ (the *empty string*).

The semantics is a compositional, dynamic theory in the tradition of Muskens (1996), Beaver (2001), and de Groote (2006). It is implemented in dependent type theory with certain types parameterized by the natural number type. Its basic types include e (*entities*), p (*propositions*), and n (*natural numbers*). Discourse contexts are modeled via the type $\mathrm{c}_n =_{\mathrm{def}} \mathrm{e}^n \to \mathrm{p}$, functions from n-ary entity vectors to propositions, and the meanings of declarative utterances are modeled by the type $\mathrm{k}_n =_{\mathrm{def}} \Pi_{c:\mathrm{c}_m}.\mathrm{c}_{m+n}$ of *contents*, functions from contexts to contexts that introduce n discourse referents, modeled by the natural numbers. Contents are promoted to *updates*, also of type $\Pi_{c:\mathrm{c}_m}.\mathrm{c}_{m+n}$, by the *context change* function cc. The type $\mathrm{d}_m =_{\mathrm{def}} \Pi_{n:\mathrm{n}}\Pi_{c:\mathrm{c}_{>n}}.\mathrm{c}_{|c|+m}$ models dynamic properties, where $|c|$ is the arity of c, the length of its input vector. This type is essentially the type of functions from a natural number n (i.e., discourse referent) to a content introducing m discourse referents, with the requirement that the resulting content's input context have a slot for n (via the type $\mathrm{c}_{>n}$). SU gives much more detail about the dynamic semantic component.

Figure 1 gives a natural deduction presentation of the rules of the grammar. In all of these rules, both the types for the phenogrammatical terms and the types for the semantic terms are omitted for clarity. However, with some knowledge of the types of variables

$$\vdash a\,;B\,;c \quad \text{(Lexical Entry)}$$

$$x\,;A\,;y \vdash x\,;A\,;y \quad \text{(Trace)}$$

$$\frac{\Gamma, x\,;A\,;y \vdash a\,;B\,;c}{\Gamma \vdash (\lambda_x a)\,;A \multimap B\,;(\lambda_y c)} \text{(Hypothetical Proof)}$$

$$\frac{\Gamma \vdash f\,;B \multimap C\,;g \qquad \Delta \vdash a\,;B\,;c}{\Gamma, \Delta \vdash (f\,a)\,;C\,;(g\,c)} \text{(Modus Ponens)}$$

$$\vdash \mathbf{e}\,;\mathrm{D}\,;\lambda_{c:\mathrm{c}}.c \quad \text{(Empty Discourse)}$$

$$\frac{\vdash a\,;\mathrm{D}\,;u \qquad \vdash b\,;\mathrm{S}\,;k}{\vdash a \cdot b\,;\mathrm{D}\,;u \circ (\mathsf{cc}\,k)} \text{(Continue)}$$

Figure 1: A natural deduction formulation of the rules of Dynamic Categorial Grammar. The symbols a, b, c, f, and g are metavariables over terms, x and y are metavariables over type-theoretic variables, Γ and Δ range over variable contexts, A, B, C, range over tecto types, u over updates, and k over contents.

and constants, the relevant types for terms in applications of the grammar rules can be inferred. The lexicon is comprised of a set of instantiations of the *Lexical Entry* rule. *Trace* is used to introduce placeholders for long-distance dependencies that can later be bound via *Hypothetical Proof*. Local dependencies are modeled by the *Modus Ponens* rule. The final two rules handle the initiation and continuation of discourses, but I do not discuss them in detail here since they are not central to the analysis of supplements.

To illustrate, the lexicon required to model the simple example

(10) Some cyclist won the Tour de France

is given below.

(11) $\vdash \lambda_{sf}.f\,(\mathrm{some} \cdot s)\,;\mathrm{N} \multimap \mathrm{QP}\,;\textsc{a}$

(12) $\vdash \mathrm{cyclist}\,;\mathrm{N}\,;\textsc{cyclist}$

(13) $\vdash \lambda_s.s \cdot \mathrm{won} \cdot \mathrm{the} \cdot \mathrm{tour} \cdot \mathrm{de} \cdot \mathrm{france}\,;\mathrm{NP} \multimap \mathrm{S}\,;\textsc{win-tdf}$

Here, the dynamic indefinite determiner $\textsc{a} : \mathrm{d}_1 \to \mathrm{k}$ and dynamic properties $\textsc{cyclist} : \mathrm{d}_1$ and $\textsc{win-tdf} : \mathrm{d}_1$ are defined as in SU, the VP *won the Tour de France* is defined syncategorematically for simplicity, and QP abbreviates $(\mathrm{NP} \multimap \mathrm{S}) \multimap \mathrm{S}$. The analysis of (10) starts with the lexical entries in (11)–(13) and invokes the Modus Ponens rule twice, as follows. First, *some* takes *cyclist* as its argument:

(14)
$$\frac{(11) \qquad\qquad (12)}{\vdash \lambda_f.f\,(\mathrm{some} \cdot \mathrm{cyclist})\,;\mathrm{QP}\,;\textsc{a cyclist}}$$

And next, the QP *some cyclist* takes the verb phrase as its argument.

(15)
$$\frac{(14) \qquad\qquad (13)}{\vdash \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathrm{won} \cdot \mathrm{the} \cdot \mathrm{tour} \cdot \mathrm{de} \cdot \mathrm{france}\,;\mathrm{S}\,;\textsc{a cyclist win-tdf}}$$

The proofs above observe some conventions that are maintained throughout this paper: rule labels have been omitted, extra parentheses have been elided when their absence

cannot trigger ambiguity, and β-reduction has been performed where possible, with the β-normal form substituted for the corresponding redex. I also adopt many of SU's and Martin and Pollard's (2014) notational conventions, for example, if $M : (A \to B) \to C$ and $\lambda_x.N : A \to B$, I write $M_x.N$ to abbreviate $(M\, \lambda_x.N)$.

3.2 Basic supplement syntax

In SU's semantics, supplement scope is handled by the independent mechanism of hypothetical proof, and anaphoric links between supplements and other content are also taken care of by built-in machinery. Since, in SU's account, supplements have no special property requiring their content to project, they are modeled via a lexical entry defining $\textsc{comma} : (\mathrm{d}_1 \to \mathrm{k}) \to \mathrm{d}_1 \to \mathrm{d}_1 \to \mathrm{k}$, the meaning of the comma intonation, as

$$\textsc{comma} =_{\mathrm{def}} \lambda_{QDE}.(Q\, D)\ \textsc{and}\ (\textsc{the}\, D\, E)\ . \tag{16}$$

As encoded in (16), the comma intonation's meaning triggers a type of QP modification. Its semantics takes a dynamic GQ Q, of type $\mathrm{d}_1 \to \mathrm{k}$, and two dynamic properties D and E, applying Q to D as its scope, and conjoining the result $(Q\, D)$ with the result of applying E to the uniquely most salient referent entailed to have the property D, obtained by the anaphoric determiner THE.

Giving a syntax-semantics interface for supplements only requires extending (16) with tecto and pheno terms, as follows:

$$\vdash \lambda_{fsg}.g\,(f\,\lambda_t.t \cdot (\mathsf{comma}\, s))\ ;\ \mathrm{QP} \multimap \mathrm{Pred} \multimap \mathrm{QP}\ ;\ \textsc{comma} \tag{17}$$

Here, Pred is the type of predicativized GQs, and the pheno term $\mathsf{comma} : \mathrm{s} \to \mathrm{s}$, left unanalyzed here, represents the phenogrammatical contribution of the comma intonation.

To demonstrate how the lexical entry in (17) works, consider how it models the following example, an extension of (10).

(18) Some cyclist, a doper, won the Tour de France. (Martin, in press, (1))

As a preliminary, the lexical entry for SU's *predicativizer* $\textsc{pred} =_{\mathrm{def}} \lambda_{Qn}.Q_m.m\ \textsc{equals}\ n$ is defined as

$$\vdash \lambda_f.f\,\lambda_s.s\ ;\ \mathrm{QP} \multimap \mathrm{Pred}\ ;\ \textsc{pred}\ . \tag{19}$$

This lexical entry takes a QP to a predicative, in keeping with its semantics PRED, which transforms an GQ into a dynamic property. The QP's pheno term is simply fed the identity function, reducing it to a string. Adding the lexical entries corresponding to *a* and *doper* allows an analysis of the supplement in (18).

$$\vdash \lambda_{sf}.f\,(\mathrm{a} \cdot s)\ ;\ \mathrm{N} \multimap \mathrm{QP}\ ;\ \textsc{a} \tag{20}$$

$$\vdash \mathrm{doper}\ ;\ \mathrm{N}\ ;\ \textsc{doper} \tag{21}$$

The lexical entry for *a* in (20) is identical to the one in (11) except that the string a replaces some. The dynamic property DOPER is as defined in SU. The analysis of (18) starts by deriving the supplement. First, the GQ *a doper* is converted to a predicative in a straightforward way based on lexical entries (19)–(21). The GQ is derived as follows:

$$\frac{(20) \qquad\qquad (21)}{\vdash \lambda_f.f\,(\mathrm{a} \cdot \mathrm{doper})\ ;\ \mathrm{QP}\ ;\ \textsc{a doper}} \tag{22}$$

And next, the predicativizer takes the derived GQ as its argument.

