

Idioms and the syntax/semantics interface of descriptive content vs. reference
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Abstract

The syntactic literature on idioms contains some proposals (e.g. Sportiche 2005, Cecchetto & Donati 2015) that are surprising from a compositional perspective: They propose that, in the case of verb-object idioms, the verb combines directly with the noun inside its DP complement, and the determiner is introduced higher up in the syntactic structure, or is late-adjoined. This seems to violate compositionality insofar as it is generally assumed that the semantic role of the determiner is to convert a noun to the appropriate semantic type to serve as the argument to the function denoted by the verb. In this paper, we establish a connection between this line of analysis and lines of work in semantics that have developed outside of the domain of idioms, including work on incorporation and a recent implementation of a semantics for the “layered” DP (Zamparelli 1995) developed in McNally (to appear), McNally & Boleda (to appear). What all of this research in semantics shares is that in one way or another it separates the composition of descriptive content from that of discourse referent introducing material; what the latter proposal offers is a particularly promising way to handle the compositional difficulties posed by idioms.

1. Introduction

A classic puzzle in the analysis of idioms (or at least idiomatically combining expressions, cf. Nunberg, Sag & Wasow 1994) involves how to account for the fact that in some cases, non-idiomatic material intervenes between the components of an idiomatic expression. For example, alongside the idiomatic expression *to pull strings* in (1a), we find variants such as (1b-d).

- (1) a. pull strings
 b. pull some strings
 c. pull political strings
 d. pull all the strings I can

These data are problematic if the noun *strings* combines with the adjective/determiner before combining with *pull*, as widely adopted syntactic constituency tests and assumptions about the semantic composition of VPs and DPs would suggest. Take (1b) as an example. On these assumptions, the result of combining *some* and *strings* yields a referential expression¹ that denotes a plurality of (literal) strings. The determiner prevents any direct access between *pull* and *strings*, raising the question of how the idiomatic interpretation of *pull (some) strings* could be derived. We know of no fully worked out semantic solution to this problem.

The syntactic literature on idioms contains some proposals (e.g. Sportiche 2005, Cecchetto & Donati 2015) that take the surprising approach of challenging the standard assumptions about the structure of such phrases, positing that in the case of verb-object idioms, the verb combines directly with the noun inside its DP complement, with the determiner being introduced higher up in the syntactic structure, or late-adjoined, as will be explained in detail below. This approach preserves the direct relation between the components of the idiom at the expense of failing to explain the surface syntactic constituency of the determiner and noun.

¹ The problem would be similar under an analysis on which *some strings* denotes a generalized quantifier; for the sake of simplicity we will not discuss this option here.

Moreover, it seems to violate compositionality insofar as, in general, the evidence would seem to indicate that the semantic role of the determiner is to convert a noun to the appropriate semantic type to serve as the argument to the function denoted by the verb.

Though these problems are serious, we have found a striking connection between this line of syntactic analysis and a variety of syntactic/semantic analysis of VPs that have emerged independently of idiom data. The main goals of this paper are to draw attention to this connection and, in so doing, cast previous syntactic accounts of idioms in a new light, as a special case of a more general compositional phenomenon in which the descriptive contents of phrases compose independently of referential elements.

We proceed by first reviewing, in section 2, the relevant syntactic accounts of idioms and then another syntactic account of VP composition developed for completely different reasons, namely that in Diesing (1992); we follow this with some general considerations concerning verb movement. In section 3 we then present the semantic proposals that we will draw on for our account of the data in (1).² We conclude in section 4 with very brief comments that place our semantics in a broader perspective.

2. The syntax of idioms and beyond

2.1. Syntactic analyses of idiomatic expressions

As noted in the introduction, it is puzzling that in verb-object idioms,³ it seems that the verb and the noun can access each other as if the D were not there. For example, the idiomatic parts of *pull strings* rely on the verb *pull* and the noun *strings* (be it as a bare plural in most cases, though not necessarily; cf. Bargmann 2015); however, the idiomatic reading is possible not only when the verb combines directly with the noun but also when non-idiomatic determiners and some adjectives intervene, as illustrated in (1). Similarly, the verb can appear in all available tense-aspect forms without such finite morphology affecting or even participating in the idiomatic meaning composition. Similar issues arise with idioms that contain free NP slots (e.g. *to pull X's leg*) (see also Bruening 2015 for recent discussion).

This and other facts have led authors like Sportiche (2005), Bruening (2015), Bruening et al. (2015), and Cecchetto & Donati (2015) to conclude more generally that verbs combine with nouns first (i.e. the verb selects the noun), and the import of determiners and other such elements is computed at a later stage. Sportiche, for instance, provides arguments from reconstruction and idiom chunks for his syntactic proposal of a split DP. One of his examples is given in (3), where the nominal part of the idiom, *care*, does not appear adjacent to the verb in its surface position, but where for semantic reasons it has to be interpreted in that lower position, leading to reconstruction of the nominal in its trace position (see Fox 1999 on the notion of reconstruction).

(3) Much care seems to have been taken *t* of the victims.

Sportiche proposes an analysis under which the verb combines with an NP in the lower

² In this paper we limit ourselves to the specific problema raised by the data in (1). We do not consider idioms in which the determiner is entirely fixed, assuming that these even exist.

³ In this work we will limit our discussion to verb-object idioms, though in principle our comments and analysis should apply to other sorts of idioms as well.

position and D is generated in the higher position to which the NP moves, as in (4) (the crossed out NP indicates the origin of movement).

(4) ... [D NP] ... [~~NP~~ V ...] ...

Bruening et al. (2015) point out that under this analysis it is not clear where to merge the D, since there is no room for D in such a higher position, outside the nominal domain. Instead they take the fact that verbs, in idioms but also more generally, select for nouns but never for determiners (or other such elements) as an argument against the now widely-accepted DP hypothesis, on which the determiner is the head of referential expressions (Abney 1987) and in favor of what they call the NP-hypothesis, on which nouns head such expressions (see also Bruening 2015). Their fundamental observations, which they illustrate with examples from English, Korean and Vietnamese, are that (i) selection is always local (V + N), and (ii) in verb-object idioms, determiners (D), number (Num), classifiers (Cl), as well as adjectives are not necessarily fixed. The basic nominal structure they assume is given in (5).

(5) [_{NP} D [_N [_{ClP} Num Cl] [_N N]]]

This, then, means that determiners and other such elements are not the heads of referential expressions that select an NP, but rather they are like adjuncts, similar to adjectives and other modifiers. A related idea is found in Cecchetto & Donati (2015), who propose that unselected elements are adjunct-like and can be late-merged, and they suggest that determiners might also be late-merged.

As noted in the introduction, proposals like Sportiche's and Cecchetto & Donati's raise questions about semantic composition. These are arguably due to the fact that they use the same representational vocabulary for encoding constituent structure as for managing selectional phenomena, creating problems when selectional requirements do not coincide with constituent structure requirements. Bruening et al. take an approach that salvages semantic composition at the expense of sacrificing the generalizations that the DP hypothesis captures. It is therefore interesting to consider one last syntactic account which makes use of a richer representational vocabulary.

An idea similar to Bruening's has been developed in Head-Driven Phrase Structure Grammar (HPSG; Pollard & Sag 1994, Sailer 2004, Bargmann & Sailer 2015). HPSG representations are feature structures that specify all of the components of linguistic signs (phonology, syntax, semantics) and the relations between them. Within the semantics, Sailer distinguishes between what he refers to as *local semantics* and *compositional semantics*. Local semantic features are where basic lexical information is stored, and are used to manage sortal and selectional restrictions between predicates and their arguments – for example, the sortal restriction of *extinct* to kind-level individuals as in (6a), or more pragmatic selectional restrictions of the sort in (6b) (from Sailer 2004):

- (6) a. The dodo/??Max is extinct.
b. Hans pflückte eine Pustelblume / ??ein Buch aus dem Regal.
Hans picked a dandelion / a book off the.DAT shelf
'Hans picked a dandelion.'

Compositional semantics, in contrast, regulates the combination of larger constituents, including the resolution of quantifier scope relations.

