Grammatical alignments and the gradience of lexical categories

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1 Introduction

The notion of part of speech dates back at least to 5th century BC Sanskrit grammar (Matilal, 1990, ch.3) and is adopted in one form or another by most current linguistic theories. In spite of this, no objective definition for part of speech labels has ever been put forth (Croft, 1984, 2001; Langacker, 1987; Aarts, 2007). The present work explores the idea that parts of speech and their syntactic distribution may be the result of language-specific alignments of several linguistic aspects: meaning (in terms of actions, individuals, or properties), semantic function (i.e. predicates, arguments, and modifiers), and morphosyntactic properties. Since Sign-Based Construction Grammar (Sag, 2010, 2012) is in an ideal position to capture such alignments in terms of fine-grained featural and constructional specifications, a grammar fragment of English is formulated along these lines, with the goal of obtaining a linguistic model where the various phrasal classes of English emerge without appeal to part of speech labels of any kind. Of special interest are the various environments which tolerate a wide range of syntactic categories, such as predicative structures and 'coordination of unlikes' phenomena.

It has long been recognized that one of the remarkable traits of predicative phrases is that they can be instantiated by a wide range of different categories. For example, verbs like *be* and *remain* allow for NP, AP, PP, and VP complements as shown in (1).

(1) He is [tall]/[in Peru]/[a teacher]/[singing]/[endorsed by Nike].

As is well-known, this kind of syntactic flexibility is by no means limited to predicative environments. The complement of (2a) can be an NP or a PP, as long as it denotes a location, and the complement in (2b) can be an NP, an AdjP, or a PP, as long as it denotes a period of time. Similarly for the PP and the adjectival passive VP in (2c), which can be modified by *very* as if they were adjectival phrases instead.

(2) a. The magician emerged from [behind the curtain]/[the box].
(Huddleston and Pullum, 2002, 599)

b. The meeting lasted [two hours]/[much too long]/[until noon].
(attributed to Jane Grimshaw in Jackendoff 1985, 280)

c. I didn't know about it [until [recently]/[May]/[the wedding]].

d. I feel very [loved by everybody]/[in touch with myself]/[happy about that].

Similarly, English subject phrases allow a wide range of different categorial instantiations as illustrated in (3). For more data and discussion, see Crystal (1967), Ross (1972, 1973), Langacker (1987), Huddleston et al. (2002b, 1327), and Aarts (2007).

(3) a. [To prove the theorem] would be a pleasure.

b. [That John quickly proved the theorem] astonished everyone.

c. [For John to have quickly proved the theorem] made no sense.

d. [John quickly proving the theorem] astonished everyone.

e. [John's quickly proving the theorem] astonished everyone.

f. [John's quick proving of the theorem] astonished everyone.

g. [The proving of the theorem (by John)] astonished everyone.

These data suggest that sometimes selection is governed by semantics rather than by morphosyntax. In other cases, however, the role of semantics is smaller and more formal selection constraints are at work. This is illustrated by the contrast between (4) and (5). Even though these verbs are near-synonymous, the complementation patterns differ.

(4) a. Robin disposed *(of) the batteries.

b. Robin discarded (*of) the batteries.

(5) a. Kim relies *(on) Robin.

b. Kim trusts (*on) Robin.

Analogously, near-synonymous adjectives like *sick* and *ill* differ because of their morphosyntactic features: *sick* can be used in comparative and superlative forms, but *ill* cannot (e.g. **iller*, **more ill* and **illest*). Yet, both adjectives can be predicative and be suffixed by *-ness*. A similar disparity is observed in pairs like *alive*/*living* and *drunken*/*drunk*.

In general, one cannot determine the distribution of a sign solely as a function of its meaning. Morphosyntactic properties often play a crucial role. Some nouns have verbal semantics (e.g. *movement*, *kiss*, *earthquake*), and others have adjectival semantics (e.g. *strength*, *whiteness*, *size*). For example, the noun *hunger* (as in *the hunger for trivia*), and the homophonous verb (in *they hunger for trivia*) are essentially synonymous and yet differ in their distribution. This is determined by morphosyntactic properties, not by semantics. See Aarts (2007) for more examples in other lexical categories of English.

The point is that a balance between morphosyntactic and semantic constraints must be struck. Some environments impose mostly semantic constraints, others impose mostly morphosyntactic constraints, and others still impose a blend of both semantic and morphosyntactic constraints. This view is amply supported cross-linguistically. As Van Valin (2008) notes, although all languages have expressions for referring and expressions for predicating, they come with different alignments of syntactic, semantic, and morphological features. Some languages have sharply differentiated lexical categories because of little semantic/morphosyntactic feature overlap, while others do not.

Theories like Head-driven Phrase Structure Grammar (Pollard and Sag, 1994) and Sign-Based Construction Grammar (Sag, 2010, 2012) are in an ideal position to formalize the intuition that categories and fine-grained distributional patterns can be modeled via sets of morphosyntactic and semantic constraints, without resorting to part of speech labels. In this rather speculative paper, I explore such an approach, and show how such an account could be formulated.

1.1 Coordination of unlike categories

Ideally, a unified account of the data discussed above should also provide a handle on so-called coordination of unlikes phenomena. Consider for example (6) and (7), from Gazdar et al. (1985), Bayer (1996), Huddleston et al. (2002a) and others. Such data raise the old problem of determining what is the part of speech and categorial status of the bracketed constituents, as well as the properties that the coordination phrase retains from each conjunct.

(6) a. Kim is [alone and without money].
[AP & PP]

b. Pat is [a Republican and proud of it].
[NP & AP]

c. Jack is [a good cook and always improving].
[NP & VP_{ger}]

d. What I would love is [a trip to Fiji and to win $10,000].
[NP & VP_{inf}]

e. That was [a rude remark and in very bad taste].
[NP & PP]

f. Pat was [awarded the Ig Nobel Prize and very upset about it].
[VP_{pas} & AP]

g. I am [expecting to get the job and of the opinion that it is a desirable one].
[VP_{ger} & PP]

h. Oprah is [a woman, rich, and in the lucky position of owning a castle].
[NP & AP & PP]

(7) a. Chimpanzees hunt [frequently and with an unusual degree of success].
[AdvP & PP]

b. I'm planning [a four-month trip to Africa and to return to York afterwards].
[NP & VP_{inf}]

c. I remembered [the appointment and that it was important to be on time].
[NP & CP]

d. I remembered [reading about you in the papers and that you lived in NY].
[VP_{ger} & CP]

e. [That Himmler appointed Heydrich and the implications thereof] frightened many observers.
[CP & NP]

f. [The danger involved and that the wiring had to be replaced] were clearly explained in the electrician's technical report.
[NP & CP]

It is clear that coordination does not simply compute the intersecting properties. As Jacobson (1987) pointed out, verbs like *remain* are compatible with both AdjP and NP complements whereas *grew* is only compatible with AdjPs. This is shown in (8). Crucially, however, the information associated with the phrase *wealthy and a Republican* somehow allows *grew* to detect the presence of the nominal, as (9a) illustrates, even when the verbs are coordinated, as in (9b–d)

(8) a. Kim remained/grew wealthy.

b. Kim remained/*grew a Republican.