(23)
$$\frac{(19) \qquad\qquad (22)}{\vdash \mathrm{a} \cdot \mathrm{doper} \,;\, \mathrm{Pred} \,;\, \textsc{pred a doper}}$$

The comma intonation then combines the QP *some cyclist*, derived above in (14), with the sign representing *a doper*:

(24)
$$\frac{(17) \qquad\qquad (14)}{\vdash \lambda_{sg}.g\,(\mathrm{some} \cdot \mathrm{cyclist} \cdot (\mathsf{comma}\; s)) \,;\, \mathrm{Pred} \multimap \mathrm{QP} \,;\, \textsc{comma}\;(\textsc{a cyclist})}$$

Next, the supplement is integrated to form a new QP.

(25)
$$\frac{(24) \qquad\qquad (23)}{\vdash \lambda_{g}.g\,(\mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\,(\mathrm{a} \cdot \mathrm{doper})) \,;\, \mathrm{QP} \,;\, \textsc{comma}\;(\textsc{a cyclist})\;(\textsc{pred a doper})}$$

Finally, the verb phrase *won the Tour de France* is taken by the derived QP as its argument.

(26)
$$\frac{(25) \qquad\qquad (13)}{\begin{array}{c}\vdash \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\,(\mathrm{a} \cdot \mathrm{doper}) \cdot \mathrm{won} \cdot \mathrm{the} \cdot \mathrm{tour} \cdot \mathrm{de} \cdot \mathrm{france} \,;\, \mathrm{S} \,; \\ \textsc{comma}\;(\textsc{a cyclist})\;(\textsc{pred a doper})\;\textsc{win-tdf}\end{array}}$$

The sign derived in (26) contains the correct syntactic analysis of (18), with tecto type S of sentences, and the intonational pauses that typically surround the supplement in spoken English demarcated by comma.

By (16), the meaning assigned to (18) reduces as follows.

$$\begin{array}{l}\textsc{comma}\;(\textsc{a cyclist})\;(\textsc{pred a doper})\;\textsc{win-tdf} \\ = (\textsc{a cyclist}\;(\textsc{pred a doper}))\;\textsc{and}\;(\textsc{the}\;(\textsc{pred a doper})\;\textsc{win-tdf})\end{array}$$

For any two contents h and k, SU's theorem A.2 establishes that the conjoined update $\mathsf{cc}\,(h\;\textsc{and}\;k)$ is equivalent to the parataxis of the component updates $(\mathsf{cc}\,h) \circ (\mathsf{cc}\,k)$. By this equivalence, we have

$$\begin{array}{l}\mathsf{cc}\,(\textsc{a cyclist}\;(\textsc{pred a doper}))\;\textsc{and}\;(\textsc{the}\;(\textsc{pred a doper})\;\textsc{win-tdf}) \\ = (\mathsf{cc}\,(\textsc{a cyclist}\;(\textsc{pred a doper}))) \circ (\mathsf{cc}\,(\textsc{the}\;(\textsc{pred a doper})\;\textsc{win-tdf}))\end{array}$$

for the meaning derived in (26). This equivalence is important because it shows how the comma intonation's meaning, for (18), separates out the contribution of the supplement and the main-clause content into different updates. This separation is how the account captures projection, as is made more evident in the examples with operators in §3.3, below.

3.2.1 Quantified supplements

Supplements anchored by GQs whose determiner is a true quantifier are known to be problematic, as in the following variant of (18) in

(27) # Every cyclist, a doper, won the Tour de France.

The lexical entry for *Every* straightforwardly parallels the one for the indefinite determiner in (20), with EVERY as defined in SU:

(28)
$$\vdash \lambda_{sf}.f\,(\mathrm{every} \cdot s) \,;\, \mathrm{N} \multimap \mathrm{QP} \,;\, \textsc{every}$$

Splicing this lexical entry into the proof in (22) in place of (20) gives the following sign:

$$\vdash \text{every} \cdot \text{cyclist} \cdot \mathsf{comma}\,(\text{a} \cdot \text{doper}) \cdot \text{won} \cdot \text{the} \cdot \text{tour} \cdot \text{de} \cdot \text{france}\,;\,\text{S}\,;$$
$$\textsc{comma}\,(\textsc{every cyclist})\,(\textsc{pred a doper})\,\textsc{win-tdf}$$

But the semantics of this sign is infelicitous, because it reduces to

$$(\textsc{every cyclist}\,(\textsc{pred a doper}))\ \textsc{and}\ (\textsc{the}\,(\textsc{pred a doper})\,\textsc{win-tdf})\,.$$

Since the discourse referent introduced for the doping cyclist gets trapped in the scope of *Every*, it cannot be accessed by the anaphoric GQ $\textsc{the}\,(\textsc{pred a doper})$. As for how the account generates (5c), it is treated in SU as an instance of telescoping (Roberts, 1989, 2005), where a discourse referent in the scope of a quantifier can be interpreted outside its scope in certain tightly constrained cases.

3.2.2 Other supplement types

This account can deal with other types of supplements besides the nominal appositive in (18). In fact, extending it to nonrestrictive relative clauses (NRRCs) and *as*-parentheticals (APs) is fairly trivial. When they take a predicative as their argument, both of these supplement types can be seen as prefixing a nominal appositive, as illustrated in

(29) Lance, $\left\{ \begin{array}{l} \text{as} \\ \text{who is} \end{array} \right\}$ a doper, got sanctioned by the UCI.

For the case of APs, the necessary extension is the following lexical entry, which closely resembles the predicativizer (19), with the exception that the word *as* is prefixed.

(30) $$\vdash \lambda_f.\text{as} \cdot (f\ \lambda_s.s)\,;\,\text{QP} \multimap \text{Pred}\,;\,\textsc{pred}$$

For NRRCs like the relevant variant of (29), two lexical entries are needed, one for *who* and one for *is* (or the relevant morphological variant of the copula).

(31) $$\vdash \lambda_f.\text{is} \cdot (f\ \lambda_s.s)\,;\,\text{QP} \multimap \text{Be}_{\text{pred}}\,;\,\textsc{pred}$$

(32) $$\vdash \lambda_s.\text{who} \cdot s\,;\,\text{Be}_{\text{pred}} \multimap \text{Pred}\,;\,\lambda_D.D$$

The lexical entry (31) is very similar to the one for *as* (30): it simply prefixes *is* to the pheno of its QP argument. The other difference is that the resulting tecto type is Be_{pred}, the type of copular predicatives.

Taken together, these lexical entries allow a model of both variants of (29). For the *as* variant, lexical entry (30) is simply applied to the QP *a doper*:

(33)
$$\frac{(30) \qquad\qquad (22)}{\vdash \text{as} \cdot \text{a} \cdot \text{doper}\,;\,\text{Pred}\,;\,(\textsc{pred a doper})}$$

The NRRC variant with *who is* requires one extra proof step, but is also straightforward.

(34)
$$\frac{(32) \qquad \dfrac{(31) \qquad\qquad (22)}{\vdash \text{is} \cdot \text{a} \cdot \text{doper}\,;\,\text{Be}_{\text{pred}}\,;\,(\textsc{pred a doper})}}{\vdash \text{who} \cdot \text{is} \cdot \text{a} \cdot \text{doper}\,;\,\text{Pred}\,;\,(\textsc{pred a doper})}$$

Either of the supplements derived in (33) and (34) could be passed to the comma intonation as its predicative argument.

The motivation for the structure of the lexical entries (30)–(31) is to ensure they not only generate the proper surface form and semantics, but that they also interact in ways that do not generate unobserved surface forms. The lexical entry for *as* in (30) rules out the following:

* as who is a doper

* as as as a doper

The reason is that *as* cannot take a NRRC as its argument due to a tecto type mismatch, and similarly, it cannot take another *as*-parenthetical. Only QP arguments are allowed for *as* by (30). The lexical entries pertaining to NRRCs in (31) and (32) together rule out these unobserved supplements:

* who is as a doper

* who as a doper

* who a doper

* who who who is a doper

As in the case of *as*-parentheticals, the grammar makes these predictions because of type mismatches: *is* can only take QP arguments, and *who* can only take arguments of type Be_{pred}.

A NRRC can also be formed from a nonpredicative complement, as in (1a), (2), and (4)–(9). The lexical entries for the on-restrictive relativizers *who* and *which* are straightforward.

(35) $\vdash \lambda_f.\text{who} \cdot (f\ \mathbf{e})\ ;\ (\text{NP} \multimap \text{S}) \multimap \text{Pred}\ ;\ \textsc{pred}$

(36) $\vdash \lambda_f.\text{which} \cdot (f\ \mathbf{e})\ ;\ (\text{NP} \multimap \text{S}) \multimap \text{Pred}\ ;\ \textsc{pred}$

As these lexical entries show, the nonrestrictive relativizers both take a property to a predicative, and their semantic effect is the same as the predicativizer (19). For example, the NRRC in *Lance, who won the Tour de France, is from Texas* is derived as follows:

(37)
$$\frac{(35) \qquad\qquad (13)}{\vdash \text{who} \cdot \mathbf{e} \cdot \text{won} \cdot \text{the} \cdot \text{tour} \cdot \text{de} \cdot \text{france}\ ;\ \text{Pred}\ ;\ (\textsc{pred}\ \textsc{win-tdf})}$$

A further demonstration of nonrestrictive relativizers is given in §3.5.

As an aside, I briefly note a nonviable alternative to the treatment of the comma intonation given here pointed out by Yusuke Kubota (personal communication). Note that it would be possible to give an alternative lexical entry for the comma intonation in which the supplement attached only to the QP's restrictor property, not to the entire QP itself. However, such a lexical entry would not be empirically adequate on the basis of examples with conjoined anchors like

(38) That man and woman, who have been married for years, seem like a happy couple.