Sailer argues for keeping local and compositional semantic content separated in HPSG because sortal and selectional restrictions are insensitive to determiners and quantifiers: They hold no matter what sort of determiner/quantifier is manifest on a selected argument and, moreover, he further observes that there are no examples of predicates that select, for example, for a universal determiner no matter the lexical content of the accompanying noun.⁴ Once separated in the representation, the interactions between local contents can be managed via HPSG principles independently of compositional contents. However, Sailer offers no explicit technique for combining the local contents in a way that would produce idiomatic meanings, though he has suggested (personal communication) that the distributional semantic techniques we discuss below could be used for this purpose.

In sum, what all these syntactic accounts have in common is that they assume two steps in the derivation or two different representations (in the following, we will talk about representations, but it should be clear that the point is equally valid for derivational syntactic approaches). At one level of representation we are dealing with selection (e.g. of Ns by Vs), with particular (sortal and/or other) restrictions imposed on the selected constituent, and thus with matters pertaining to conceptual semantics. At another level of representation we are dealing with the syntax of determiners, quantifiers, and classifiers, which are elements that contribute referential semantic information.⁵ The idea of distinguishing two levels of representation, with nouns and verbs playing a double role at both levels, as we will see shortly, also underlies Diesing's Mapping Hypothesis, to which we now turn.

2.2. Two levels of syntactic representation and interpretation

In this section we will first address the framework of Diesing (1992), which divides sentences into two levels, the VP and the IP/CP level; referential NPs are argued to have to vacate the VP in order to be interpreted (in the restrictor of an overt or covert quantifier). Diesing & Jelinek (1995) tie this in with general consideration about verb movement and how high verbs move in different languages. What is crucial, then, is that it is assumed that not just (referential) nominals but also finite verbs⁶ move out of their base position (V^0). A consequence of such approaches, even if this is not directly addressed as such, is that both verbs and nouns combine at a lower level first (at the level of the VP), without taking into account the referential properties of determiners, quantifiers, or finiteness, and then both move out of the VP for independent reasons that one can semantically tie to referentiality (reference of the individual arguments but also of the event denoted by the verbal predicate). In section 3, we will see parallel proposals from the semantic domain.

2.2.1. Diesing's Mapping Hypothesis

A two-way division in the syntactic-semantic representation of propositions is essential to Diesing's (1992) Mapping Hypothesis, according to which the VP maps into the nuclear

⁴ This point is also discussed at length in the papers by Bruening and colleagues. Although Sailer notes that one exception might be *there* sentences, see McNally (1992), among others, for an alternative account that does not rely on lexical selection. Note also that there are idioms with fixed determiners such as *kick the bucket*.

⁵ Note that we use the term "referential" broadly, to include aspects of meaning related to quantification, insofar as on theories incorporating a notion of discourse reference such as Discourse Representation Theory (DRT, Kamp 1981), quantifiers, like truly referential expressions, are associated with (non-persistent) discourse referents. Authors like Bruening and colleagues also add adjectives to the elements that do not play a role in selection. For now we will leave aside adjectives.

⁶ In periphrastic verb forms it is assumed that the non-finite verb stays in V^0 and does not move.

scope of a given operator and the IP maps into its restriction. In particular, the VP is identified as the domain for default existential closure whereas any material above the VP is associated with a (possibly covert) quantifier. Initially, this system was designed to capture scrambling facts from German, for example the contrast between (7) and (8) (Diesing & Jelinek 1995:129).

- (7) a. ... weil Elly immer Lieder singt. German
 since Elly always songs sings
 ‘since Elly is always singing songs.’
 b. ALWAYS_t [time(t)] $\exists x$ [song(x) \wedge sings(Elly, x, t)]
- (8) a. ... weil Elly Lieder immer singt. German
 since Elly songs always sings
 ‘since always, if something is a song, Elly sings it.’
 b. ALWAYS_x [song(x)] [sings(Elly, x)]

In (7a) we see that if the bare plural object, an indefinite, which is assumed by Diesing & Jelinek to be of type $\langle e, t \rangle$, remains within the VP it gets an existential interpretation (because it is existentially closed at that level) and its interpretation is not affected by the quantifier associated with *immer* ‘always’, which is analyzed as a quantifier over times. We can paraphrase this reading as ‘at all times Elly sings songs’. However, when the bare plural moves (scrambles) across *immer*, as in (7b), which involves movement to some VP-external position (implicitly assuming that an adverb like *immer* adjoins to VP), *Lieder* ‘songs’ is interpreted in the restrictor of the quantifier associated with *immer*; this reading can be paraphrased as in the free translation above.

Within this system, indefinites can be of different types and this determines whether they can stay within the VP or have to move out of it. In (7a), indefinites that stay within the VP are of type $\langle e, t \rangle$ and provide a free variable that can ultimately get existentially closed.⁷ Another possibility is that it is of a quantificational type ($\langle \langle e, t \rangle, e \rangle$) so that when it appears in object position it has to move (QR at LF) to repair the type mismatch. In addition, Diesing assumes two subject positions, a VP-internal and a VP-external one. The existential closure operation is assumed to be unselective so that any free variable in its scope (in the VP) gets existentially bound. Traces, however, are not free variables, and any nominal expression that moves out of the VP should not be interpreted (weak) existentially.

Following Heim (1982), typical definites are also analyzed as open propositions containing free variables. However, since their referential interpretation is incompatible with the existential interpretation they would have if they stayed within the VP (which is subject to the Novelty Condition), they have to move out of the VP. This explains, for instance, why an unscrambled definite in object position in German is rather odd (9a) (Diesing & Jelinek 1995:130).⁸ Finally, pronouns are assumed to be of type e and therefore are argued to have to

⁷ How exactly this works technically is not clear in Diesing & Jelinek’s system, since a property should not be able to provide such a free variable; it rather looks like the *in situ* nominal is interpreted as an open proposition as in Heim (1982), but nothing is said about how an open proposition would combine semantically with the denotation of the verb. The DRT analysis of the semantics of bare plurals in Farkas & de Swart (2003), briefly discussed below, shows how such an idea can be implemented.

⁸ Some definite NPs can appear in an unscrambled position when they receive a quantificational interpretation (are of type $\langle \langle e, t \rangle, t \rangle$) and undergo QR at LF and therefore do not introduce a bindable variable within the VP. This is argued to be the case in (i) (Diesing & Jelinek 1995:130), which involves an attributive (rather than a referential) definite, in the sense of Klein (1980).

vacate the VP as well, cf. (9b) (Diesing & Jelinek 1995:131).

- (9) a. *?... weil ich selten die Katze streichle. German
since I seldom the cat pet
b. *... weil ich selten sie streichle.
since I seldom her pet

In sum, in this system referential nominals have to move out of the VP to get interpreted, whereas weak indefinites remain within the VP. In section 3.1 we will discuss an approach according to which incorporated nominals, which are commonly analyzed as property-denoting (of type $\langle e, t \rangle$), also stay within the VP and, crucially, are not interpreted as directly introducing any entity in the discourse.

Diesing & Jelinek (1995) integrate Diesing's system and her account of scrambling in German (and other languages) into a more general system that also takes into account cross-linguistic variation in verb movement, to cover empirical facts from Egyptian Arabic object pronouns, Scandinavian object shift, and English particle shift. We will discuss these observations in the following section and provide a brief overview of the syntax of verb and object movement, because this will serve as yet another example where syntactic expressions contributing descriptive content have been teased apart from material contributing referential information, again recalling the move by Sportiche and Cecchetto & Donati to account for idiomatic expressions.

2.2.2. Verb and object movement

At least since Pollock (1989) it has been assumed that in some languages (e.g. French, Icelandic) (finite) verbs obligatorily move to I (or T in more recent approaches), whereas in other languages (e.g. English) the verb does not move to I. Nevertheless, recent approaches assume for languages like English that the verb undergoes at least a short movement to v.⁹ Some authors relate the possibility of a language being able to move the verb to I to rich agreement, i.e. there is a strong agreement feature on I that triggers movement of the verb (for a recent defense of a strong version of this hypothesis see Koenen & Zeijlstra 2014, who argue that the relevant projection is ArgP) or to a strong feature on Tense (e.g. Biberauer & Roberts 2010), while others deny a correlation of V-to-I movement with agreement, yet still assume that such movement takes place (e.g. Bentzen et al. 2007). Whichever position we take, it is clear that the syntactic literature converges on the idea that verbs move out of their base position (V) to some higher projection. Thus, it is generally assumed that (finite) verbs are base-generated as V heads and then undergo short or long movement in the course of the syntactic derivation.