(9) a. Kim remained/*grew [wealthy and a Republican].

b. Kim grew and remained wealthy.

c.*Kim grew and remained a Republican.

d.*Kim grew and remained [wealthy and a Republican].

A number of influential accounts in Type-logical grammar (Morrill, 1990, 1994; Bayer, 1996) have used one of the rules of inference from propositional calculus in order to deal with coordination of unlikes phenomena, namely, disjunction introduction (or addition): from P one can infer $P \vee Q$. Thus, by assuming that categories like NP, PP and so on can also be disjunctive, the grammar allows an expression of type 'NP' to lead a double life as an 'NP $\vee$ PP' expression, or the type 'AP' to be taken as an 'AP $\vee$ PP $\vee$ NP' and so on.[1] This account is only possible if one accepts the existence of part of speech labels in the first place. In this work, I follow Croft (2001), Van Valin (2008) and others in assuming that such labels are artificial and unnecessary. In that view, what is needed is a fine-grained characterization of categories in terms of independently motivated morphosyntactic and semantic properties. The goal is to identify what are the key linguistic factors that allow apparently different categories to be conjoinable.

1.2 On left-periphery ellipsis

Crysmann (2000), Yatabe (2002), Beavers and Sag (2004) and others argue that coordination of unlikes can be explained by a deletion operation that omits the left periphery of non-initial conjuncts. In that view, (6) and (7) are verbal coordinations where the verb (or the verb and the subject) has been deleted (e.g. *Kim is alone and ~~is~~ without money*). This analysis is independently motivated by data like (10).

(10) a. Tom gave a book to Mary, and ~~gave~~ a magazine to Sue.

b. He drinks coffee with milk at breakfast and ~~drinks coffee with~~ cream in the evening. (Hudson, 1984)

c. There was one fatality yesterday, and ~~there were~~ two others on the day before.
(Chaves, 2007, 339).

d. I see the music as both going backward and ~~going~~ forward.
[http://pdxjazz.com/dave-holland; 20 December 2010]

However, left-periphery ellipsis cannot fully explain coordination of unlikes phenomena. First, nothing explains the subject-verb agreement of (7f), repeated in (11).

(11) [The danger involved and that the wiring had to be replaced] **were** clearly explained in the electrician's technical report.

[1]See also Daniels (2002), Sag (2002) and Yatabe (2004) for related accounts.

Second, the data in (12) cannot be viewed as involving ellipsis.[2]

(12) a. Simultaneously shocked and in awe, Fred couldn't believe his eyes.

b. Both tired and in a foul mood, Bob packed his gear and headed North. (Chaves, 2006)

c. Both poor and a Republican, *no one* can possibly be.

d. Dead drunk and yet in complete control of the situation, *no one* can be. (Levine, 2011)

Further problems for an ellipsis account of coordination of unlikes phenomena are posed by the position of the correlative coordinators *both*, *either* and *neither* in (13).

(13) a. Isn't this both illegal and a safety hazard?

b. It's both odd and in very poor taste to have a fake wedding.

c. Who's neither tired nor in a hurry?

d. Isn't she either drunk or on medication?

If (13a) is an elliptical coordination like *isn't this both illegal and ~~isn't this~~ a safety hazard*, then the location of *both* is unexpected. Instead of occurring before the first conjunct, it is realized inside the first conjunct. Crucially, the non-elided counterparts are not grammatical, e.g. **isn't this both illegal and isn't this a safety hazard?* The same issue is raised by (13b,c). In an elliptical account one would have to stipulate that *both* can only float in the presence of ellipsis, which is unmotivated. In sum, left-periphery ellipsis does not offer a complete account of coordination of unlikes.

1.3 Goals of this paper

The main goal of this paper is to explore how linguistic categories can emerge implicitly – without part of speech labels – from independently motivated morphosyntactic and semantic constraints. For example, in this view, any sign with valent arguments that describes an eventuality and has the potential for verbal inflection will have verbal distribution. Similarly, any sign that describes entities conceptualized as entities, and that is capable of bearing case and of inflecting for number will have a nominal distribution. Argument classes emerge as a consequence of the constraints imposed by the governing heads. For example, verbs like *devein* and *diagonalize* are well-known to impose extremely specific constraints on their valents, as shown in (14) from McCawley 1968.

[2]Levine (2011) offers arguments against the coercion account of Chaves (2006), and against the existence of left-periphery ellipsis. See Yatabe (2012) for a reply.

(14) a. Mia deveined the shrimp / *duck.

b. Tom diagonalized the matrix / *equation.

In contrast, verbs like *be* and *remain* impose very few morphosyntactic and semantic constraints on their valents and therefore can combine with many kinds of phrases. Hence, a wide range of phrases have similar distributions if they share the relevant morphosyntactic and semantic constraints that are required by the selecting head. The degree of cross-categorial distributional overlap in coordinate and in non-coordinate environments therefore follows from fine-grained morphosyntactic and semantic constraints that are associated to a sign.

The structure of the paper is as follows. In §2, I lay out a variant of Sign-Based Construction Grammar where grammatical labels play no role, and in §3, I focus on coordination of unlikes phenomena.

2 A grammar fragment

The feature geometry adopted in this work draws from Sign-based Construction Grammar (Sag, 2010, 2012) with various modifications. Perhaps the most significant change is that various features that would be only appropriate for signs of a given part of speech are now appropriate for all signs. The advantage of this move is that all signs boil down to the same repertoire of features, and therefore will be able to conjoin as long as they have compatible information. The adopted feature geometry is shown in Figure 1. The adopted features are assumed to be appropriate for English, but not necessarily appropriate for other languages. As usual, the PHON(OLOGY) feature pertains to the representation of phonology and CONTEXT to pragmatics. These dimensions will not be addressed in the present work.[3]

2.1 Syntactic features

The feature SYN(TAX) specifies syntactic information. Let us first focus on the CAT feature. The grammar adopted here differs from previous HPSG/SBCG work in that there are no types for parts of speech and the features in CAT are appropriate for all signs. The type *category* is maximal, and therefore has no subtypes. This eliminates the problem of deciding what features are appropriate for the mother node of a coordination of unlike categories. All features are appropriate. Note that CAT information need not be explicitly enumerated in listemes. As usually assumed in HPSG, similar lexemes can be clustered in an Hierarchical Lexicon and

[3]See Engdahl and Vallduví (1994), Kuhn (1996), Klein (2000), Koenig (1999), Orgun (2000), Haji-Abdolhosseini (2003), Gundel (2003), and Wilcock (2005). Also not discussed are unbounded dependencies; see Levine and Hukari (2006), Sag (2010), Chaves (2012) and references cited.