Applying the property signaled by the supplement *who have been married for years* only to *woman* would give truth conditions that are out of line with intuitions about the meaning of (38). This account also accords with Nouwen's (2014) observation that the scope of an appositive is always at least as wide as that of its anchor. For example, (39) cannot mean that there is some professor such that if that professor is famous and publishes a book, he will make a lot of money.

(39) If a professor, a famous one, publishes a book, he will make a lot of money. (Nouwen, 2014, (29))

That is, a successful account of (39) must not allow the supplement *a famous one* to scope narrow relative to the conditional while *a professor* scopes wider than it. This proposal avoids both of these issues by modeling supplements as attaching to QPs, rather than just to their restrictor property.

3.3 Supplement projection and nonprojection

To see how the account functions for a projecting supplement, consider the variation of (18) in

(40) It's not true that Lance, a doper, won the Tour de France.

Examples like these show a supplement inside a negated main clause that nevertheless projects: (40) implies that Lance is a doper even though the information that he won the Tour is negated.

Analyzing this example requires some additional lexical entries for the proper name *Lance* and for sentential negation.

(41) $\vdash \lambda_f.f\,\text{lance}\,;\,\text{QP}\,;\,\textsc{lance}$

(42) $\vdash \lambda_s.\text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot s\,;\,\text{S}\multimap\text{S}\,;\,\textsc{not}$

Here, *Lance* receives a GQ treatment, with the tecto type QP of quantifier phrases, and semantics $\textsc{lance} =_{\text{def}} \textsc{the named-lance}$, which passes to its scope the unique antecedent entailed to have the name "Lance". The sentential negation is defined syncategorematically for simplicity; its semantics NOT is SU's dynamic negation, which both negates its argument's content and traps any discourse referents introduced in its scope, rendering them inaccessible to subsequent anaphora.

The derivation of the sign corresponding to (40) first generates the QP *Lance, a doper* by combining lexical entry (41) with the proof of the supplement *a doper* in (23):

(43)
$$\dfrac{\dfrac{(17) \qquad (41)}{\vdash \lambda_{sg}.g\,(\text{lance}\cdot(\mathsf{comma}\,s))\,;\,\text{Pred}\multimap\text{QP}\,;\,\textsc{comma lance}} \qquad (23)}{\vdash \lambda_g.g\,(\text{lance}\cdot\mathsf{comma}\,(\text{a}\cdot\text{doper}))\,;\,\text{QP}\,;\,\textsc{comma lance}\,(\textsc{pred a doper})}$$

But in order to get the observed projective reading for (40), this QP must outscope the negation. So rather than immediately combine the sign in (43) with the verb phrase, we first derive the a version of the entire utterance with a slot for a missing QP.

To accomplish this, we first pass a placeholder argument to the verb phrase using Trace.

(44)
$$\dfrac{(13) \qquad\qquad s\,;\,\text{NP}\,;\,n\vdash s\,;\,\text{NP}\,;\,n}{s\,;\,\text{NP}\,;\,n\vdash s\cdot\text{won}\cdot\text{the}\cdot\text{tour}\cdot\text{de}\cdot\text{france}\,;\,\text{S}\,;\,\textsc{win-tdf}\,n}$$

Next, the sentential negation takes the sign derived in (44) as its argument, and then the trace is withdrawn via Hypothetical Proof (here, won abbreviates the full verb phrase pheno won · the · tour · de · france).

(45)
$$\dfrac{\dfrac{(42) \qquad\qquad (44)}{s\,;\,\text{NP}\,;\,n\vdash\text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot s\cdot\text{won}\,;\,\text{S}\,;\,\textsc{not}\,(\textsc{win-tdf}\,n)}}{\vdash\lambda_s.\text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot s\cdot\text{won}\,;\,\text{NP}\multimap\text{S}\,;\,\lambda_n.\textsc{not}\,(\textsc{win-tdf}\,n)}$$

Finally, the QP *Lance, a doper* is applied to the sign in (45) to produce the full sign representing (40).

(46)
$$\dfrac{(43) \qquad\qquad (45)}{\begin{array}{l}\vdash\text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot\text{lance}\cdot\mathsf{comma}\,(\text{a}\cdot\text{doper})\cdot\text{won}\cdot\text{the}\cdot\text{tour}\cdot\text{de}\cdot\text{france}\,;\,\text{S}\,;\\ \quad(\textsc{comma lance}\,(\textsc{pred a doper}))_n.\textsc{not}\,(\textsc{win-tdf}\,n)\end{array}}$$

Expanding the semantics derived in (46) shows how the supplement escapes negation:

$$\begin{aligned}&\textsc{comma lance}\,(\textsc{pred a doper})\,\lambda_n.\textsc{not}\,(\textsc{win-tdf}\,n)\\&=(\textsc{lance}\,(\textsc{pred a doper}))\,\textsc{and}\,(\textsc{the}\,(\textsc{pred a doper})\,\lambda_n.\textsc{not}\,(\textsc{win-tdf}\,n))\end{aligned}$$

Because of the way the comma intonation is defined, only Lance's winning is in the scope of negation, but his being a doper survives unscathed, that is, it projects. As an explanation for why the projective scoping is preferred to the one with negation wide, in which both the supplement and the main clause content are effected by negation, SU appeals to the preference for definites such as proper names to scope as closely as possible to their antecedent's site. This means that the projective reading of (40) is preferred because *Lance*'s antecedent, the unique discourse referent entailed to be named "Lance", does not occur in the utterance itself.

Things are different when the supplement is anchored by an indefinite, which can scope narrow relative to operators, as illustrated in (3). In the case of the variant of (18) in

(47) It is not true that some cyclist, a doper, won the Tour de France,

the narrow-scope reading is the one that might arise by default in situations where the Tour had for some reason been canceled. To generate this reading, sentential negation is simply applied to the sign derived for (18) in (26), as follows.

(48)
$$\frac{(42)\qquad\qquad(26)}{\begin{array}{l}\vdash \text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot\text{some}\cdot\text{cyclist}\cdot\mathsf{comma}\,(\text{a}\cdot\text{doper})\cdot\text{won}\,;\,\text{S}\,;\\\quad\textsc{not}\,(\textsc{comma}\,(\textsc{a cyclist})\,(\textsc{pred a doper})\,\textsc{win-tdf})\end{array}}$$

(Here again, won abbreviates the full verb phrase in (47).) In this narrow-scope reading, both the supplement and the main clause are negated, so this meaning is equivalent to *It's not true that some doping cyclist won the Tour.* Of course, the wide-scope, projective reading is available for this case, too:

(49)
$$\frac{(25)\qquad\qquad(45)}{\begin{array}{l}\vdash \text{it}\cdot\text{is}\cdot\text{not}\cdot\text{true}\cdot\text{that}\cdot\text{some}\cdot\text{cyclist}\cdot\mathsf{comma}\,(\text{a}\cdot\text{doper})\cdot\text{won}\,;\,\text{S}\,;\\\quad(\textsc{comma}\,(\textsc{a cyclist})\,(\textsc{pred a doper}))_n.\textsc{not}\,(\textsc{win-tdf}\,n)\end{array}}$$

Similar to (46), above, this reading is equivalent to *Some cyclist is a doper, and this cyclist didn't win the Tour.* Due to this flexibility with respect to supplement scope, this account can capture the full range of readings available for (3)–(5), in contrast with other accounts, which rule out narrow-scope readings for supplements.

3.4 Utterance-final supplements

This syntax derives signs with supplements both in utterance-medial and utterance-final position. To generate a sign for (50a), the only required extension to the grammar is a lexical entry for the verb *met.*

(50) a. Some cyclist, a doper, met Lance.

b. Some cyclist met Lance, a doper.

The required lexical entry is

(51) $$\vdash \lambda_{st}.t\cdot\text{met}\cdot s\,;\,\text{NP}\multimap\text{NP}\multimap\text{S}\,;\,\textsc{met}\,,$$

where MET : d_2 is the binary dynamic property corresponding to the verb *met*.

Deriving (50a) starts by providing the verb with its subject, after first generating a trace for the object argument.

$$(52)\quad \dfrac{(25)\ \dfrac{(51)\ \overline{s\,;\,\mathrm{NP}\,;\,m \vdash s\,;\,\mathrm{NP}\,;\,m}}{s\,;\,\mathrm{NP}\,;\,m \vdash \lambda_t.t \cdot \mathrm{met} \cdot s\,;\,\mathrm{NP} \multimap \mathrm{S}\,;\,\textsc{met}\,m}}{\begin{array}{c}s\,;\,\mathrm{NP}\,;\,m \vdash \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\,(\mathrm{a} \cdot \mathrm{doper}) \cdot \mathrm{met} \cdot s\,;\,\mathrm{S}\,; \\ \textsc{comma}\,(\textsc{a cyclist})\,(\textsc{pred a doper})\,(\textsc{met}\,m)\end{array}}$$

Next, the trace is withdrawn, and the object takes scope:

$$(53)\quad \dfrac{(41)\ \dfrac{(52)}{\begin{array}{c}\vdash \lambda_s.\mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\,(\mathrm{a} \cdot \mathrm{doper}) \cdot \mathrm{met} \cdot s\,;\,\mathrm{NP} \multimap \mathrm{S}\,; \\ \lambda_m.\textsc{comma}\,(\textsc{a cyclist})\,(\textsc{pred a doper})\,(\textsc{met}\,m)\end{array}}}{\begin{array}{c}\vdash \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\,(\mathrm{a} \cdot \mathrm{doper}) \cdot \mathrm{met} \cdot \mathrm{lance}\,;\,\mathrm{S}\,; \\ \textsc{lance}_m.(\textsc{comma}\,(\textsc{a cyclist})\,(\textsc{pred a doper})\,(\textsc{met}\,m))\end{array}}$$

Note that in this derived meaning of (50a), the supplement's content is separated off from the main clause content by the comma intonation in the same way as for (18).