This is also assumed by Diesing & Jelinek (1995), who tie in differences in the height to which finite verbs move in particular languages with the different position of pronouns in

-
- (i) ... weil ich selten die kleinste Katze streichle. German
since I seldom the smallest cat pet
'since I seldom pet the smallest cat.'

Here, the interpretation can be paraphrased as "there are few times for which it holds that I pet the smallest cat" (the paraphrase "the smallest cat is such that I rarely pet it" would correspond to the sentence where *die kleinste Katze* is scrambled over the adverb *selten*).

⁹ Diesing & Jelinek (1995) argue that it moves to Asp.

these languages and Diesing's Mapping Hypothesis described above. For example, they observe that Egyptian Arabic does not have free-standing object pronouns and argue that such pronouns obligatorily attach to the verb as a means of raising out of the VP (together with the verb that moves out of the VP) and thus escaping the scope of existential closure. This movement is only possible if the verb moves out of the VP as well.

Diesing & Jelinek also consider object shift in Scandinavian and particle shift in English. Let us start with object shift, as illustrated for Danish in (10) (Diesing & Jelinek 1995:148).¹⁰

- (10) Peter læsde {den} uden tvivl {*den} ikke. Danish
 Peter read it without doubt it not
 'Without doubt, Peter didn't read it.'

As we see here, similar to the scrambling cases above (though, see Vikner 2006 for arguments for keeping scrambling and object shift apart) the pronoun *den* 'it' is shifted across the adverb *uden tvivl* 'without doubt', and the reverse order, where the pronoun remains in its presumed base position, is ungrammatical. Holmberg (1986) observed that in Mainland Scandinavian only pronouns undergo object shift, whereas in Icelandic full NPs can also shift optionally; pronoun shift is assumed to be obligatory in both types of languages. Holmberg's Generalization correlates object shift with verb movement: The object shifts whenever the verb moves.¹¹

Diesing & Jelinek focus on the obligatoriness of pronouns and optionality of full DPs (in Icelandic) to shift and make the crucial semantic observation that it is only definite or specific NPs that shift. Since pronouns are almost always referential and thus have to move out of the VP, this accounts for the obligatoriness of their shifting in both Mainland Scandinavian and Icelandic. In (11) (Diesing & Jelinek 1995:150) we further see the contrast between a shifted definite NP and a non-shifted (non-specific) indefinite (a bare plural) in Icelandic.

- (11) Hann las {bækurnar} ekki {bækur}. Icelandic
 He read books-the not books
 'He didn't read (the) books.'

Given that, according to the authors, indefinites can in principle either receive a weak existential interpretation, as with the indefinite in (11), or a generically quantified one (which on Diesing's 1992 account required the object to move out of the VP), there are also minimal pairs of non-shifted and shifted indefinites which illustrate precisely this meaning difference; cf. (12) (Diesing & Jelinek 1995:151).

- (12) a. Ég les ekki bækur. Icelandic
 I read not books
 'I don't read books.' (existential)

¹⁰ There are many different syntactic accounts for object shift; see Vikner (2006) for an overview. The precise syntactic account, however, is orthogonal to the ultimately semantic lesson of this section, since all accounts agree on the fact that objects shift (undergo short movement out of the VP) and that finite verbs also undergo short or long movement out of the VP, and whether or not the two are correlated from a syntactic point of view is not the point here. For the most part of this section, we will focus on the semantic effects of object shift as described by Diesing & Jelinek (1995).

¹¹ Among others, this is also supposed to capture the observation that in main clauses with auxiliaries where the non-finite verb stays in V no object shift takes place. This is obviously a problem for Diesing (& Jelinek) since referential objects should still vacate the VP, so something more would have to be added to their account.

b. Ég les bækur ekki.	Icelandic
I not read books	
‘I don’t read books (... I just buy them).’	(quantificational)

Finally, Diesing & Jelinek argue that so-called particle shift in English, illustrated in (13) (Diesing & Jelinek 1995:152), actually involves short movement of an object around the particle.

(13) Bert looked {the reference / it} up {the reference / *it}.

Again, the conditions on this movement, which is also obligatory with (unstressed) pronouns and optional with full NPs, as we see in (13), are tied in with the Mapping Hypothesis and with whether or not the verb moves (to Asp(ect) in English), among other considerations such as deictic uses or stress. For both types of languages (Scandinavian and English) it is argued that object pronouns behave more like clitics than free-standing pronouns so that they move along with the verb (because they have to vacate the VP as well) and thus appear in the higher positions they end up in (but see Vikner 2006 for arguments against treating them on a par with clitics, e.g. of the Romance type).

These proposals resonate with the sorts of accounts we saw for idioms in the previous section. In all cases, there is a first step in which verbs and their objects (and possibly also subjects, if we assume the VP-internal subject hypothesis) combine within the VP, presumably where thematic roles are first associated with content from nominal expressions. Then both finite verbs and referential nominals move outside of the VP (again, whether or not these movement operations syntactically depend on one another or not, is a separate issue). In particular Diesing (& Jelinek) argue that the optionality of moving nouns (in scrambling, object shift, and particle shift) depends on the referential status of the nouns: non-specific indefinites can stay inside the VP, whereas other NPs, notably definites, move out of the VP. We can now make similar assumptions about the referential status of the event associated with the verbal predicate: if the event is instantiated in space and time, which is arguably connected to finiteness (see Gehrke 2013 for a proposal along those lines), the verb moves out of the VP (to I/T in some languages or to Asp in others, e.g. English), whereas non-finite verbs stay in the VP. Interestingly, the semantics literature contains various proposals that independently point to a similar dissociation event and entity descriptive content, on the one hand, and event and entity discourse referents, on the other. Let us turn to these now.

3. Dissociating descriptive content from reference

We inspire our semantic account of the separation of descriptive content from reference first and foremost in three works on the semantics of noun incorporation, each of which provides a crucial clue. First, it will be crucial to appeal to the distinction between type- or kind-level vs. token-level expressions in Carlson’s (2003) analysis (see Carlson 1977 for an early formal semantic treatment of kinds). Carlson proposes that verbs denote event kind descriptions – simple properties of events with no arguments; we will compare his proposal to Chung & Ladusaw’s (2004) “Restriction and Saturation” account of incorporation, which adds in a syntactic component in which restricting material occupies argument positions and saturating material appears in adjunct position. The result of this comparison will lead us to conclude that the notion of “argument” is used in two ways in syntax, and often conflated in both the discussions in the literature and in the syntactic representations themselves. A proposal for

teasing apart these two uses of argument in a way that will help us resolve the composition problem with idioms appears in Farkas and de Swart's (2003) account of incorporation.

None of these proposals speaks directly to the problem of combining descriptive content in the seemingly non-transparent way that occurs in idioms; however, the appeal to event kind descriptions both in Carlson (2003) and in our own previous work, especially on the semantics of nominals, provides the key. We sketch how we can adapt the distributional semantic analysis of complex nominal kind descriptions in McNally (to appear) and McNally & Boleda (to appear) to event kind descriptions, which will facilitate the sort of semantics for idiom descriptions that we need.

3.1. Event kind descriptions, restriction, and saturation

In his paper on weak indefinites, Carlson (2003) suggests to view the VP as the domain of event types:

[T]he VP is the domain of a context-free interpretive mechanism specifying an event-type, which is then the input to the usual context-sensitive propositional semantics generally assumed for all levels of the sentence. That is, something fundamentally different goes on within the VP that does not go on "above" the VP – it is only information about types/properties that appears there and not information about (contingent) particulars. (Carlson 2003:198)

Carlson is particularly concerned with the semantics of noun incorporation(-like) structures, such as those in (14). He takes the nominals in such structures, which include bare nominals and weak indefinites, to be property-denoting (following, among others, McNally 1998; see also the references cited below on incorporation more generally).