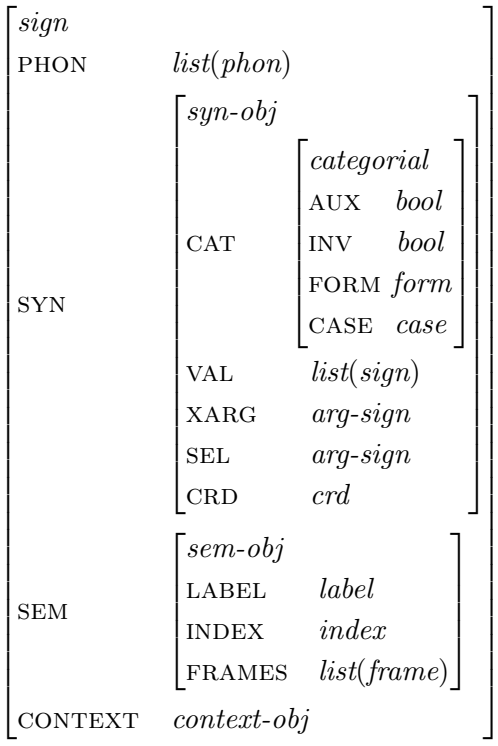


Figure 1: Feature geometry for signs

their featural specifications can be determined by various principles with different generality.

Following Sag (2012), the feature AUX specifies if the sign occurs as the head of auxiliary constructions.[4] Since AUX provides information about the environment of the sign rather than about the sign itself, non-auxiliary verbs are always specified as [AUX–], and auxiliary verbs other than unstressed *do* are underspecified. The result is that the distribution of auxiliary and non-auxiliary verbs is distinct but overlaps in some cases. As hinted at above, all non-auxiliary verbs and all non-verbal signs are [AUX–].[5] The feature INV specifies if the sign occurs as the head of certain inversion constructions. As Sag (2005) shows, all four combinations of [AUX+/] and [INV+/−] are attested in English. I assume that all signs other than certain non-auxiliary verbs are lexically specified as [INV−].[6]

[4]That is, sentential negation, contraction, VP-Ellipsis or subject-auxiliary inversion constructions (Fillmore, 1999), such as *Has he left?*, *Am I tired!*, *May you live long and prosper*, and *Had he been on time, John would have made it to the concert.*

[5]Allowing AUX to be available to non-verbal signs could provide a uniform account of VP/N-Ellipsis in terms of a single rule (Jackendoff, 1971; Beavers, 2003).

[6]In languages like Kiowa, however, determiners are underspecified for INV and therefore can occur to the right or to the left of the nominal (Adger et al., 2009, 8).

The feature FORM identifies the tense/voice inflectional class of the sign. The type *form* has the usual subtypes *bare*, *fin*, *psp*, *inf*, *prp*, *pass*, and *none*. All *-ing* forms are systematically typed as *prp* (present participle) (Huddleston and Pullum, 2002, 82). The type *none* is reserved for signs without any kind of verbal inflection. The value of the feature CASE can be *nom*(*inative*), *acc*(*usative*), *gen*(*itive*) or *none*. Nouns and gerundial forms are underspecified for CASE, and personal pronouns have inherent case along the lines of Levine et al. (2001). All other signs are [CASE *none*], and therefore cannot be assigned case. Thus, in this theory a sign can have a verbal suffix *-ing* and yet inflect for number and obtain structural case as in [*the sightings of UFOs*] *were too frequent to ignore*.

The VAL(ENCE) records the syntactic valents of the sign, and (E)X-(TERNAL) ARG(UMENT) singles out a distinguished argument that can be accessed from outside the projected phrase (Williams, 1980; Sag and Pollard, 1991; Meurers, 1999). For example, in English there is strong evidence that subjects must be visible from outside their clause (Bender and Flickinger, 1999; Levine, 2001). See §2.5 for more discussion about XARG. The feature SEL(ECT) enables non-heads (such as modifiers and markers) to impose constraints on the heads they combine with. The type *arg-sign* subsumes the types *none* and *sign*. The former indicates that the feature value is null.

Finally, drawing inspiration from Beavers and Sag 2004, the marking feature CRD distinguishes coordinator lexemes like *and* and *or* (and signs marked by such markers) from all other signs. All coordinator lexemes have a specific CRD value, and all non-coordinate signs below are assumed to be specified as [CRD –].

2.2 Semantic features

The feature SEM(ANTICS) specifies semantic content and essentially follows the accounts proposed in Copestake et al. 2005 and Sag 2012. The type *frame* corresponds to a semantic predication formed by a relation feature called RELN and its arguments, as in Fillmore et al. 2003. The feature LABEL singles out the label of the main semantic frame of the sign, and INDEX singles out the main index. For convenience, I abbreviate semantic representations as in (15).

(15) a.

$$[l : cat(x)] \qquad \text{abbreviates} \qquad \begin{bmatrix} \textit{frame} & \\ \text{LABEL} & l \\ \text{RELN} & \textit{cat} \\ \text{ARG} & x \end{bmatrix}$$

b.

$[l_1 : \forall x(l_2 \rightarrow l_3)]$ abbreviates $\begin{bmatrix} \textit{frame} & \\ \text{LABEL} & l_1 \\ \text{RELN} & \forall \\ \text{ARG}_0 & x \\ \text{ARG}_1 & l_2 \\ \text{ARG}_2 & l_3 \end{bmatrix}$

Following Pollard and Sag (1994), the value of INDEX is either a referential index *r-index* or a dummy *it* or *there* type. A referential index is essentially an unsorted variable that can in principle correspond to any kind of individual or eventuality. Crucially, it is assumed in this work that the difference between an eventuality and an individual is a matter of degree, and that indices can sometimes correspond to entities that have both individual- and eventuality-like properties. Alternatively, the reader may prefer to assume that referential indices are sorted in a fine-grained conceptual ontology like the one in Asher 2011. Some sorts are reserved for concrete individuals, other for abstract individuals, others for mixed individual-eventuality entities, and others still for various types of eventualities. The key point is that referential indices are assumed to correspond to a spectrum of entities with varying ontological status (see §2.3 below). Finally, I assume that agreement features are appropriate for all referential indices, but are lexically specified to be null for indices describing finite tense eventualities.