To model the utterance-final supplement in (50b), some work remains to be done in order for the syntax to line up with SU's account of supplement deniability. In SU, a supplement's deniability is influenced by its recency in terms of the temporal sequence of updates comprising the discourse. So for (50b), just as for (7) and (8), the supplement *a doper* can be more easily denied because it comes *after* the main clause content. However, the lexical entry for the comma intonation in (17) expects the verb phrase's contribution to come last, so the supplement would precede another update.

Giving a lexical entry for supplements in utterance-final position is as straightforward as changing the order of the arguments. The variant entry required to model (50b) is

$$(54)\qquad \vdash \lambda_{fgs}.g\,(f\,\lambda_t.t \cdot (\mathsf{comma}\,s))\,;\,\mathrm{QP} \multimap (\mathrm{NP} \multimap \mathrm{S}) \multimap \mathrm{Pred} \multimap \mathrm{S}\,;\,\textsc{comma}\ .$$

The difference between (54) and (17) is simply that the verb phrase argument is taken before the supplement argument. The semantics remains the same; only the surface order of the supplement in relation to the verb phrase is changed, which has the effect of making the supplement's update come after the verb phrase's.

To see how this variant lexical entry differs from (17) in practice, consider the model of (50b) it produces. Since the proper name *Lance* takes widest scope, the proof starts by providing *Lance* to the comma intonation.

$$(55)\quad \dfrac{(54) \qquad (41)}{\vdash \lambda_{gs}.g\,(\mathrm{lance} \cdot (\mathsf{comma}\,s))\,;\,(\mathrm{NP} \multimap \mathrm{S}) \multimap \mathrm{Pred} \multimap \mathrm{S}\,;\,\textsc{comma lance}}$$

Next, the verb phrase is derived with a hypothesized slot for its object.

$$(56)\quad \dfrac{(14)\ \dfrac{(51)\ \overline{s\,;\,\mathrm{NP}\,;\,m \vdash s\,;\,\mathrm{NP}\,;\,m}}{s\,;\,\mathrm{NP}\,;\,m \vdash \lambda_t.t \cdot \mathrm{met} \cdot s\,;\,\mathrm{NP} \multimap \mathrm{S}\,;\,\textsc{met}\,m}}{s\,;\,\mathrm{NP}\,;\,m \vdash \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathrm{met} \cdot s\,;\,\mathrm{S}\,;\,(\textsc{a cyclist})_n.\textsc{met}\,m\,n}}{\vdash \lambda_s.\mathrm{some} \cdot \mathrm{cyclist} \cdot \mathrm{met} \cdot s\,;\,\mathrm{NP} \multimap \mathrm{S}\,;\,\lambda_m.(\textsc{a cyclist})_n.\textsc{met}\,m\,n}$$

Then the sign derived in (55) takes the derived verb phrase as its argument.

$$(57)\quad \dfrac{(55) \qquad (56)}{\begin{array}{c}\vdash \lambda_s.\mathrm{some} \cdot \mathrm{cyclist} \cdot \mathrm{met} \cdot \mathrm{lance} \cdot (\mathsf{comma}\,s)\,;\,\mathrm{Pred} \multimap \mathrm{S}\,; \\ \textsc{comma lance}_m.(\textsc{a cyclist})_n.\textsc{met}\,m\,n\end{array}}$$

Finally, the supplement provides the last argument for the comma intonation.

$$\frac{\text{(57)} \qquad\qquad \text{(23)}}{\begin{array}{l}\vdash \text{some} \cdot \text{cyclist} \cdot \text{met} \cdot \text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{doper})\,;\,\text{S}\,; \\ \quad \textsc{comma}\,(\textsc{lance}_m.(\textsc{a cyclist})_n.\textsc{met}\,m\,n)\,(\textsc{pred a doper})\end{array}} \tag{58}$$

Expanding the semantics of this final sign representing (50b) illustrates how the supplement is more deniable than its counterpart in (50a)

$$\begin{array}{l}\textsc{comma}\,(\textsc{lance}_m.(\textsc{a cyclist})_n.\textsc{met}\,m\,n)\,(\textsc{pred a doper}) \\ = (\textsc{lance}_m.(\textsc{a cyclist})_n.\textsc{met}\,m\,n)\ \textsc{and} \\ \quad \textsc{the}\,(\lambda_m(\textsc{a cyclist})_n.\textsc{met}\,m\,n)\,(\textsc{pred a doper})\end{array}$$

This dynamic meaning is paraphrasable by *Lance was met by a cyclist, and the person who was met by the cyclist is a doper*. In SU's account, the supplement is the most recent discourse update, and is therefore easier to target via denial. I also propose that the presence of an utterance boundary disambiguates between the medial comma intonation in (17) and the final one in (54), but leave the implementation of the details beyond the scope of this paper.

3.5 Supplements and anaphora

In this account, anaphora between a supplement and other content is just a special case of anaphora more generally, which SU's dynamic semantics is designed to handle. A good demonstration is the example

(59) Melanie$_i$, who bought herself$_i$ a car$_j$, drives it$_j$. (Simplification of Martin in press, (52))

In (59), the anaphoric link labeled i consists of a pronoun inside a supplement with an antecedent outside, while the one labeled j has the antecedent within a supplement but the pronoun outside.

To model (59), the lexicon needs to be extended with entries for *Melanie*, the common noun *car*, the verbs *bought* and *drives*, and the pronouns *herself* and *it*. Pronouns, in this account, are treated as GQs, as are all noun phrases, and so giving lexical entries for both the pronouns and the name *Melanie* is straightforward.

$$\vdash \lambda_f.f\,\text{melanie}\,;\,\text{QP}\,;\,\textsc{melanie} \tag{60}$$

$$\vdash \lambda_f.f\,\text{herself}\,;\,\text{QP}\,;\,\textsc{herself} \tag{61}$$

$$\vdash \lambda_f.f\,\text{it}\,;\,\text{QP}\,;\,\textsc{it} \tag{62}$$

As do all proper names in this account, *Melanie* is anaphoric, following Beaver (2001) and Martin (2013, in press): $\textsc{melanie} =_{\text{def}} \textsc{the named-melanie}$ passes to its scope argument the unique discourse referent entailed to be named "Melanie", similarly to *Lance*, above. The pronouns *herself* and *it* receive the same treatment as in SU, selecting the unique discourse referent consistent with being female and nonhuman, respectively. I assume that some mechanism intervenes to enforce binding constraints for pronouns, but do not go into an explicit modeling of binding here.

The lexical entry for the common noun *car* closely resembles the one for *doper* in (21). In the lexical entry below, CAR is the dynamic property of being a car:

$$\vdash \text{car}\,;\,\text{N}\,;\,\textsc{car} \tag{63}$$

As for the verbs, the pheno must spell out the surface locations of the eventual arguments.

(64) $\vdash \lambda_{stu}.u \cdot \text{bought} \cdot t \cdot s \,;\, \text{NP} \multimap \text{NP} \multimap \text{NP} \multimap \text{S} \,;\, \textsc{buy}$

(65) $\vdash \lambda_{st}.t \cdot \text{drives} \cdot s \,;\, \text{NP} \multimap \text{NP} \multimap \text{S} \,;\, \textsc{drive}$

Here, BUY and DRIVE are respectfully the ternary and binary properties corresponding to buying and driving.

The derivation of a sign representing (59) starts by hypothesizing traces for the arguments to *bought*. Starting with the objects, we derive the following:

(66)
$$\dfrac{\dfrac{(64) \qquad s \,;\, \text{NP} \,;\, k \vdash s \,;\, \text{NP} \,;\, k}{s \,;\, \text{NP} \,;\, k \vdash \lambda_{tu}.u \cdot \text{bought} \cdot t \cdot s \,;\, \text{NP} \multimap \text{NP} \multimap \text{S} \,;\, \textsc{buy}\, k} \qquad t \,;\, \text{NP} \,;\, m \vdash t \,;\, \text{NP} \,;\, m}{s \,;\, \text{NP} \,;\, k, t \,;\, \text{NP} \,;\, m \vdash \lambda_u.u \cdot \text{bought} \cdot t \cdot s \,;\, \text{NP} \multimap \text{S} \,;\, \textsc{buy}\, k\, m}$$

Then a trace for the subject is provided and the object trace withdrawn.

(67)
$$\dfrac{\dfrac{(66) \qquad u \,;\, \text{NP} \,;\, n \vdash u \,;\, \text{NP} \,;\, n}{s \,;\, \text{NP} \,;\, k, t \,;\, \text{NP} \,;\, m, u \,;\, \text{NP} \,;\, n \vdash u \cdot \text{bought} \cdot t \cdot s \,;\, \text{S} \,;\, \textsc{buy}\, k\, m\, n}}{t \,;\, \text{NP} \,;\, m, u \,;\, \text{NP} \,;\, n \vdash \lambda_s.u \cdot \text{bought} \cdot t \cdot s \,;\, \text{NP} \multimap \text{S} \,;\, \lambda_k.\textsc{buy}\, k\, m\, n}$$

In preparation for integrating *a car* with *bought*, the GQ is derived.