- (14) a. bike ride
b. collect stamps, ride a bike

He takes verbs to denote non-functional eventuality types, which lack arguments altogether. The nominals in (14) are argued to necessarily stay within the VP to form structures that are of the same type as the verb and thus denote event subtypes, as in (15); their semantic contribution is added conjunctively.

- (15) [[eat cake]] ≤ [[eat]]

Referential and quantificational nominal expressions, whose interpretation Carlson assumes to depend on times or worlds, and thus on context, are combined with verbs not at the VP level but to only be interpretable in the IP domain, in accordance with Diesing's (1992) Mapping Hypothesis, as outlined in section 2.2. Likewise, at the IP level, event types are mapped to event tokens.

The idea of taking the VP as the level of event types (or kinds) is found in various recent works, even if it is sometimes more implicit than explicit. The general proposal of positing event kinds that get realized or instantiated by event tokens is found in Landman & Morzycki (2003), who propose that there is kind anaphora in the verbal domain, in analogy to nominal kind anaphora with *such* (see Carlson 1977) and who take manner modification to be event kind modification. Anderson & Morzycki (2015) further develop this proposal and extend it

to the domain of adjectives. Further empirical domains for which event kinds have been shown to be useful are adjectival passives (Gehrke 2011 et seq.), generalfactual imperfectives (Mueller-Reichau 2013, 2015), weak definites (Carlson et al. 2014, Schwarz 2014), and *-ing* nominalizations (Grimm & McNally 2015, 2016). All of these accounts assume that verb and noun (or verb and VP-internal nominals more generally) combine to form an event kind description. In other words, these works suggest that we could identify the composition of type-level descriptions with the combination of descriptive content as manifest in V selection for N in the different analyses in section 2.

However, none of these proposals is particularly explicit about what to do with nominals that refer to actual entities in the discourse, since they are mostly concerned with property-denoting nominals to begin with, which, as Carlson proposes, stay within the VP anyway.¹² Thus, the problem that all these accounts face is the following: How can we combine the descriptive content of a DP with that of a V, ignoring the intervening D, while still preserving compositionality? Can one form an event-type description with a referential expression in it, and if so, how? Interestingly, other work in the incorporation literature points to options, even though it does not make use of the event type/token distinction.

Consider first the analysis in Chung & Ladusaw (2004). In developing an account of incorporation in Chamorro and Maori, Chung & Ladusaw point to the need to distinguish restriction of verbal participant roles from saturation. One argument for making this distinction comes from Chamorro data such as that in (16) (Chung & Ladusaw 2004: 89, ex. (29a)), in which an incorporated noun (here *ga'* 'pet') is doubled by a full DP (here *un ga'lagu* 'a dog'):

- (16) *Gäi-ga'* (un *ga'lagu*) ennao na patgun. Chamorro
 agr.have-pet a dog that L child
 'That child has a pet dog.'

Interestingly, Chung & Ladusaw argue that *un ga'lagu* in (16) is not the direct complement to the verb in the syntax, but rather occupies an adjunct position higher up in the syntactic structure. This is strikingly similar to the syntax proposed by Sportiche and Cecchetto & Donati.

To account for (16) Chung & Ladusaw propose that natural language avails itself of more semantic composition rules than just function application, contrary to what has largely been assumed since Klein & Sag (1985). They begin with the observation that the incorporated nominal denotes a property, rather than an entity or generalized quantifier, and therefore is not of the right semantic type to saturate the verb, which by hypothesis denotes a relation between

¹² One theoretical option to get all referential arguments out of the VP is to assume that they are never merged that low (within the VP) to begin with but that they are severed from the verb, a proposal which goes back to at least Schein (1993) (see Lohndal 2014 for recent discussion of various such approaches). Under such approaches, we can take the verb alone to provide the conceptual content of the event kind or type; arguments do not play a role at this lower level. At a higher level, then, referential arguments can be added and compositionally combined with the event (for which we would have to assume event instantiation taking place beforehand). For cases in which it seems that the event type/kind first gets modified by the property denoted by its internal argument, we could assume a kind of lowering mechanism that is constraint by particular considerations (only those argument properties can be interpreted that low which derive somewhat established event subkinds/subtypes, since these are general restrictions on incorporation-like structures observed in the literature). However, since we believe that we need an account that combines the descriptive content of V and N before adding referentiality, we will not pursue this option, since it merely pushes the problem to a higher level.

entities. To resolve this type clash, they propose a rule **Restrict** (see (17a)), which combines a predicate denoting such a relation with a property-type expression, the latter expression adding descriptive content conjunctively to the outermost argument of the relation without saturating it. The output of **Restrict** can then be saturated with the semantic value of a DP by function application (**FA** in (17b)). Chung & Ladusaw observe that the entity-type denotation of an indefinite DP can result from the application of a choice function, **f**, licensed by the indefinite article, to the denotation of the noun (see e.g. Reinhart 1997, Winter 1997); we use this option here for the sake of illustration. Alternatively, if no doubling DP appears in the sentence, existential closure can apply to saturate the argument (**EC** in (17c), inspired in Heim 1982; see also the discussion of Diesing 1992 in section 2.2).

- (17) a. **Restrict**($\lambda y \lambda x [\mathbf{have}(x, y)]$, **pet**) = $\lambda y \lambda x [\mathbf{have}(x, y) \wedge \mathbf{pet}(y)]$
 b. **FA**($\lambda y \lambda x [\mathbf{have}(x, y) \wedge \mathbf{pet}(y)]$, **f(dog)**) = $\lambda x [\mathbf{have}(x, \mathbf{f}(\mathbf{dog})) \wedge \mathbf{pet}(\mathbf{f}(\mathbf{dog}))]$
 c. **EC**($\lambda y \lambda x [\mathbf{have}(x, y) \wedge \mathbf{pet}(y)]$) = $\lambda x \exists y [\mathbf{have}(x, y) \wedge \mathbf{pet}(y)]$

Chung & Ladusaw's analysis does something that no analysis before it that we are aware of does so explicitly: It dissociates the syntactic complement/adjunct distinction from the semantic argument/modifier distinction. The latter distinction is cashed out in the notions of saturation and restriction, respectively. Interestingly, even though restricting nominals are argued to occupy verb complement positions, their representations for verb denotations still crucially rely on arguments in a different sense: they use lambda-bound variables representing the thematic roles of the verb to glue together the verb and nominal meanings appropriately. Typically, both in syntax and semantics, the same representation, whether a tree or a logical formula, conflate the mechanism that drives saturation with the mechanism that guarantees the appropriate connection of nominals to the thematic roles of the verbs they combine with.¹³ This brings us to a third semantic proposal that will distinguish these mechanisms even more clearly.

3.2 A more radical separation of descriptive content composition and saturation: Extending Farkas & de Swart (2003)

Our approach to fully teasing apart descriptive content composition from saturation is an extension of a proposal in Farkas & de Swart's (2003) analysis of incorporation. This analysis is implemented in DRT, in which semantic interpretation is read off of a logical representation that is in turn generated from the syntax via a set of construction rules. DRT representations, called Discourse Representation Structures (DRSs), crucially separate discourse referents from the conditions that these referents must satisfy. In the version of DRT that Farkas & de Swart use, which draws on a proposal in Koenig & Mauner (1999), the variables corresponding to discourse referents, and which instantiate the arguments of a predicate, are distinguished from the variables for so-called Thematic Arguments, which serve the double function of compositional glue and of representing the arguments that need to be saturated, rather like Chung & Ladusaw's lambda-bound variables. Farkas & de Swart, also like Chung & Ladusaw, propose two different kinds of semantic composition rules. On the one hand, they propose *Unification of thematic arguments*, given in (18), which has a similar function to **Restrict**.

- (18) **Unification of thematic arguments**: Replace the relevant thematic argument y of a

¹³ HPSG's distinction between local and non-local content, which we briefly discussed at the end of section 2.1, is arguably an exception in this respect.

verbal predicate with the thematic argument z contributed by a nominal argument of the verb. (Farkas & de Swart 2003: 65)

On the other, they propose three types of *Instantiation*, which substitutes a variable corresponding to a discourse referent in the place of the variable corresponding to a thematic argument in the discourse representation of a predicate, effectively saturating it. (19) is the rule for saturating a verbal thematic argument by instantiating it with the discourse referent associated with a nominal.