Finally, a clausal root can be defined as in (16), with no appeal to parts of speech. Basically, a root clause is an unmarked independent clause with finite verbal inflection, no case, no unsaturated valents, and no selected dependents. I assume that finite CPs cannot function as root clauses for semantic reasons, as discussed in §2.7.

(16)

S_{root} abbreviates $\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix} \text{FORM} & \textit{fin} \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL} & \langle\,\rangle \\ \text{SEL} & \textit{none} \\ \text{CRD} & - \end{bmatrix} \end{bmatrix}$

2.3 Analytical metaphysics and semantic selection

Following Givón (1984, 51), Link (1998b) and others, I assume that the difference between individuals and eventualities is one of degree, based on the properties that the corresponding concepts individuate. This means that the linguistic indices used in semantic representations can correspond to entities which have both individual-like and eventuality-like properties. There is a long tradition of viewing concepts

in terms of fine-grained primitives in linguistics (Wierzbicka, 1972, 1996, 2006; Katz and Fodor, 1963; Hjelmslev, 1975; Andersen, 1974; Keenan and Faltz, 1985; Langacker, 1987; Link, 1998b; Croft, 2001; Cruse, 2004), in psychology (Collins and Quillian, 1972; Rosch, 1973; Rosch and Mervis, 1975; Smith and Medin, 1981; Medin, 1989; McRae et al., 1997; Cree and McRae, 2003; McRae et al., 2003, 2005) and in artificial intelligence (Minsky, 1975; Norman and Rumelhart, 1975).[7] One can view such primitives as features forming a conceptual space, as in the theory of conceptual representations of Gärdenfors (2001), the vector models of memory of Murdock (1982); Hintzman (1986), and current connectionist models of object recognition (Plaut, 2002), word recognition (Harm and Seidenberg, 2004), and semantic memory (Hinton and Shallice, 1991; Plaut and Shallice, 1993). For my purposes, it suffices to assume that lexical meaning is associated to particular regions in such conceptual space and that the emergent conceptual classes can overlap. To be clear, I am not concerned with the physical structure of the world here, but rather, with our thoughts about the world. All concepts are abstract by definition and therefore their conceptualization and individuation does not always reflect actual physical properties.

Following Givón (1984, 51), Link (1998b), and Gärdenfors (2001, 167, 193–195), I take two of the defining conceptual features of individuals to be *stability* and *reference*. Individuals are conceptualized as having intrinsic properties that apply continuously during their existence and which can be referenced by other linguistic expressions. In Link's terms, their existence is attributed to an intrinsic causal continuity, not to a series of individuals. Conversely, the persistence attributed to an eventuality is due to an iteration of eventualities.

Non-stative eventualities are conceptualized as dynamic manifestations which require intrinsic change. Such non-stative eventualities can sometimes be anaphorically referenced (e.g. *I cheated on the exam. That wasn't very wise. It caused me to fail the class*). Finally, states are stable manifestations, but cannot be referenced anaphorically (e.g. *I know Danish. *It is a pleasure*). It is therefore assumed that the grammar can distinguish meanings that are stable and referential from those which are not. In this work, I reserve the variables $x...y$ for stable referential entities, whereas s is used for states (stable non-referential manifestations) and e for other eventualities (i.e. non-stable but possibly referential). I use ϵ to describe eventualities in general.

To reiterate, this indexical system of individuals, states and eventualities is a categorical abstraction over a gradient system: there are fine-grained differences between types of indices that the current system must be sensitive to. As already mentioned, one could if desired sort indices in a fine-grained ontology like the one developed by Asher (2011), or resort to various features to characterize the concep-

[7]See Elman (2009, 2011) for a the view in which lexical elements are highly distributed and contextualized networks associated to fine-grained nonlinguistic cues.

tual dimensions of the denoted concept. For example, primitives like [STABILTY±], [REFERENCE±], [DURATION±], [CONCRETENESS±], [ACTION±], etc. Crucially, the present system allows for the existence of words with mixed semantic properties like *war* or *happiness*. Because both words describe concepts that are stable and referential, they have nominal morphosyntactic features, and therefore a nominal distribution. I refer to these eventuality-turned-individual expressions using $x...y$ variables rather than e or s. Similarly, nouns like *claim* bear nominal morphosyntactic features because they are conceptualized as being individual-like manifestations, even though they share some conceptual properties with verbs. A claim is a monadic predicate that describes a type of message: a countable propositional entity brought about by the verbal action of claiming. As such, it can be predicated by truth-value expressions and be modified by adjectives as in *that last claim is true*. Also, like all count nouns, it must combine with a determiner. The same analysis applies to other nominals that share some conceptual properties with verbs, such as *action*, *event*, and *process*. Gerunds are a more extreme instance of this phenomenon of mixed nominal/verbal grammatical alignments. Although their root morphemes describe canonical eventualities, the gerundial form corresponds to a more individual-like region of conceptual space. Consequently, the distribution of the phrases they project overlaps with the distribution of more canonical nominal phrases.

A final assumption about semantics is that predicates impose semantic constraints on their arguments. For example, semantically, a verb like *leave* corresponds to [FRAMES $\langle \exists e\, leave(e, x, y), agent(x), area(y) \rangle$]. Basically, the verb requires that x is a volitional entity and that y is a spatial area. Hence, (17a) is well-formed, but (17b) is not.

(17) a. The cat exited the garage.

b.*The instant exited the shouting.

There is much independent motivation for the existence of semantic selection constraints. As already discussed in §1, certain complements can be of any category as long as they denote a location, such as (18).

(18) The magician emerged from [behind the curtain]/[the box].

The opposite situation is illustrated in (19), which shows that *speak* selects an extremely restricted class of complements.

(19) a.*Kim spoke a story/poem/joke (about Robin).

b. Kim spoke [something]/[a few words] about Robin.

Semantic selection constraints also explain the oddness of (20), which arises when the complement adds no new information to the constraints already imposed by the verb.

(20) a. Kim buttered the bread with ??(unsalted) butter.

b. Sue elbowed me with her ??(arthritic) elbow.

c. We danced a ??(traditional Indian) dance.

2.4 Nominal environments

In this theory there is no general notion of NP. What we have is a family of overlapping distributional classes which emerge from lexical and constructional constraints on semantic and morphosyntactic properties. Let us start by the simplest possible case. Dummy pronouns *there* and *it* are directly selected by certain verbs in certain constructions, without any effect on semantic interpretation. For illustration, I provide in full the lexical entry for dummy *it* in (21).