(68)
$$\dfrac{(20) \qquad (63)}{\vdash \lambda_f.f\ (\text{a} \cdot \text{car}) \,;\, \text{QP} \,;\, \textsc{a car}}$$

Next *a car* takes scope, and the indirect object trace is withdrawn.

(69)
$$\dfrac{\dfrac{(68) \qquad (67)}{t \,;\, \text{NP} \,;\, m, u \,;\, \text{NP} \,;\, n \vdash u \cdot \text{bought} \cdot t \cdot \text{a} \cdot \text{car} \,;\, \text{S} \,;\, (\textsc{a car})_k.\textsc{buy}\, k\, m\, n}}{u \,;\, \text{NP} \,;\, n \vdash \lambda_t.u \cdot \text{bought} \cdot t \cdot \text{a} \cdot \text{car} \,;\, \text{NP} \multimap \text{S} \,;\, \lambda_m.(\textsc{a car})_k.\textsc{buy}\, k\, m\, n}$$

Then *herself* takes scope, and the subject trace is withdrawn.

(70)
$$\dfrac{\dfrac{(61) \qquad (69)}{u \,;\, \text{NP} \,;\, n \vdash u \cdot \text{bought} \cdot \text{herself} \cdot \text{a} \cdot \text{car} \,;\, \text{S} \,;\, \textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\, k\, m\, n}}{\vdash \lambda_u.u \cdot \text{bought} \cdot \text{herself} \cdot \text{a} \cdot \text{car} \,;\, \text{NP} \multimap \text{S} \,;\, \lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\, k\, m\, n}$$

And then the nonrestrictive relativizer *who* is applied to (70) to derive the NRRC in (59).

(71)
$$\dfrac{(35) \qquad (70)}{\vdash \text{who} \cdot \mathbf{e} \cdot \text{bought} \cdot \text{herself} \cdot \text{a} \cdot \text{car} \,;\, \text{Pred} \,;\, (\textsc{pred}\ \lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\, k\, m\, n)}$$

With the NRRC sign completed, we turn to deriving the verb phrase *drives it*. As for *bought herself a car*, the process starts by providing traces for the verb's arguments, then withdrawing the object trace.

(72)
$$\dfrac{\dfrac{\dfrac{(65) \qquad s \,;\, \text{NP} \,;\, k \vdash s \,;\, \text{NP} \,;\, k}{s \,;\, \text{NP} \,;\, k \vdash \lambda_t.t \cdot \text{drives} \cdot s \,;\, \text{NP} \multimap \text{S} \,;\, \textsc{drive}\, k} \qquad u \,;\, \text{NP} \,;\, n \vdash u \,;\, \text{NP} \,;\, n}{s \,;\, \text{NP} \,;\, k, u \,;\, \text{NP} \,;\, n \vdash u \cdot \text{drives} \cdot s \,;\, \text{S} \,;\, \textsc{drive}\, k\, n}}{u \,;\, \text{NP} \,;\, n \vdash \lambda_s.u \cdot \text{drives} \cdot s \,;\, \text{NP} \multimap \text{S} \,;\, \lambda_k.\textsc{drive}\, k\, n}$$

The next step is for the pronoun *it* to take scope, and then withdraw the subject trace.

(73)
$$\dfrac{\dfrac{(62) \qquad (72)}{u \,;\, \text{NP} \,;\, n \vdash u \cdot \text{drives} \cdot \text{it} \,;\, \text{S} \,;\, \textsc{it}_k.\textsc{drive}\, k\, n}}{\vdash \lambda_u.u \cdot \text{drives} \cdot \text{it} \,;\, \text{NP} \multimap \text{S} \,;\, \lambda_n.\textsc{it}_k.\textsc{drive}\, k\, n}$$

Now all the ingredients required by the comma intonation are in place, so we can start deriving a sign representing (59) in its entirety. Starting with *Melanie* and the supplement, we derive:

$$(74)\quad \dfrac{\dfrac{(17) \qquad\qquad (60)}{\vdash \lambda_{sg}.g\,(\text{melanie}\cdot(\mathsf{comma}\;s))\;;\;\text{Pred}\multimap\text{QP}\;;\;\textsc{comma melanie}}\qquad (71)}{\begin{array}{c}\vdash \lambda_g.g\,(\text{melanie}\cdot\mathsf{comma}\,(\text{who}\cdot\mathbf{e}\cdot\text{bought}\cdot\text{herself}\cdot\text{a}\cdot\text{car}))\;;\;\text{QP}\;;\\ \textsc{comma melanie}\,(\textsc{pred}\;\lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\;k\,m\,n)\end{array}}$$

Finally, the comma intonation takes the verb phrase derived in (73) as its last argument.

$$(75)\quad \dfrac{(74) \qquad\qquad (73)}{\begin{array}{c}\vdash \text{melanie}\cdot\mathsf{comma}\,(\text{who}\cdot\mathbf{e}\cdot\text{bought}\cdot\text{herself}\cdot\text{a}\cdot\text{car})\cdot\text{drives}\cdot\text{it}\;;\;\text{S}\;;\\ \textsc{comma melanie}\,(\textsc{pred}\;\lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\;k\,m\,n)\;\lambda_n.\textsc{it}_k.\textsc{drive}\;k\,n\end{array}}$$

The semantics of this sign shows how the anaphoric links are enabled: *herself* is interpreted in a context that has *Melanie* as an available antecedent, and similarly, the context passed to *it* contains *a car*. As for the surface form, with the empty string $\mathbf{e}$ axiomatized as an identity for inhabitants of the type of strings, the derived pheno term is equivalent to melanie $\cdot$ comma (who $\cdot$ bought $\cdot$ herself $\cdot$ a $\cdot$ car) $\cdot$ drives $\cdot$ it, as desired.

Since supplements are not special with respect to the incremental interpretation in this framework, anaphora between two supplements is also very straightforward. The following example gives a nice illustration:

(76) Melanie$_i$, who bought herself$_i$ a car$_j$, met some cyclist, its$_j$ former owner.

All of the elements required for deriving a sign representing (76) are already in place except those in the last supplement. The needed lexical extensions are given below.

$$(77)\quad \vdash \lambda_{sf}.f\,(\text{its}\cdot s)\;;\;\text{N}\multimap\text{QP}\;;\;\textsc{its}$$

$$(78)\quad \vdash \text{former}\cdot\text{owner}\;;\;\text{N}\;;\;\textsc{owner}$$

The entry in (62) corresponds to the possessive determiner *its*, and (78) syncategorematically defines *former owner* to avoid the complexities associated with *former*.

This proof starts by deriving a version of the verb *met* with a hypothesized object.

(79)

$$\dfrac{\dfrac{(51)\qquad\qquad s\;;\;\text{NP}\;;\;m\vdash s\;;\;\text{NP}\;;\;m}{s\;;\;\text{NP}\;;\;m\vdash\lambda_t.t\cdot\text{met}\cdot s\;;\;\text{NP}\multimap\text{S}\;;\;\textsc{met}\,m}\qquad t\;;\;\text{NP}\;;\;n\vdash t\;;\;\text{NP}\;;\;n}{\dfrac{s\;;\;\text{NP}\;;\;m,t\;;\;\text{NP}\;;\;n\vdash t\cdot\text{met}\cdot s\;;\;\text{S}\;;\;\textsc{met}\,m\,n}{t\;;\;\text{NP}\;;\;n\vdash\lambda_s.t\cdot\text{met}\cdot s\;;\;\text{NP}\multimap\text{S}\;;\;\lambda_m.\textsc{met}\,m\,n}}$$

Then the QP *its former owner* is derived and predicativized.

$$(80)\quad \dfrac{(19)\quad \dfrac{(77)\qquad\qquad (78)}{\vdash\lambda_f.f\,(\text{its}\cdot\text{former}\cdot\text{owner})\;;\;\text{QP}\;;\;\textsc{its owner}}}{\vdash\text{its}\cdot\text{former}\cdot\text{owner}\;;\;\text{Pred}\;;\;(\textsc{pred its owner})}$$

The utterance-final comma intonation then takes *some cyclist* as its argument.