- (19) **A(rgument)-Instantiation**: Instantiate the n -th thematic argument of a verbal predicate by the discourse referent contributed by the fully interpreted nominal argument. (ibid.: 33)

Interestingly, Farkas & de Swart propose that there are two distinct means by which a nominal can be associated with a discourse referent. The standard means is by what they call Determiner Instantiation: The semantic value of a determiner is to contribute a discourse referent for the thematic argument of its nominal complement, as stated in (20). In their system, this process must precede A-Instantiation by that nominal. The association of the nominal referent with the appropriate verbal thematic argument is managed by so-called construction rules in DRT, which specify how the independent syntactic representation is mapped to a DRS.

- (20) **D(eterminer)-Instantiation**: Instantiate the thematic argument z of the NP by the discourse referent u contributed by material under D, and subscript u with the index x , writing u_x .¹⁴ (ibid.: 35)

However, for bare plurals, where there is no determiner, Farkas & de Swart posit a different mechanism for instantiating the nominal's thematic argument, which they call Secondary Instantiation (see (21)). They propose that the presence of plurality indicates that the speaker effectively presupposes a plural discourse referent (a_x in (21)) – if this were not the case, there would be no reason for the speaker to use the plural. The hearer must accommodate this presupposition.¹⁵

- (21) **Secondary Instantiation**: Instantiate the thematic argument x of a nominal with a discourse referent a_x that it is co-indexed with. (ibid.: 49)

Interestingly, Farkas & de Swart make the following comment:

Secondary Instantiation, unlike D-Instantiation, is driven by the presuppositional semantics of the plural rather than by the lexical input of the syntactic configuration. Unlike D-Instantiation, Secondary Instantiation is not triggered by a reduction rule,

¹⁴ The subscripts are introduced by Farkas & de Swart for bookkeeping purposes. We follow their convention here.

¹⁵ Farkas & de Swart do this to distinguish bare plurals from bare numberless nominals, which lack the ability to license discourse anaphora. We refer the reader to their work for detailed discussion of the data.

Note also that it is arguably more appropriate to consider this contribution of the plural as some other sort of non-asserted content (or “projective meaning”) than a presupposition, insofar as the hearer is not required to be familiar in advance with the discourse referent in question: after all, the referent introduced by a bare plural is novel in the discourse, in contrast to the referent presupposed by, for example, definite DPs. We will use the term “speaker presupposition” to refer to this contribution here, but must leave investigation of exactly what type of meaning this is for future research.

and therefore its application is not tied to a particular point in the derivation [italics ours]. It is a last resort strategy that allows a discourse referent contributed by the plural feature to connect to the thematic argument of the nominal in the absence of a proper binder. (ibid.: 48-49)

That is, Farkas & de Swart provide a mechanism for dissociating the point at which discourse referents are instantiated from the point at which thematic arguments are unified. Though they do not avail themselves of this option in the case of DPs, we suggest here that there is, in fact, no strong reason not to do so. After all, DPs quite generally convey number, and the same sort of presupposition that supports Secondary Instantiation for bare plurals should justify Secondary Instantiation for any DP's discourse referent. We also know of no undesirable effects of eliminating D-Instantiation in favor of Secondary Instantiation, at least for non-quantificational DPs.¹⁶

We can illustrate this analysis with the derivation of the Chamorro example from (16) in (22) and (23), where DRSs are represented as ordered triples of sets of discourse referents, the descriptive content conditions these referents must satisfy, and any projective conditions accompanying them.¹⁷ We begin with the analysis of the nominal expressions ((22)). We distinguish the incorporated *-ga* 'pet' from *ga'lagu* 'dog' as used in the DP *un ga'lagu* 'a dog' by associating the latter, but not the former, with a number feature and a corresponding, coindexed, speaker-presupposed discourse referent u_w . Instead of appealing to D-Instantiation for the analysis of *un ga'lagu*, we treat the indefinite article as contributing nothing other than a discourse novelty condition on any referent eventually instantiated within its nominal complement (not represented in (22)). An entirely analogous treatment can be given to *ennaona patgun* 'that child', the only difference being that the demonstrative carries with it different conditions on the hearer's familiarity with the speaker presupposed referent accompanying *patgun*.

- (22) a. *-ga* 'pet': $\langle \{\}, \{\mathbf{pet}(z)\}, \{\}\rangle$
 b. *ga'lagu*_[sg] 'dog': $\langle \{\}, \{\mathbf{dog}(w)\}, \{u_w\}\rangle$
 c. *un ga'lagu*_[sg] 'a dog': $\langle \{u_w\}, \{\mathbf{dog}(u_w)\}, \{u_w\}\rangle$ (after Secondary Instantiation)
 d. *ennaona patgun*_[sg] 'that child': $\langle \{u_v\}, \{\mathbf{child}(u_v)\}, \{u_v\}\rangle$
 (after Secondary Instantiation)

In (23) we show the composition of the verb with these nominals. The verb *gäi* 'have' combines with *-ga* by Unification. If we translate Chung & Ladusaw's analysis directly into Farkas & de Swart's formalization, *un ga'lagu* will combine with the *gäi-ga* by A-Instantiation, as in (23c), and then the subject will compose with the VP in the same manner ((23d)).

- (23) a. *Gäi* 'have': $\langle \{\}, \{\mathbf{have}(x, y)\}, \{\}\rangle$
 b. *Gäi-ga* 'have-pet': $\langle \{\}, \{\mathbf{have}(x, z), \mathbf{pet}(z)\}, \{\}\rangle$ (after Unification)
 c. *Gäi-ga un ga'lagu* 'have a pet dog':
 $\langle \{u_w\}, \{\mathbf{have}(x, u_w), \mathbf{pet}(u_w), \mathbf{dog}(u_w)\}, \{u_w\}\rangle$ (after A-Instantiation)

¹⁶ It is less obvious to us that D-Instantiation can be abandoned in the case of necessarily quantificational DPs. Interestingly for what follows, it is not obvious that necessarily quantificational determiners are permitted in idiomatic constructions. It seems impossible to interpret *pull each string* idiomatically unless in prior discourse *string* has already been used to identify sources of influence. We set aside necessarily quantificational DPs here.

¹⁷ In this respect we extend the standard DRT notation in which DRSs are represented as ordered pairs of sets of discourse referents and descriptive content conditions. See e.g. Geurts, et al. (2016).

- d. *Gäi-ga' un ga'lagu ennao na patgun* ‘That child has a pet dog’:
 $\langle \{u_w, u_v\}, \{\mathbf{have}(u_v, u_w), \mathbf{pet}(u_w), \mathbf{dog}(u_w), \mathbf{child}(u_v)\}, \{u_w\} \rangle$
 (after Argument-Instantiation)

However, if we follow Farkas & de Swart’s proposal that Secondary Instantiation “is not tied to a particular point in the derivation”, another derivation is possible: We could first perform Unification of thematic arguments on *Gäi-ga'* and *un ga'lagu*, and then subsequently perform Secondary Instantiation on the thematic argument of *un ga'lagu* and, along with it, the verb, as in (24):¹⁸

- (24) a. *Gäi-ga'* ‘have-pet’: $\langle \{\}, \{\mathbf{have}(x, z), \mathbf{pet}(z)\}, \{\}\rangle$
 b. *un ga'lagu*_[sg] ‘a dog’: $\langle \{\}, \{\mathbf{dog}(w)\}, \{u_w\} \rangle$
 c. *Gäi-ga' un ga'lagu* ‘have a pet dog’: $\langle \{\}, \{\mathbf{have}(x, w), \mathbf{pet}(w), \mathbf{dog}(w)\}, \{u_w\} \rangle$
 (after Unification)
 d. *Gäi-ga' un ga'lagu* ‘have a pet dog’:
 $\langle \{u_w\}, \{\mathbf{have}(x, u_w), \mathbf{pet}(u_w), \mathbf{dog}(u_w)\}, \{u_w\} \rangle$ (after Secondary Instantiation)

Distinguishing thematic arguments from discourse referents provides us with a mechanism for capturing the disconnect of the determiner from the rest of the DP and for capturing semantic selection of N by V in the syntactic analyses of idioms. As long as the object of an idiomatic expression has a presupposed referent, the only challenge will be to guarantee that the descriptive content conditions that accompany the referents are appropriately specified. However, achieving this is not trivial. To make this clearer, consider an analysis like (22)-(23) for *pull some strings*. First, we treat *some* as a non-quantificational determiner that introduces descriptive content and (like the indefinite article) a novelty condition. To deal with the speaker-presupposed discourse referent that arguably accompanies it, we introduce a version of Unification for nominal modification.¹⁹

- (25) **Unification for modification:** Replace the relevant thematic argument x of a modifier with the thematic argument y contributed by the predicate it modifies. Eliminate any speaker-presupposed discourse referent associated with the modifier.