(21)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{it} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{XARG} \quad \textit{none} \\ \text{VAL} \quad \langle\,\rangle \\ \text{SEL} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & \textit{it} \\ \text{FRAMES} & \langle\,\rangle \end{bmatrix} \end{bmatrix}$$

The lexical entry for the verb *rains* is given in (22). The features in SYN and SEM are typical of a verbal sign. Note, however, that this verb directly selects the dummy *it* subject, without appeal to any categorial constraints whatosoever. Drawing from Sag 2010, the specification $X{:}\phi$ means that X has at least the features described in ϕ.

(22)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{rains} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{CASE} & \textit{none} \\ \text{FORM} & \textit{fin} \end{bmatrix} \\ \text{XARG } X{:}\left[\text{SEM} \mid \text{INDEX } \textit{it}\right] \\ \text{VAL} \quad \langle X \rangle \\ \text{SEM} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & e \\ \text{LABEL} & l_2 \\ \text{FRAMES} & \left\langle [l_1 : \exists e(l_1)], [l_2 : \textit{rain}(e)] \right\rangle \end{bmatrix} \end{bmatrix}$$

Drawing from Sag 2010, the constructional rule in (23) allows a subject phrase of any kind to combine with an eventuality-denoting predicate phrase. The specification $Y!\varphi$ means that the various occurrences of Y share all their features except those mentioned in φ.[8]

[8]For illustration, consider the descriptions in (i) and (ii), and assume that F_1 and F_2 are the only features appropriate for τ. The description (i) abbreviates (ii).

(i) $$\begin{bmatrix} \text{G}_1 \; X! \begin{bmatrix} \tau \\ \text{F}_2 \; \alpha \end{bmatrix} \\ \text{G}_2 \; X \end{bmatrix}$$

(ii) $$\begin{bmatrix} \text{G}_1 \begin{bmatrix} \tau \\ \text{F}_1 \; X \\ \text{F}_2 \; \alpha \end{bmatrix} \\ \text{G}_2 \begin{bmatrix} \tau \\ \text{F}_1 \; X \end{bmatrix} \end{bmatrix}$$

(23) Subject-Predicate Construction

$$\textit{subj-pred-cxt} \Rightarrow \begin{bmatrix} \textsc{mtr} & \begin{bmatrix} \textsc{syn} & Y! \left[\textsc{val} \ \langle\rangle \right] \\ \textsc{sem} & \begin{bmatrix} \textsc{index} & \epsilon \\ \textsc{label} & l \end{bmatrix} \end{bmatrix} \\ \textsc{dtrs} & \left\langle X, \begin{bmatrix} \textsc{syn} & Y : \begin{bmatrix} \textsc{cat} & \left[\textsc{form} \ \neg none \right] \\ \textsc{xarg} & X \\ \textsc{val} & \langle X \rangle \end{bmatrix} \\ \textsc{sem} & \begin{bmatrix} \textsc{index} & \epsilon \\ \textsc{label} & l \end{bmatrix} \end{bmatrix} \right\rangle \\ \textsc{cx-content} & \langle\rangle \end{bmatrix}$$

I adopt the type hierarchy of Sag (2010). Hence, *subj-pred-cxt* is a sub-type of *head-cxt*, which in turn is a sub-type of *phrasal-cxt*.

The constructional rule in (24), drawn from Copestake et al. 2005, specifies how semantic composition takes place. The feature CX-CONTENT allows constructions to make a semantic contribution.

(24) Principle of Compositionality

$$\textit{phrasal-cxt} \Rightarrow \begin{bmatrix} \textsc{mtr} & \left[\textsc{sem} \left[\textsc{frames} \ X_0 \oplus X_1 \oplus \ldots \oplus X_n \right] \right] \\ \textsc{dtrs} & \left\langle \left[\textsc{sem} \left[\textsc{frames} \ X_1 \right] \right], \ldots, \left[\textsc{sem} \left[\textsc{frames} \ X_n \right] \right] \right\rangle \\ \textsc{cx-content} & X_0 \end{bmatrix}$$

The proposed grammar fragment licenses the construct in Figure 2.
Following standard practice in construction grammar, the structures licensed by constructions are referred to as constructs. In this paper, I exclusively depict constructs in figures.

Let us now discuss non-expletive nominal phrases. For convenience, I use the abbreviation 'NP' to refer to a non-expletive and non-predicative nominal phrase. To be clear, this is nothing but a shorthand for the constraints in (25). This is reminiscent of Van Valin (2008), where 'RP' (reference phrase) replaces the 'NP' label.

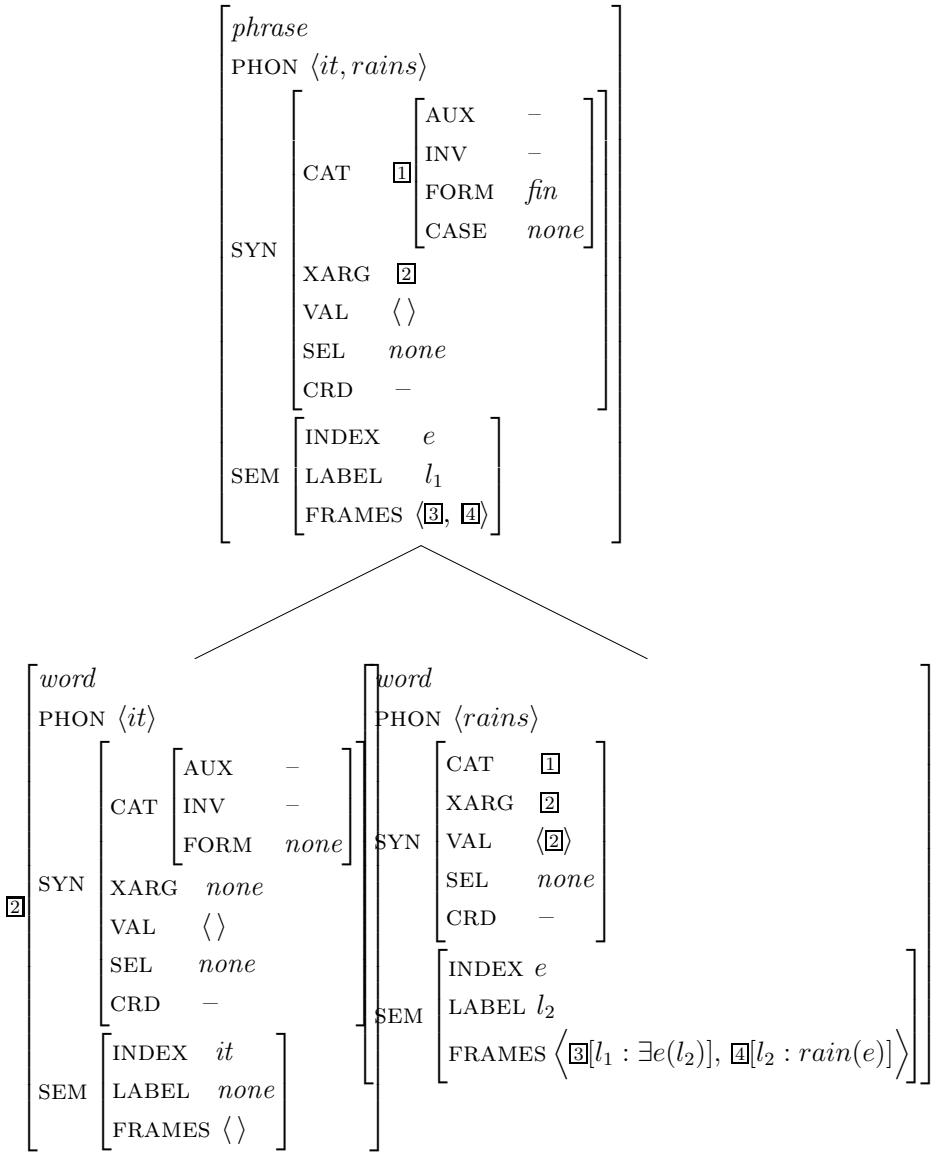
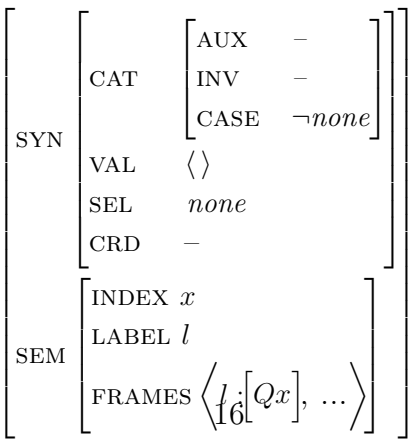