(81)

$$\dfrac{(54)\qquad\qquad (14)}{\vdash\lambda_{gs}.g\,(\text{some}\cdot\text{cyclist}\cdot(\mathsf{comma}\;s))\;;\;(\text{NP}\multimap\text{S})\multimap\text{Pred}\multimap\text{S}\;;\;\textsc{comma}\,(\textsc{a cyclist})}$$

Next, the newly derived verb phrase and predicative are integrated, and then the subject trace is withdrawn.

$$\dfrac{\dfrac{(81) \qquad (79)}{\begin{array}{l} t\,;\mathrm{NP}\,;n \vdash \lambda_s.t \cdot \mathrm{met} \cdot \mathrm{some} \cdot \mathrm{cyclist} \cdot (\mathsf{comma}\; s)\,;\mathrm{Pred} \multimap \mathrm{S}\,; \\ \quad \textsc{comma}\;(\textsc{a cyclist})\;\lambda_m.\textsc{met}\;m\;n \end{array}}\ (80)}{\begin{array}{l} t\,;\mathrm{NP}\,;n \vdash t \cdot \mathrm{met} \cdot \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\;(\mathrm{its} \cdot \mathrm{former} \cdot \mathrm{owner})\,;\mathrm{S}\,; \\ \quad \textsc{comma}\;(\textsc{a cyclist})\;(\lambda_m(\textsc{met}\;m\;n))\;(\textsc{pred its owner}) \end{array}} \tag{82}$$

$$\vdash \lambda_t.t \cdot \mathrm{met} \cdot \mathrm{some} \cdot \mathrm{cyclist} \cdot \mathsf{comma}\;(\mathrm{its} \cdot \mathrm{former} \cdot \mathrm{owner})\,;\mathrm{NP} \multimap \mathrm{S}\,;$$
$$\lambda_n.\textsc{comma}\;(\textsc{a cyclist})\;(\lambda_m(\textsc{met}\;m\;n))\;(\textsc{pred its owner})$$

With the second, utterance-final supplement derived, the rest of the derivation proceeds by providing the utterance-medial comma intonation (17) with its arguments.

$$\dfrac{\dfrac{(17) \qquad (60)}{\vdash \lambda_{sg}.g\;(\mathrm{melanie} \cdot (\mathsf{comma}\; s))\,;\mathrm{Pred} \multimap \mathrm{QP}\,;\textsc{comma melanie}}\ (71)}{\begin{array}{l} \vdash \lambda_g.g\;(\mathrm{melanie} \cdot \mathsf{comma}\;(\mathrm{who} \cdot \mathbf{e} \cdot \mathrm{bought} \cdot \mathrm{herself} \cdot \mathrm{a} \cdot \mathrm{car}))\,;\mathrm{QP}\,; \\ \quad \textsc{comma melanie}\;(\textsc{pred}\;\lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\;k\;m\;n) \end{array}} \tag{83}$$

As its final argument, the matrix comma intonation takes the sign in (82).

$$\dfrac{(83) \qquad (82)}{\begin{array}{l} \vdash \mathrm{melanie} \cdot \mathsf{comma}\;(\mathrm{who} \cdot \mathbf{e} \cdot \mathrm{bought} \cdot \mathrm{herself} \cdot \mathrm{a} \cdot \mathrm{car}) \cdot \mathrm{met} \cdot \mathrm{some} \cdot \mathrm{cyclist} \cdot \\ \quad \mathsf{comma}\;(\mathrm{its} \cdot \mathrm{former} \cdot \mathrm{owner})\,;\mathrm{S}\,; \\ \quad \textsc{comma melanie}\;(\textsc{pred}\;\lambda_n.\textsc{herself}_m.(\textsc{a car})_k.\textsc{buy}\;k\;m\;n) \\ \quad \lambda_n.\textsc{comma}\;(\textsc{a cyclist})\;(\lambda_m(\textsc{met}\;m\;n))\;(\textsc{pred its owner}) \end{array}} \tag{84}$$

Since the underlying semantic framework gives an incremental, dynamic interpretation, not only is *Melanie* accessible as the antecedent to *herself*, as before, but also the car introduced is accessible from *its*. And so, in this account, anaphora among supplements and between supplements and other content is treated exactly as all other instances of anaphora are.

3.6 Stacking

This supplement syntax also extends to the phenomenon of supplement *stacking* (Potts, 2005, 100), in which multiple supplements are attached to the same anchor, such as

(85) Lance, a cyclist, a doper, won the Tour de France.

Since the comma intonation takes a QP and a predicativized QP to another QP, chaining together supplements is fairly straightforward. Starting with the first supplement, the QP *a cyclist* is first derived.

$$\dfrac{(19)\ \dfrac{(20) \qquad (12)}{\vdash \lambda_f.f\;(\mathrm{a} \cdot \mathrm{cyclist})\,;\mathrm{QP}\,;\textsc{a cyclist}}}{\vdash \mathrm{a} \cdot \mathrm{cyclist}\,;\mathrm{Pred}\,;\textsc{pred a cyclist}} \tag{86}$$

Applying the (medial) comma intonation to *Lance* and the first supplement yields a QP.

$$\dfrac{\dfrac{(17) \qquad (41)}{\vdash \lambda_{sg}.g\;(\mathrm{lance} \cdot (\mathsf{comma}\; s))\,;\mathrm{Pred} \multimap \mathrm{QP}\,;\textsc{comma lance}}\ (87)}{\vdash \lambda_g.g\;(\mathrm{lance} \cdot \mathsf{comma}\;(\mathrm{a} \cdot \mathrm{cyclist}))\,;\mathrm{QP}\,;\textsc{comma lance}\;(\textsc{pred a cyclist})} \tag{87}$$

A second instance of the comma intonation then takes this QP as its argument.

$$\frac{(17) \qquad (87)}{\begin{array}{c}\vdash \lambda_{sg}.g\,(\text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot (\mathsf{comma}\; s))\;;\, \text{Pred} \multimap \text{QP}\;; \\ \textsc{comma}\;(\textsc{comma lance}\;(\textsc{pred a cyclist}))\end{array}} \tag{88}$$

Then the second supplement is taken as the argument to this second comma intonation.

$$\frac{(88) \qquad (23)}{\begin{array}{c}\vdash \lambda_{g}.g\,(\text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot \mathsf{comma}\,(\text{a} \cdot \text{doper}))\;;\, \text{QP}\;; \\ \textsc{comma}\;(\textsc{comma lance}\;(\textsc{pred a cyclist}))\;(\textsc{pred a doper})\end{array}} \tag{89}$$

Lastly, this new QP incorporating both supplements is applied to the verb phrase.

(90)
$$\frac{(89) \qquad (13)}{\begin{array}{c}\vdash \text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot \mathsf{comma}\,(\text{a} \cdot \text{doper}) \cdot \text{won} \cdot \text{the} \cdot \text{tour} \cdot \text{de} \cdot \text{france}\;;\, \text{S}\;; \\ \textsc{comma}\;(\textsc{comma lance}\;(\textsc{pred a cyclist}))\;(\textsc{pred a doper})\;\textsc{win-tdf}\end{array}}$$

Expanding the semantics of this sign shows how the content of both supplements is integrated.

$$\begin{aligned}&\textsc{comma}\;(\textsc{comma lance}\;(\textsc{pred a cyclist}))\;(\textsc{pred a doper})\;\textsc{win-tdf} \\ &= (\textsc{comma lance}\;(\textsc{pred a cyclist})\;(\textsc{pred a doper}))\;\textsc{and} \\ &\quad (\textsc{the}\;(\textsc{pred a doper})\;\textsc{win-tdf}) \\ &= (\textsc{lance}\;(\textsc{pred a cyclist}))\;\textsc{and}\;(\textsc{the}\;(\textsc{pred a cyclist})\;(\textsc{pred a doper}))\;\textsc{and} \\ &\quad (\textsc{the}\;(\textsc{pred a doper})\;\textsc{win-tdf})\end{aligned}$$

In this semantics for (85), the derived meaning could be paraphrased by *Lance is a cyclist. The one who's a cyclist is also a doper. That doper won the Tour de France.*

For the case of utterance-final supplements like

(91) Some cyclist met Lance, a cyclist, a doper,

a model of stacking is more complicated because the tecto type of the utterance-final comma intonation is less amenable to composition. After the comma intonation is provided with its QP argument *Lance*, it takes a trace as its verb phrase argument.

$$\frac{(55) \qquad g\;;\, \text{NP} \multimap \text{S}\;;\, D \vdash g\;;\, \text{NP} \multimap \text{S}\;;\, D}{g\;;\, \text{NP} \multimap \text{S}\;;\, D \vdash \lambda_{s}.g\,(\text{lance} \cdot (\mathsf{comma}\; s))\;;\, \text{Pred} \multimap \text{S}\;;\, \textsc{comma lance}\; D} \tag{92}$$

The first supplement is then integrated, and then the trace is withdrawn to make way for the second comma intonation.

$$\frac{\dfrac{(92) \qquad (86)}{\begin{array}{c}g\;;\, \text{NP} \multimap \text{S}\;;\, D \vdash g\,(\text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}))\;;\, \text{S}\;; \\ \textsc{comma lance}\; D\;(\textsc{pred a cyclist})\end{array}}}{\begin{array}{c}\vdash \lambda_{g}.g\,(\text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}))\;;\, \text{QP}\;; \\ \lambda_{D}.\textsc{comma lance}\; D\;(\textsc{pred a cyclist})\end{array}} \tag{93}$$

Now the comma intonation takes the QP derived in (93) as its first argument.

$$\frac{(54) \qquad (93)}{\begin{array}{c}\vdash \lambda_{gs}.g\,(\text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot (\mathsf{comma}\; s))\;;\, (\text{NP} \multimap \text{S}) \multimap \text{Pred} \multimap \text{S}\;; \\ \textsc{comma}\;\lambda_{D}.\textsc{comma lance}\; D\;(\textsc{pred a cyclist})\end{array}} \tag{94}$$

Next, the verb phrase containing an object gap is integrated.

(95)

$$\frac{(94) \qquad (56)}{\begin{array}{l}\vdash \lambda_s.\text{some} \cdot \text{cyclist} \cdot \text{met} \cdot \text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot (\mathsf{comma}\; s)\,;\, \text{Pred} \multimap \text{S}\,; \\ \quad \textsc{comma}\;(\lambda_D(\textsc{comma lance}\; D\;(\textsc{pred a cyclist})))\;\lambda_m.(\textsc{a cyclist})_n.\textsc{met}\; m\; n\end{array}}$$

In the last proof step, the second supplement is provided as the final argument to the comma intonation.