With this rule in hand, we can derive *pull some strings* as in (26):

- (26) a. *pull*: $\langle \{\}, \{\mathbf{pull}(x, y)\}, \{\}\rangle$
 b. *some*: $\langle \{\}, \{\mathbf{some}(w)\}, \{u_w\} \rangle$ (+ Novelty condition)
 c. *strings*: $\langle \{\}, \{\mathbf{strings}(z)\}, \{u_z\} \rangle$
 d. *some strings*: $\langle \{\}, \{\mathbf{strings}(z), \mathbf{some}(z)\}, \{u_z\} \rangle$ (after Unification for modification)
 e. *pull some strings*: $\langle \{\}, \{\mathbf{pull}(x, z), \mathbf{strings}(z), \mathbf{some}(z)\}, \{u_z\} \rangle$
 (after Unification of thematic arguments)
 f. *pull some strings*: $\langle \{u_z\}, \{\mathbf{pull}(x, u_z), \mathbf{strings}(u_z), \mathbf{some}(u_z)\}, \{u_z\} \rangle$
 (after Secondary Instantiation)

We must ensure that the conditions encoded in **strings** concern something like influence,

¹⁸ We should point out that Farkas & de Swart only do Unification followed by Secondary Instantiation in cases where there are syntactic reasons to consider that incorporation applies despite the presence of number on the incorporated nominal. They consider such a use of Secondary Instantiation as a kind of last resort accommodation. Our proposal could be considered a considerable departure from theirs in this respect.

¹⁹ It should be possible to make a general Unification rule that subsumes (16) and (21), but we leave this for another occasion.

rather than those that identify the physical object we call ‘string’.²⁰ Nothing in what we have seen so far suggests how this non-transparent interpretation arises. For this, we extend a recent semantics developed in McNally (to appear) and McNally & Boleda (to appear) for kind-level nominal descriptions.

3.3. Handling the non-transparency of descriptive content composition: Insights from the layered DP and distributional semantics

Our proposal originates in Zamparelli’s (1995) proposal that determiner phrases (DPs) have a layered structure featuring what he called a *kind phrase* (KIP), a *predicative determiner phrase* (PDP), and a *strong determiner phrase* (SDP), as in (27):

(27) [SDP every [PDP two [KIP weeks]]]

Zamparelli was especially interested in accounting for “stacked” determiners such as *every two*; our interest is mainly in the distinction between KIP and higher layers. Crucially, Zamparelli (1995:196) argued that all common nouns project into the syntax as kind phrases and “denote individual ‘kinds of objects’ in the domain”, where kinds of objects are modeled following Carlson (1977) as an abstract subsort of the entity domain, related by a realization relation **R** to token, or object-level, entities, which are a distinct subsort in the domain. Zamparelli then used the type-shifting operation KO to convert the kind phrase into a PDP that denotes a set of token entities or subkinds (see Zamparelli 1995:208, where **KIP** stands for the logical translation of the kind phrase; other irrelevant details modified from Zamparelli’s original).

(28) KO(KIP): $\lambda x_o[\mathbf{R}(x_o, \mathbf{KIP})]$

Adapting a proposal in Espinal (2010), where nouns are treated as syntactically numberless in the lexicon and Number is added separately in the syntax, we will use NP instead of KIP, and NumP for PDP.

(29) [DP every [NumP two [NP weeks]]]

However, under Zamparelli’s analysis of nouns as kind-denoting, it is not obvious how restrictive modification within NP to form subkind descriptions is to be effected. For example, McNally & Boleda (2004) argued that the peculiar properties of at least some relational adjectives (e.g. *pulmonary* in (30); see Bally 1944 for the term), including the fact that they must appear closer to the modified noun than other modifiers, can be explained under the hypothesis that that they form complex kind descriptions which are subsequently converted to token-level descriptions that can themselves be modified by token-descriptive modifiers (see also e.g. the discussion in Bouchard 2005).

(30) a. a serious pulmonary infection
b. ??a pulmonary serious infection

The problem is that, as noted, Carlson, and thus Zamparelli, model kinds as (atomic) entities. The only way they enter into semantic composition is as arguments in predication, but the

²⁰ It is less clear that something similar is necessary for **pull** – it depends on how specified the verb’s semantics is. See Spalek (2014) for arguments that verb meanings are highly underspecified and essentially identical across at least some literal and figurative uses.

result of predicating a property of an entity will be a proposition, not another entity. If we treat the modifier (e.g. *pulmonary* in (30a)) as a predicate, we get (31a) (where we translate *pulmonary* as **pulmonary** and the kind-denoting *infection* as **i**), which corresponds to a proposition, rather than to a subkind-denoting expression as we need. If, in contrast, we treat the modifier as some sort of entity similar to the noun, as in (31b), there is no standardly assumed semantic composition rule that will combine them – the only operations that are typically used to combine entities are algebraic ones (e.g. mereological summation), and these will not yield the right result.

- (32) a. **pulmonary(i)**
 b. **p ?? i**

One way around this problem is to treat the noun as denoting not a kind but rather a *property of a kind* which can then be intersectively modified by the adjective; this was McNally & Boleda’s (2004) approach. However, intersective modification provides no insight into how the non-transparency observed in idiom formation could be achieved. Indeed based on similar sorts of complexities involving the semantic composition of descriptive contents, McNally (to appear) proposes to compose nouns and subkind-forming modifiers using a fundamentally different sort of semantics.²¹ The intuition is that modified NPs should not be understood as two separate (intersective) predications of properties to an abstract individual but rather as standing for the output of a more complex operation that is conceptual, rather than referential, in nature. Though there are different ways one could implement this operation, McNally (to appear) and McNally & Boleda (to appear) use a compositional version of distributional semantics, an approach to representing word and phrase meaning with a long history and currently widely used in computational semantics (see Harris 1954, Firth 1957, Landauer & Dumais 1997; see Hanks 2006 for a similar approach in lexicography, and see Baroni, et al. 2014 for an overview that situates distributional semantics in relation to formal semantics as well as for a large number of references to current work in this area).

Though distributional semantic models have rapidly become very sophisticated, we can illustrate the general way they work with a toy model. In these models, the lexical semantics of a content word such as *red* is represented as a vector of co-occurrences of *red* with other content words, as illustrated in the form of a table in the top line of Table 1 (here, for example, the co-occurring words are *bright*, *fiery*, *grapes*, etc.) within a particular window or syntactic configuration (such as the same sentence).²²

	<i>Bright</i>	<i>fiery</i>	<i>grapes</i>	<i>carrot</i>	<i>blood</i>	<i>Meal</i>
<i>red</i>	99	55	41	18	100	1
<i>hair</i>	39	2	0	51	35	0
<i>wine</i>	6	6	79	12	65	150
<i>red hair</i>	148	77	41	69	135	1
<i>red wine</i>	105	57	120	30	165	151

²¹ See also Asher (2011) and ongoing work by Asher and colleagues, and Del Pinal (2015) for other mixed approaches to semantics.