Figure 2: A Subject-Predicate construct

(25)

NP_x abbreviates



A nominal phrase is therefore a sign that bears noun-like morphosyntactic and semantic information. It is a referential phrase that is semantically 'determined' by some quantifier Q. I assume direct access to the relevant frame in FRAMES via the label, but this could also be modeled via the feature HOOK (Copestake et al., 2005) or LID (Sag, 2012).

Also consistent with (25) are noun phrases with covert determiners such as bare plural and non-count nominal phrases. Proper names are assumed to contain a bound variable as well, along the lines of Kamp and Reyle (1993) (e.g. $\exists x\, kim(x)$).

Note that the presence of such a quantifier is not restricted to nominals. Verbs, adjectives, adverbs, and some prepositions are lexically specified as containing a quantified Neo-Davidsonian variable (i.e. existential closure). The result is that a wide range of phrases will be compatible with the constraints in (25), including gerundial, complementizer, infinitival, and (certain) prepositional and adjectival phrases.

The symbol 'N' is used to abbreviate a nominal phrase whose index is not quantificationally bound. For example, determiners select such a nominal host via the feature SEL, as (26) shows.

(26)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{each} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\,\rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \quad \text{N}_x\Big[\text{LABEL } l_2\Big] \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & x \\ \text{LABEL} & l_1 \\ \text{FRAMES} & \Big\langle [l_1 : \forall x(l_2 \rightarrow l_3)] \Big\rangle \end{bmatrix} \end{bmatrix}$$

The lexical entry for a singular common noun is shown in (27).

(27)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{cat} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\,\rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} \quad x \begin{bmatrix} \text{NUM} & \textit{sg} \\ \text{PER} & \textit{3rd} \\ \text{GEN} & \textit{neut} \end{bmatrix} \\ \text{LABEL} \quad l_2 \\ \text{FRAMES} \left\langle [l_2 : \textit{cat}(x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

The HEAD-FUNCTOR CONSTRUCTION in (28), taken from Sag 2012, allows determiners, modifiers, adpositions, and markers to select the head phrases that they combine with, via the feature SEL(ECT). In this work, I assume linearization is handled as in Kathol 2000.

(28) HEAD-FUNCTOR CONSTRUCTION

$$\textit{head-functor-cxt} \Rightarrow \begin{bmatrix} \text{MTR} \begin{bmatrix} \text{SYN } Y \\ \text{SEM} \begin{bmatrix} \text{INDEX } \alpha \\ \text{LABEL } l \end{bmatrix} \end{bmatrix} \\ \text{DTRS} \left\langle \begin{bmatrix} \text{SYN} \begin{bmatrix} \text{SEL } X \\ \text{VAL } \langle\rangle \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX } \alpha \\ \text{LABEL } l \end{bmatrix} \end{bmatrix}, X{:}\begin{bmatrix} \text{SYN } Y \end{bmatrix} \right\rangle \\ \text{CX-CONTENT } \langle\rangle \end{bmatrix}$$

I use α to refer to referential indices of any kind, without specifying if they correspond to individuals or eventualities. We license constructs like *each cat* as shown in Figure 3. This is the result of combining the two signs in (26) via the *head-functor construction* in (23). The two daughters are omitted from Figure 3 due to space limitations.

Since (28) is a headed construction, it inherits all the constraints in (23) and (24). Verbs impose morphosyntactic and semantic constraints on valents as illustrated by the verb shown in (29).

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON } \langle \textit{each}, \textit{cat} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\,\rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX } x \begin{bmatrix} \text{NUM} & \textit{sg} \\ \text{PER} & \textit{3rd} \\ \text{GEN} & \textit{neut} \end{bmatrix} \\ \text{LABEL } l_1 \\ \text{FRAMES} \left\langle [l_1 : \forall x(l_2 \rightarrow l_3)],\ [l_2 : \textit{cat}(x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

Figure 3: A Noun Phrase construct (daughters omitted)

(29)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{yawns} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} - \\ \text{INV} - \\ \text{FORM } \textit{fin} \\ \text{CASE } \textit{none} \end{bmatrix} \\ \text{XARG } Y \\ \text{VAL} \quad \left\langle Y : \text{NP}_x \begin{bmatrix} \text{AGR} & \textit{3rd} \\ \text{NUM} & \textit{sg} \end{bmatrix} \right\rangle \\ \text{SEL} \quad \textit{none} \\ \text{CRD} - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX } e \\ \text{LABEL } l_2 \\ \text{FRAMES} \left\langle [l_1 : \exists e(l_2)], [l_2 : \textit{yawn}(e, x)], [l_2 : \textit{animate}(x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

Let us now turn to prepositional phrases. As illustrated in (36a), so-called 'case marking' prepositions make a basic semantic case contribution, consisting of semantic role predicates such as *agent*(x), *source*(x), *patient*(x), etc. (see, for example, Wechsler 1995 and Davis 2001).