(96)

$$\frac{(95) \qquad (23)}{\begin{array}{l}\vdash \text{some} \cdot \text{cyclist} \cdot \text{met} \cdot \text{lance} \cdot \mathsf{comma}\,(\text{a} \cdot \text{cyclist}) \cdot \mathsf{comma}\,(\text{a} \cdot \text{doper})\,;\, \text{S}\,; \\ \quad \textsc{comma}\;(\lambda_D(\textsc{comma lance}\; D\;(\textsc{pred a cyclist})))\;\lambda_m.(\textsc{a cyclist})_n.\textsc{met}\; m\; n \\ \qquad (\textsc{pred a doper})\end{array}}$$

Like the medial stacking case above, the embedded comma intonations make the semantics derived in (96) somewhat complex. It reduces as follows:

$$\begin{array}{l}\textsc{comma}\;(\lambda_D(\textsc{comma lance}\; D\;(\textsc{pred a cyclist})))\;\lambda_m.(\textsc{a cyclist})_n.\textsc{met}\; m\; n \\ \quad (\textsc{pred a doper}) \\ = (\textsc{comma lance}\;(\lambda_m(\textsc{a cyclist})_n.\textsc{met}\; m\; n)\;(\textsc{pred a cyclist}))\;\textsc{and} \\ \quad \textsc{the}\;(\lambda_m(\textsc{a cyclist})_n.\textsc{met}\; m\; n)\;(\textsc{pred a doper}) \\ = (\textsc{lance}_m(\textsc{a cyclist})_n.\textsc{met}\; m\; n)\;\textsc{and} \\ \quad (\textsc{the}\;(\lambda_m(\textsc{a cyclist})_n.\textsc{met}\; m\; n)\;(\textsc{pred a cyclist}))\;\textsc{and} \\ \quad \textsc{the}\;(\lambda_m(\textsc{a cyclist})_n.\textsc{met}\; m\; n)\;(\textsc{pred a doper})\end{array}$$

Roughly, this meaning for (91) is equivalent to *Lance was met by some cyclist. The one that a cyclist met is a cyclist, and he's also a doper.*

4 Comparison with other accounts

At the level of semantics, this account breaks with nearly all others in treating supplements as ordinary at-issue denotations. Rather than construing supplements as having a special property requiring them to project, their projection is instead directly linked to the scope of their anchors, which is itself influenced by independent processes. The impact of this design choice on the syntax is that supplements can be modeled syntactically as attaching themselves to their anchors. As detailed above, the implication for the two-component syntax of Dynamic Categorial Grammar is that supplement syntax can be captured straightforwardly via two lexical entries, one for utterance-medial supplements and the other for utterance-final ones. I argue that in both its parsimony and empirical coverage, this account compares favorably with previous attempts to model supplements.

The tradition of movement-based analysis exemplified by McCawley (1998), del Gobbo (2007), and Schlenker (2010, ms) share the common feature that they treat supplements as extraposed free-standing sentences. However, as Potts (2005, chapter 6) points out, this has the unsavory consequence of requiring a non-standard redefinition of the syntactic dominance relation. An illustrative example is

(97) Fred, who you met at a party, is a lawyer. (McCawley, 1998, 449, (20))

McCawley treats nonrestrictive relatives as sentence-level adjuncts that are then moved to a position immediately following their anchor. Figure 2 shows the pre-transformation syntax

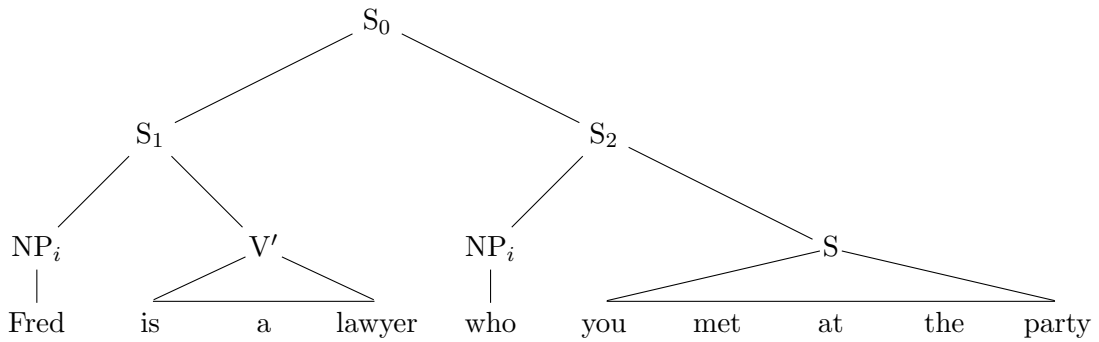

Figure 2: McCawley's (1998) syntax for the pre-transformation variant of (97).

for (97) in McCawley's (1998) account. The syntax in Figure 2 highlights an unfavorable aspect of the transformational analyses pointed out by Schlenker (ms, 20): the anchor *Fred* and the relativizer *who* must be co-indexed, and so a constituent's interpretation depends in part on a neighboring constituent's interpretation, implying that the resulting semantics departs from strong compositionality.

Another complicated aspect of these analyses can been seen in the syntax for (97) that McCawley's account posits as the result of the transformation (Figure 3). The configuration

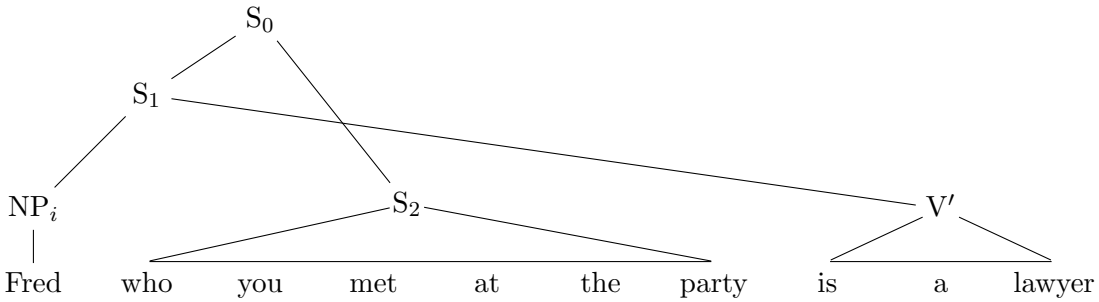

Figure 3: McCawley's (1998) syntax for (97), after transforming it from the syntax in Figure 2.

of the arcs show how McCawley's account needs a non-standard notion of dominance. To derive the correct surface word order, McCawley's transformation generates a tree that does not adhere to the condition of *nontangling*, which stipulates that all children of a node that precedes another node must also precede that other node's children.

Potts (2005, chapter 6) also highlights multiple additional problems with McCawley's approach, casting doubt on the idea that the underlying form in Figure 2 represents a structure that mirrors the interpretation of supplements. Note that, as Figure 2 shows, McCawley's *syntax* of supplements models them as separate but conjoined sentences, whereas the account here models a supplement's syntax as attaching to its anchor's and its *semantics* as generating a separate update. This account's syntax is thus much simpler than the transformational process described by Figures 2 and 3, with lambda terms in the pheno configured to simply attach the supplement's surface form to its anchor's (cf. (17) and (54)). Also, although it does use the anaphoric determiner THE in the meaning of the comma intonation, this account does not require the use of *E-type pronouns*, as del Gobbo's (2007) transformational account does.

Though, strictly speaking, it does not give an account of supplement syntax, Potts's (2005) account of supplements is not without its drawbacks. In addition to requiring that supplement content always inhabit a separate meaning dimension from non-supplement content, which I argue in §2.1 is empirically incorrect, Potts's semantics is already quite complex. For Potts, a special rule applies when ordinary content combines with supplement content, generating a pair of denotations. The semantic contribution of this pair of denotations must later be harvested via another special rule of "parsetree interpretation" that traverses the derivation to collect any supplement content and add it back into the meaning of the entire utterance. Since Potts's account is only semantic, it is difficult to guess how it would be extended to generate the corresponding surface forms. Clearly, though, even more specialized machinery would be needed.

Another approach to keeping supplement and non-supplement content separate is to use the continuation passing technique, as do Kubota and Uegaki (2009), extending Barker and Shan's (2008) continuation semantics. For Kubota and Uegaki, the semantics is set up so that the types require supplements to always take widest scope, i.e., to project. Like most other accounts, the predictions made by Kubota and Uegaki's are too strict, since they do not allow supplements to scope narrow with respect to operators. The added machinery is also quite complicated, requiring very complex lambda terms as well as specialized (though general) rules for dealing with continuations. A similar approach in this same vein is the use of monads to keep supplement content separate from other content (Giorgolo and Asudeh, 2012), but this approach is equally complicated, and still not fine-grained enough to allow supplements to interact with scope-taking operators.

AnderBois et al. (2010, 2015), Bekki and McCready (2014), and Koev (2014) all give accounts of supplements that allows them to interact anaphorically with other content, while keeping their content separate from main-clause content. However, none of these accounts allows supplements to participate in scope interactions. As such, some extensions would be required to each of these accounts in order to model any of the data in (1)–(5), which show that supplements have the potential to scope narrow relative to operators.