²² There are many parameters of variation in the way these vectors are constructed. These include the size of the window considered, whether or not the co-occurrence vectors are sensitive to the grammatical function played by the co-occurring words (so that e.g. they would count *machine* for *run* differently depending on whether the noun appeared in the subject vs. direct object of the verb), and whether the counts are absolute or relativized to take into account differences in basic frequency of different words. We largely set aside these details in what follows.

Table 1. Toy distributional model for *red*, *hair*, *wine*, *red hair*, and *red wine*.

The intuition is that high co-occurrence values are semantically significant, whereas low co-occurrence values are not. From the vector it is possible to extract a lot of general information about the use of a word and, indirectly, the concept(s) associated with it; for example, by contrasting the vectors for *hair* and *wine*, also in Table 1, we can see that wine has something to do with grapes, but hair does not. In this respect, distributional models contrast sharply with formal lexical semantic representations, which typically focus on the lexical entailments associated with a word.

Note that the distributional representation for a word is generally all-inclusive and not disambiguated; it simultaneously encodes all of the senses of a word – in this respect, the distributional approach is radically different than what is often assumed in formal models of lexical meaning, where words are associated with sets of senses, and any given use is assumed to enter the composition process fully disambiguated. Thus, in the representation of *red* we see that the word has something to do with blood, but also with carrots. This sort of information, together with other co-occurrence information, indirectly encodes the fact that the red of red blood is in fact a different color from the red of carrot red hair (which is, in fact, closer to orange despite the adjective used), without forcing us to list different senses of red. The same mechanism that achieves this will also work for achieving the non-transparency of idiomatic expressions.

Note that the same type of vector representation can in principle be given for any content category, whether noun, verb, adjective or adverb. In contrast, function words (e.g. determiners, auxiliaries) are generally ignored in distributional semantic models because their occurrences are generally not sensitive to specific words but rather strictly to syntactic categories, rendering distributional models of their meaning rather uninformative. This suggests that a distributional semantic model is not likely to be optimal on its own but is arguably better combined with some other sort of semantic model more suited to the treatment of function words (though see Baroni et al. 2014 for brief discussion of this general issue and references to works that take a different view from that adopted here).

Interestingly, vectors can be composed to form other vectors of the same type, through operations such as vector addition or multiplication (or, indeed, much more sophisticated operations). For instance, the last lines of Table 1 show the result of using vector addition to form representations for *red hair* and *red wine*. This toy example shows how this composition process has a narrowing effect on the interpretation of a word: when values for a given component of two combining vectors are both high, that value of that component is strengthened in the result relative to the values of the other components, indicating high semantic significance. For instance, *bright*, *fiery* and *carrot* are all strengthened in *red hair* and comparatively weakened in *red wine*, in line with the fact that these expressions are used in descriptions of the former but not the latter. This, in turn, correlates with the fact that the contribution of *red* in *red wine* is not that of a simple color adjective, which can be intensified, but rather that of a non-gradable classifier (see Kennedy & McNally 2010).

In a directly analogous fashion, compositional distributional semantics provides a very elegant account of the differences in predicate senses that emerge in combination with different arguments (see e.g. Erk & Padó 2008, Mitchell & Lapata 2008), including non-literal senses (e.g. Kintsch 2000). In exactly the same way that the vector for *red* can be added

to that of *wine*, the vector for *pull* can be added to that of *strings*. The effect of associating *strings* with the appropriate participant role is achieved by using syntactic labeling to treat *strings-as-subject/agent* as a different vector component from *strings-as-object/patient*.²³ The accompanying co-occurrence information in the resulting vector for *pull strings* can eventually be used to capture the non-transparency of the idiomatic interpretation (for instance, via a high occurrence of accompanying expressions such as *power*, *influence*, or *pressure*). Let us thus see how we can connect this sort of semantics with the DRT analysis developed in the previous section.

Distributional vectors are effectively saturated objects, insofar as they do not contain anything like argument slots that need to be filled – indeed, they are syntactically inert. However, since they can be interestingly composed, McNally (to appear) suggests that they can help solve the problem associated with creating subkind descriptions illustrated in (32), above. Specifically, she adopts Zamparelli’s (1995) layered DP analysis but models kinds as distributional vectors, rather than atomic entities. Vector composition applies below the level of NP and is computed outside of the logical semantics, the result being introduced as the value of the NP at the level of NumP, as if it were a logical constant. Thus, *pulmonary infection* is derived as in (33), where vectors are represented with all capital letters and **comp(VECTOR1, VECTOR2)** stands for the vector resulting from the composition of **VECTOR1** and **VECTOR2**. Note that the descriptive content condition in (33b) is analogous to the representation in (28) – the result of combining *pulmonary* and *infection* serves as the equivalent of a (sub)kind that can be realized by a token referent – and this condition substitutes for the simple predicative condition used for nouns in section 3.2.

- (33) a. [_{NP} pulmonary infection]: $\langle \{\}, \{\mathbf{comp(PULMONARY, INFECTION)}\}, \{\}\rangle$
 b. [_{NumP}[_{NP} pulmonary infection]]:
 $\langle \{\}, \{\mathbf{R}(x, \mathbf{comp(PULMONARY, INFECTION)})\}, \{u_x\}\rangle$

Only minor modifications are needed to extend this analysis to VPs. First, as long as we assume that there is syntactic information to connect the verb to its complements, we do not need thematic arguments to the same extent as they were used in section 3.2. The job of Unification is taken over by distributional composition as in (34), where the subscript **Ob** on **STRING** indicates **PULL** is combining with the vector for *strings* marked as an object.²⁴ The output of (34) is effectively an event subkind description entirely analogous to the one proposed for *eat cake* by Carlson (2003), in (15), above.

- (34) **comp(PULL, STRING_{Ob})**

The inner workings of the composition operation will guarantee that *pull strings* can be interpreted idiomatically.²⁵

²³ Though various options are possible, to account for passives, where grammatical function and thematic role are aligned differently, such a system would probably rely on distinguishing the participial form of the verb from non-participial forms.

²⁴ Thus, in this particular set-up, the representation for *strings* when used as a subject will be (perhaps inelegantly) different from that when it is used as an object. Like many other aspects of the syntax-semantics interface of distributional modeling, there are alternatives to this set-up, but we must leave discussion of them for another occasion.

²⁵ In fact, it will not disambiguate between the idiomatic and non-idiomatic interpretations, just as we noted above that the lexical entry for *red* does not disambiguate the different shades that correspond to this color or its use as a classifier (e.g. for wine). Other material that is subsequently combined with the phrase will eventually permit full disambiguation.

The remaining crucial steps are the following. First, we must adapt our lexical entries for content words to take into account the fact that they consist of vector representations, rather than predicates. We must allow these vectors to combine, on the one hand, and be able to connect them to DRS conditions that guarantee that the descriptive content is appropriately realized by token discourse referents. Note that we need a discourse referent not only corresponding to *strings*, but also for the entire event (sub)kind description, at least in the case of finite sentences containing such descriptions: as observed at the end of section 2.3, the function of finite inflectional morphology is to anchor an event description to a particular event in space and time. We will therefore need to introduce a realization relation with which to link a token discourse referent to descriptive content not only for the nominal but also for the entire VP.

To illustrate how this might work, we recast and extend the analysis of (26) for the full sentence in (35).

(35) The politician pulled some strings.

We will slightly revise our lexical entries and the Unification (of thematic arguments) rule. Lexical entries for content words will now be quadruples, rather than triples, the new element being the vector contributed by the word or phrase in question.²⁶ Not all words introduce such vectors; specifically, we will assume that contentful determiners such as *some* simply impose extensional conditions on the cardinality of the discourse referents they are eventually associated with – the intuition being that words like *some* do not describe kinds of things, properties or situations.

If verbs, like nouns, introduce syntactically inert kind descriptions, the thematic argument information we saw associated with them before will be lacking in their logical representation. The Unification rule that previously operated on thematic arguments will therefore have to be replaced by vector composition.²⁷ The connections between the eventual discourse referent for the event described by the verb and those of the participants, previously captured by Unification, will follow from the accumulation of DRS conditions and the effect of vector composition. We only need to make one final assumption: the individuals that realize the descriptive contents contributed by nouns and verb on their own must be compatible with the complex description resulting from vector composition. Thus, we can see the final component of the tuple as contributing a kind of understood contextualization of the verb and noun meanings, as a point to which we return in the conclusions. Finally, secondary Instantiation can take place as before.