(30)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{on} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{VAL} \left\langle \begin{bmatrix} \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL } \langle\,\rangle \\ \text{SEL } \textit{none} \\ \text{CRD } - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX } x \\ \text{LABEL } l \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{XARG } \textit{none} \\ \text{SEL } \textit{none} \\ \text{CRD } - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX } x \\ \text{LABEL } l \\ \text{FRAMES } \left\langle [l : \textit{support}(x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

After combining with an NP, the resulting phrase is a suitable complement for a verb like *rely*, which selects a support-denoting individual.

The construction that allows heads to combine their complements is shown in (31), adapted from Sag 2012. This states that a lexical sign Z that selects a non-empty list of valents yields a phrase that is similar to X, except that its valence is saturated.[9]

[9]I assume that auxiliary verbs are [XARG *none*]. Consequently, this constructional rule can also license subject-inversion structures *Are you tired?* and *Am I tired!*

(31) Saturational Head-Complement Construction

$$\textit{sat-head-comp-cxt} \Rightarrow \begin{bmatrix} \text{MTR} & \begin{bmatrix} \text{SYN} & X!\left[\text{VAL } \langle\rangle\right] \\ \text{SEM} & \left[\begin{matrix}\text{INDEX } \alpha \\ \text{LABEL } l\end{matrix}\right] \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \textit{word} \\ \text{SYN } X\text{:}\begin{bmatrix}\text{VAL } \langle Y\rangle \oplus L \\ \text{XARG } \neg Y\end{bmatrix} \\ \text{SEM}\left[\begin{matrix}\text{INDEX } \alpha \\ \text{LABEL } l\end{matrix}\right] \end{bmatrix}, Y \right\rangle \oplus L \\ \text{CX-CONTENT } \langle\rangle \end{bmatrix}$$

As (30) combines with its complement, the result is a *support*-denoting NP. For convenience, I abbreviate such phrases with the label $\text{PP}_x[C]$. This is an NP_x specified as [CASE *none*] that contains in FRAMES a semantic condition C on index x. The verb *rely* is given in (32).

(32)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{rely} \rangle \\ \text{SYN} & \begin{bmatrix} \text{CAT} & \begin{bmatrix}\text{AUX} & - \\ \text{INV} & - \\ \text{CASE} & \textit{none} \\ \text{FORM} & \textit{fin}\end{bmatrix} \\ \text{VAL} & \left\langle Y\text{:}\text{NP}_x\left[\text{CASE } \textit{nom}\right], \text{PP}_y[\textit{support}] \right\rangle \\ \text{XARG} & Y \\ \text{SEL} & \textit{none} \\ \text{CRD} & - \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX} & e \\ \text{LABEL} & l_2 \\ \text{FRAMES} & \left\langle [l_1 : \exists e(l_2)], [l_2 : \textit{rely}(e,x,y)], [l_2 : \textit{animate}(x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

Since the subject of *rely* is required to be animate, sentences like **Our future relies on sustainable energy sources* are deemed anomalous. Conversely, a verb like *depend* makes no such requirement and can therefore combine with a wider range of subjects, including actions, regions and abstract entities (e.g. *Our future depends on sustainable energy sources*).[10]

[10]A reviewer argues against this analysis given the acceptability of attested examples like *such calculations rely on two concepts from algebra*. But this is probably a different, though related,

There are still some constraints limits, however, since *depend* verb cannot apply to locatives as shown by **there depends on it* and by **near the door depends on it*.

There are many other uses for the preposition *on*. Consider the one shown in (33), for example. This preposition denotes the spatial location x where y is situated, and is therefore not a semantically empty preposition.

(33)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{on} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\ \text{NP}_y\ \rangle \\ \text{XARG} \ \textit{none} \\ \text{SEL} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & x \\ \text{LABEL} & l_1 \\ \text{FRAMES} & \left\langle [l_1 : \exists x(l_2)], [l_2 : \textit{region}(x),\ l_2 : \textit{on}(x,y)] \right\rangle \end{bmatrix} \end{bmatrix}$$

The x referent is internal to the preposition in the same way that a relational noun like *owner* implies two different individuals: a possessor (the internal referent) and a possessed (which is external, and introduced by a subcategorized PP[*possessed*] complement).

Because prepositions like (33) are not specified for case and denote a stable (spatial or temporal) entity, they can occur in nominative and accusative NP environments as long as the verb does not impose conflicting semantic constraints, as in (34).

(34) a. [(On/Under) the table] became my favorite place to sleep.

b. The cat jumped from [(under) the table].

c. He considered [(under/in) the closet] a good place for the key.

use of the verb. In this example, the calculations are brought about by the algebraic operations, and there is no underlying purpose served by the relation between the calculations and the algebraic operations. Thus, purpose phrases are disallowed: **Such calculations rely on two algebraic operations to solve equations*. The meaning of this use of *rely* is essentially the same as that of *depend*, and any dynamic referential entity will serve as a subject. In the use of *rely* that (32) is intended to correspond to, the entity denoted by the subject is not brought about by the object That is, in *Tom relies on Sue* the existence of Tom is not bought about by Sue. Moreover, there is an implicit goal for the relation between the two individuals, which explains why purpose phrases are allowed, e.g. *Tom relies on Sue to paint the garage*.

d. [From/Between here to downtown] is a distance of thirty miles.

e. [(After/By/On) Christmas] is not considered to be too late.

f. [(By/Before) the end of the week] would suit me better.

g. The magician emerged [from [(behind/inside) the closet]].

h. The meeting lasted [two hours] / [much too long] / [until midnight].

There is also a double coordinator construction, illustrated in (35), that allows two such PPs to be combined. The result is a phrase that denotes a vector between the endpoints denoted by the daughters. In SBCG this double PP structure can be easily modeled by a construction that takes two such PPs and that adds the vector semantics via CX-CONTENT. The whole phrase is referential and therefore suitable for subject and complement environments.

(35) a. Tom searched from Boston to Providence.

b. From Boston to Providence is not far.
(Huddleston and Pullum, 2002, 641)

The adnominal counterpart of (33) is given in (36). This word denotes the state of x being spatially located on y and projects a phrase that modifies NPs. This is achieved via the [SEL NP] specification, which allows the prepositional phrase to combine with a nominal host via the HEAD FUNCTOR CONSTRUCTION in (28). Note that the preposition must combine with the complement before it can adjoin to the nominal head, since (28) requires the functor to be specified as [VAL $\langle\,\rangle$].