By comparison, the account of supplement syntax given here is very simple, requiring only a pair of lexical entries to capture all of the data in §2.1, including cases where supplements take scope and cases where they are deniable. It would be possible to argue that the addition of a second syntactic component is itself a quite complex move, even though the syntax is general purpose. However, both of the syntactic components are well-motivated, with one capturing the underlying combinatorics and the other dedicated to generating the proper surface forms. One might also argue that the heavy use of generalized quantification in this account is not too dissimilar from the continuation passing technique, since generalized quantification can be seen as an instance of continuation passing (Barker and Shan, 2014). I leave open the question of whether an analogous account expressed in Barker and Shan's framework would be more or less complicated.

5 Conclusion

This paper straightforwardly extends SU's semantics for supplements to a full syntax-semantics interface. In comparison to other accounts of supplement syntax, only a single meaning dimension, and not much extra machinery, is required to get this syntax-semantics interface—in fact, only two new lexical entries for the comma intonation are needed specifically to model supplements. Much of the reduced complexity comes from the fact that SU's account departs from the idea that supplements always project, never interacting with other content. Treating supplements as essentially extra property denotations added

into the restrictor of a generalized quantifier allows the grammar to harness independently motivated machinery to handle them.

In place of the complex transformations, special-purpose rules, continuations and monads posited by other accounts, this account instead calls upon the two-component syntax developed by Martin and Pollard (2014), which is used independently to model all other syntactic aspects of the grammar. The resulting formalism handles a wide range of phenomena, including supplements in both medial and final position, stacked supplements, and anaphora between supplements and other content. In addition to its reduced complexity, this account also compares favorably with others because it covers more of the facts, allowing supplements to interact with other content at the level of scope.

References

Amaral, Patricia, Craige Roberts, and E. Allyn Smith. 2007. Review of *The Logic of Conventional Implicatures* by Chris Potts. *Linguistics and Philosophy* 30(6):707–749.

AnderBois, Scott, Adrian Brasoveanu, and Robert Henderson. 2010. Crossing the appositive/at-issue meaning boundary. In *20th Conference on Semantics and Linguistic Theory (SALT)*.

AnderBois, Scott, Adrian Brasoveanu, and Robert Henderson. 2015. At-issue proposals and appositive impositions in discourse. *Journal of Semantics* 32(1):93–138.

Barker, Chris, Rafaella Bernardi, and Chung-chieh Shan. 2010. Principles of interdimensional meaning interaction. In *20th Conference on Semantics and Linguistic Theory (SALT)*.

Barker, Chris and Chung-chieh Shan. 2008. Donkey anaphora is in-scope binding. *Semantics and Pragmatics* 1(1):1–42.

Barker, Chris and Chung-chieh Shan. 2014. *Continuations and Natural Language*. No. 53 in Oxford Studies in Theoretical Linguistics. New York, NY and Oxford: Oxford University Press.

Barwise, Jon and Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4(2):159–220.

Beaver, David I. 2001. *Presupposition and Assertion in Dynamic Semantics*. Stanford, CA: CSLI Publications.

Bekki, Daisuke and Eric McCready. 2014. CI via DTS. In *11th International Workshop on Logic and Engineering of Natural Language Semantics (LENLS)*, 110–123.

de Groote, Philippe. 2001. Towards abstract categorial grammars. In *Association for Computational Linguistics, 39th Annual Meeting and 10th Conference of the European Chapter*.

de Groote, Philippe. 2006. Towards a Montagovian account of dynamics. In *16th Conference on Semantics and Linguistic Theory (SALT)*.

de Groote, Philippe and Mark-Jan Nederhof, eds. 2012. *Formal Grammar*, No. 7395 in Lecture Notes in Computer Science, Dordrecht. Springer.

del Gobbo, Francesca. 2007. On the syntax and semantics of appositive relative clauses. In N. Dehé and Y. Kavalova, eds., *Parentheticals*, 173–201. Amsterdam & Philadelphia, PA: John Benjamins.

Ginzburg, Jonathan. 2012. *The Interactive Stance*. New York, NY and Oxford: Oxford University Press.

Giorgolo, Gianluca and Ash Asudeh. 2012. $\langle M, \eta, \star \rangle$ monads for conventional implicatures. In A. A. Guevara, A. Chernilovskaya, and R. Nouwen, eds., *Sinn und Bedeutung 16*, vol. 1. Cambridge, MA: MIT Working Papers in Linguistics.

Harris, Jesse A. and Christopher Potts. 2009. Perspective-shifting with appositives and expressives. *Linguistics and Philosophy* 32(6):532–552.

Huddleston, Rodney and Geoffrey K. Pullum. 2002. *The Cambridge grammar of the English language*. Cambridge: Cambridge University Press.

Keenan, Edward L. and Jonathan Stavi. 1986. A semantic characterization of natural language determiners. *Linguistics and Philosophy* 9(3):253–326.

Koev, Todor. 2012. On the information status of appositive relative clauses. In M. Aloni, V. Kimmelman, F. Roelofsen, G. W. Sassoon, K. Schulz, and M. Westera, eds., *Logic, Language and Meaning*, No. 7218 in Lecture Notes in Computer Science, 401–410. Berlin and Heidelberg: Springer.

Koev, Todor. 2014. Two puzzles about appositives: Projection and perspective shift. In U. Exteberria, A. Fălăuş, A. Irurtzun, and B. Leferman, eds., *Sinn und Bedeutung 18*. University of the Basque Country.

Kubota, Yusuke and Wataru Uegaki. 2009. Continuation-based semantics for conventional implicatures: The case of Japanese benefactives. In *19th Conference on Semantics and Linguistic Theory (SALT)*.

Martin, Scott. 2013. *The Dynamics of Sense and Implicature*. Ph.D. thesis, Ohio State University, Columbus, OH.

Martin, Scott. in press. Supplemental update. *Semantics and Pragmatics* (`http://semanticsarchive.net/Archive/TMzYTZhY/suppdate.pdf`).

Martin, Scott and Carl Pollard. 2012a. A higher-order theory of presupposition. *Studia Logica* 100(4):727–751.

Martin, Scott and Carl Pollard. 2012b. Hyperintensional dynamic semantics: Analyzing definiteness with enriched contexts. In de Groote and Nederhof (2012), 114–129.

Martin, Scott and Carl Pollard. 2014. A dynamic categorial grammar. In G. Morrill, R. Muskens, R. Osswald, and F. Richter, eds., *19th Conference on Formal Grammar*, No. 8612 in Lecture Notes in Computer Science, 138–154. Dordrecht: Springer.

McCawley, James D. 1998. *The syntactic phenomena of English*. Chicago, IL: University of Chicago Press, 2nd edn.

Mihaliček, Vedrana. 2012. *Serbo-Croatian Word Order: A Logical Approach*. Ph.D. thesis, Ohio State University, Columbus, OH.

Murray, Sarah E. 2014. Varieties of update. *Semantics and Pragmatics* 7(2):1–53.

Muskens, Reinhard. 1996. Combining Montague semantics and discourse representation theory. *Linguistics and Philosophy* 19(2):143–186.

Muskens, Reinhard. 2007. Separating syntax and combinatorics in categorial grammar. *Research on Language and Computation* 5(3):267–285.

Nouwen, Rick. 2007. On appositives and dynamic binding. *Research on Language and Computation* 5(1):87–102.

Nouwen, Rick. 2014. A note on the projection of appositives. In E. McCready, K. Yabushita, and K. Yoshimoto, eds., *Formal Approaches to Semantics and Pragmatics: Japanese and Beyond*, No. 95 in Studies in Linguistics and Philosophy. Dordrecht: Springer.

Oehrle, Richard T. 1994. Term-labeled categorial type systems. *Linguistics and Philosophy* 17(6):633–678.

Potts, Christopher. 2005. *The Logic of Conventional Implicatures*. No. 7 in Oxford Studies in Theoretical Linguistics. New York, NY and Oxford: Oxford University Press.

Roberts, Craige. 1989. Modal subordination and pronominal anaphora in discourse. *Linguistics and Philosophy* 12(6):683–721.

Roberts, Craige. 2005. Pronouns as definites. In M. Reimer and A. Bezuidenhout, eds., *Descriptions and Beyond*, 503–543. New York, NY and Oxford: Oxford University Press.

Roberts, Craige. 2012a. Information structure: Afterword. *Semantics and Pragmatics* 5(7):1–19.

Roberts, Craige. 2012b. Information structure in discourse: Towards an integrated formal theory of pragmatics. *Semantics and Pragmatics* 5(6):1–69. Accompanying afterword in Roberts 2012a.

Schlenker, Philippe. 2010. Supplements within a unidimensional semantics I: Scope. In M. Aloni, H. Bastiaanse, T. de Jager, and K. Schulz, eds., *Logic, Language and Meaning*, No. 6042 in Lecture Notes in Computer Science, 77–83. Dordrecht: Springer.

Schlenker, Philippe. ms. Supplements without bidimensionalism. Unpublished manuscript, Institut Jean-Nicod and New York University, February, 2013. (`http://www.semanticsarchive.net/Archive/jgwMjNmM/Supplements_without_Bidimensionalism.pdf`).

Tonhauser, Judith, David Beaver, Craige Roberts, and Mandy Simons. 2013. Towards a taxonomy of projective content. *Language* 89(1):66–109.

Worth, Chris. 2014. The phenogrammar of coordination. In *EACL Workshop on Type Theory and Natural Language Semantics*. Association for Computational Linguistics.