- (36) a. *pulled*: $\langle \{\}, \{\mathbf{R}(e, \mathbf{PULL})\}, \{u_e\}, \{\mathbf{PULL}\} \rangle$
 b. *some*: $\langle \{\}, \{\mathbf{some}(y)\}, \{u_y\}, \{\}\rangle$ (+ Novelty condition)
 c. *strings*: $\langle \{\}, \{\mathbf{R}(z, \mathbf{STRING})\}, \{u_z\}, \{\mathbf{STRING}\} \rangle$
 d. *some strings*: $\langle \{\}, \{\mathbf{R}(z, \mathbf{STRING}), \mathbf{some}(z)\}, \{u_z\}, \{\mathbf{STRING}\} \rangle$
 (after Unification for modification)
 e. *the politician* $\langle \{\}, \{\mathbf{R}(x, \mathbf{POLITICIAN})\}, \{u_x\}, \{\mathbf{POLITICIAN}\} \rangle$

²⁶ Note that we need to separate this contribution from the DRS conditions insofar as it is not propositional in nature.

²⁷ Though we were not explicit about this previously, vector composition can be modeled as a recursive process.

- (+ Familiarity condition)
- f. *pulled some strings*: $\langle \{\}, \{\mathbf{R}(e, \mathbf{PULL}), \mathbf{R}(z, \mathbf{STRING}), \mathbf{some}(z)\}, \{u_e, u_z\}, \{\mathbf{comp}(\mathbf{PULL}, \mathbf{STRING}_{\mathbf{Ob}})\} \rangle$ (after vector composition)
- g. *the politician pulled some strings*:
 $\langle \{\}, \{\mathbf{R}(x, \mathbf{POLITICIAN}), \mathbf{R}(e, \mathbf{PULL}), \mathbf{R}(z, \mathbf{STRING}), \mathbf{some}(z)\}, \{u_e, u_z, u_x\}, \{\mathbf{comp}(\mathbf{POLITICIAN}_{\mathbf{Su}}, \mathbf{comp}(\mathbf{PULL}, \mathbf{STRING}_{\mathbf{Ob}}))\} \rangle$
 (after vector composition)
- h. *the politician pulled some strings*: $\langle \{u_e, u_z, u_x\}, \{\mathbf{R}(u_x, \mathbf{POLITICIAN}), \mathbf{R}(u_e, \mathbf{PULL}), \mathbf{R}(u_z, \mathbf{STRING}), \mathbf{some}(u_z)\}, \{u_e, u_z, u_x\}, \{\mathbf{comp}(\mathbf{POLITICIAN}_{\mathbf{Su}}, \mathbf{comp}(\mathbf{PULL}, \mathbf{STRING}_{\mathbf{Ob}}))\} \rangle$
 (after Secondary Instantiation)

Obviously, this is just a first attempt at combining distributional semantics with DRT at the level of the clause; there are other ways this might be implemented (see e.g. Garrette, et al. 2011 for a different sort of proposal with different objectives). We hope it makes clear how the intuition behind Sportiche's (2005) syntactic account of determiner intervention in idioms can be captured in an otherwise largely independently motivated semantics and that it inspires further investigation into alternative, perhaps simpler, representations.

4. Conclusion

Our discussion of the compositional problem posed by idiomatic expressions such as *pull some strings* has taken a circuitous route from our initial reflections on the syntactic proposals by Sportiche (2005) and Cecchetto & Donati (2015). Though these proposals look quite odd if we think of tree structures as a reflection of morphosyntactic structure, our excursus into the relation between syntax and logical form and then into DRT places them in a different perspective.

Specifically, we took these proposals as a reflection of a well-known and quite general problem: verbs select for the descriptive content of nouns not just in idioms but rather quite generally, whereas determiners and other elements are not selected for in the same way but rather are added later on (in some syntactic proposals as adjuncts, or through movement of N to D, out of the VP etc.). We then connected this phenomenon to analyses of the syntax-semantics interface that use two levels of representation (often connected derivationally), and in which verbal and nominal descriptive content plays a double role. First, nominal descriptive content serves to restrict verbal descriptive content to form complex event (sub)kind descriptions: this is so both for idioms (*pull strings*) as well as for more or less fixed and non-idiomatic V-N combinations (such as *ride a bike* and *pull a cart*, respectively). We proposed using distributional semantics for this part of the composition process because of its ability to generate non-transparent interpretations.

Second, both verbal and nominal expressions are embedded under functional structure (Aspect, Number) that we take to be responsible for instantiating events / individuals and for the introduction of discourse referents for both. We suggested that even though it is commonly assumed that a full DP is built before it is introduced as an argument in the complement position of V, the instantiation of both the discourse referent for the event described by the VP and the individual discourse referent licensed by Number or the determiner should go hand in hand and take place after the VP is composed. This is precisely what the systems of Diesing (1992), Carlson (2003), Sailer (2004), and Sportiche (2005) all

try to achieve in slightly different ways in representing (the import of) D separately from (that of) N. We further observed that the obligatory movement of finite verbs illustrated in section 2, which authors like Diesing & Jelinek (1995) connect to the movement of referential pronouns and DPs out of the VP, could be seen as a way of moving the verb to a level at which the event can get instantiated (at Asp or in the domain of IP or TP) and a discourse referent for the event is introduced. The parallels between this proposed movement and our semantic proposal should now be evident.

The analysis we sketch at the end of section 3 is not compositional in the usual sense, insofar as we take a speaker presupposition to license Secondary Instantiation – eventually recast as the introduction of token individuals and events that realize kind-level descriptions – and the point at which this happens does not have to respect strict morphosyntactic constituency. Whether this is a problem or not is a matter that must be left for future research, but to close we offer a final comment that we hope will encourage deeper thought about this aspect of the analysis.

Sportiche (2005:83) observes:

One might object to the very idea that there should be any syntactic reflex of V-N semantic selection because the selection could be recovered in some alternative way. One such way involve[s] presupposition (Fox, p.c., Spector, p.c.). Roughly, the idea would be as follows: there are independently attested observations about presupposition projection, which will account for the V-N selection facts if observed selectional patterns arise as a result of presupposition projection. For example, “Every N is intelligent” presupposes that such Ns are animate. And more generally “Det NP VP” presupposes that every NP satisfies the presuppositions of VP.

It is, of course, well known that the basic sortal restrictions imposed by a verb on its complements are not at issue, unlike the matter of which specific individual(s) participate in the actual situation described by the verb. Perhaps less obvious is the fact that when we use a polysemous verb, the choice between the relevant sense of the verb and irrelevant senses is typically not at issue. For instance, if I deny that I cut my finger, I am typically not denying that my finger is something that can take an incision. Similarly, I am not denying that what cutting would involve with a finger is making an incision in it, as opposed to some other action that could be described by the verb, such as reducing or stopping (see Spalek 2014). It may be, then, that the details of the composition of the complex descriptive contents we propose to compose via distributional semantic methods belong in a separate semantic dimension (in the sense of Potts 2005) from the ascription of those contents to discourse referents. In this case, the appropriately disambiguated components of the idiom could be inserted in the at issue dimension of the semantics where they belong, and composition could proceed as is generally assumed.

Finally, under our analysis the semantic composition of the descriptive contents associated with V and N quite systematically involve narrowing down the meaning potential of each component to fit the contribution of the other. In this respect, idioms are merely a special case in which we very consciously observe how much the content of each component is modulated; we are simply less conscious of this narrowing down for other V-N combinations. Thus, idioms are just one extreme of a continuum from fixed V-N combinations to less fixed ones (like *ride a bike*, related to incorporated forms such as *bike ride*, which often show some degree of non-transparency) to combinations that are commonly not analyzed as idioms, such

as *cut my finger*.

Weinreich (1969:42) defined idioms as follows: “A phraseological unit that involves at least two polysemous constituents, and in which there is a reciprocal contextual selection of subsenses, will be called an idiom.” But in light of the preceding observations, idioms are no different from any other combination of words – they are simply more spectacular.

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