(36)
$$\begin{bmatrix} \textit{word} \\ \text{PHON } \langle \textit{on} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{CASE} & \textit{none} \\ \text{FORM} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \left\langle \text{NP}_y \right\rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \quad \text{NP}_x \\ \text{CRD} \quad - \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & e \\ \text{LABEL} & l_2 \\ \text{FRAMES} & \left\langle [l_1 : \exists s(l_2)],\ [l_2 : \textit{on}(s, x, y)] \right\rangle \end{bmatrix} \end{bmatrix}$$

2.5 Predicative environments

A predicative phrase is an expression that assigns a thematic role to a referential phrase which is external to the projection. Sometimes this is mediated by a raising verb (*We are happy*) sometimes not (*This made us happy*). There are many constructions which involve predicative structures, including certain adnominal environments (e.g. *All rivers navigable are being controlled*), subject-oriented dangling modifiers (*Furious, Kim stormed out of the room*) and absolute constructions (*With Sue injured, the play could not continue*). What is common to all of these structures is that the predicative phrase imposes constraints on an external argument. In some cases, the external argument is not a valent. The feature XARG is ideal to capture this phenomenon, since it allows one distinguished sign to be visible outside its local domain. For example, Bender and Flickinger (1999) use XARG to model the fact that tag questions must access the syntactic subject of the preceding clause (cf. *Sarah read the book, didn't she/*it?* with *The book was read by Sarah, wasn't it/*she*), Sag (2012) uses it for 'copy-raising' (cf. *There looks like there's/*it's going to be a storm* with *It looks like it's/*there's going to rain*) and for certain idioms (e.g. *Bob$_i$ lost his$_i$ marbles*), and Chaves (2006) uses XARG to ensure that dangling modifiers can predicate the syntactic subject of the clause they adjoin to (cf. *Furious, Kim threw the TV out the window* with **Furious, the TV was thrown out the window*).

I therefore reject the purely descriptive feature PRED (Gazdar et al., 1985, 85) and attempt to characterize predicative environments via independently motivated features like XARG. In what follows, I focus on the constraints imposed on post-copular environments. The features common to all post-copular predicative expressions are in Figure 4.

$$\begin{bmatrix} \text{SYN} & \begin{bmatrix} \text{VAL} & \langle\rangle \\ \text{XARG} & \text{NP}_x \\ \text{SEL} & \textit{none} \\ \text{CRD} & - \end{bmatrix} \\ \text{SEM} \mid \text{INDEX} & \epsilon \end{bmatrix}$$

Figure 4: A post-copular predicative sign

A post-copular predicative phrase is therefore a non-modifier sign that denotes an eventuality ϵ of some kind, requires a nominal external argument, and has saturated valence. Such signs are selected as complements by linking verbs, as illustrated in (37).[11] The complement must have saturated valence, must have an external NP

[11]The copula verb is underspecified for AUX and INV, so that it may occur in various (non)inverted (non)auxiliary environments (e.g. *Was I wrong? I wasn't wrong, was I? I was wrong. Boy, was I wrong!*).

coindexed with the copula's subject, must not be a modifier, and must describe an eventuality of some kind. The index ϵ corresponds to any kind of eventuality, including states.

(37)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon}\ \langle \textit{is} \rangle \\ \textsc{syn} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{case}\ \textit{none} \\ \textsc{form}\ \textit{fin} \end{bmatrix} \\ \textsc{val} \left\langle K : \mathrm{NP}^{nom}x \begin{bmatrix} \textsc{num}\ \textit{sg} \\ \textsc{per}\ \textit{3rd} \end{bmatrix}, \begin{bmatrix} \textsc{syn} \begin{bmatrix} \textsc{val} & \langle\rangle \\ \textsc{xarg} & \mathrm{NP}_x \\ \textsc{sel} & \textit{none} \\ \textsc{crd} & - \end{bmatrix} \\ \textsc{sem} \begin{bmatrix} \textsc{index}\ \epsilon \\ \textsc{label}\ l \end{bmatrix} \end{bmatrix} \right\rangle \\ \textsc{xarg} \quad K \\ \textsc{sel} \quad \textit{none} \\ \textsc{crd} \quad - \end{bmatrix} \\ \textsc{sem} \begin{bmatrix} \textsc{index}\ \epsilon \\ \textsc{label}\ l \\ \textsc{frames} \quad \langle\, [l : t(\epsilon) = t_{now}]\, \rangle \end{bmatrix} \end{bmatrix}$$

The index and label of the verb are the same as the complement so that VP adjuncts can access the predicate's semantics. The constraints imposed on the complement are minimal, which explains why so many different kinds of phrases can be used predicatively. This combinatorial flexibility is obtained without resorting to such part of speech labels.

Let us consider some examples. Predicative and attributive uses of the same adjective are distinguished by different lexical specifications. This is consistent with the fact that predicative adjectives that select objects cannot do so in their attributive pre-nominal use, as (38) shows. Whereas the attributive adjective in (38b) is as [SEL NP], [XARG *none*], and [VAL $\langle\rangle$], the predicative use in (38a) is specified as [SEL *none*], [XARG NP], and [VAL $\langle$PP$\rangle$]. Similarly, the only syntactic difference between attributive *drunken* and the predicative *drunk* is the SEL and XARG specifications.[12]

(38) a. The team is proud (of the coach).

[12]The complex adnominal adjunct in (38b) is acceptable if the entire expression *proud-of-the-coach* is taken to be a compound morphological unit. As Bresnan and Mchombo (1995, 194) note with examples like *an-I-told-you-so-attitude*, such phrasal material is quotational, and can even involve phrases from foreign languages such as *a certain je ne sais quoi quality*.

b. The proud (*of the coach) team.

A predicative adjective is shown in (39). It requires a physical entity x and denotes a state. This predicate is a suitable complement for (37).

(39)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon}\ \langle \textit{yellow} \rangle \\ \textsc{syn} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{aux} & - \\ \textsc{inv} & - \\ \textsc{form} & \textit{none} \\ \textsc{case} & \textit{none} \end{bmatrix} \\ \textsc{val} \quad \langle\,\rangle \\ \textsc{xarg} \quad \mathrm{NP}_x \\ \textsc{sel} \quad \textit{none} \\ \textsc{crd} \quad - \end{bmatrix} \\ \textsc{sem} \begin{bmatrix} \textsc{index}\ s \\ \textsc{label}\ l_2 \\ \textsc{frames} \left\langle [l_1 : \exists s(l_2)], [l_2 : \textit{yellow}(s,x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

The adnominal counterpart of the adjective is shown in (40). It selects a referential nominal index x which is not yet bound by a quantifier. Given the non-empty SEL value and the null value for XARG, it is clear that this adjective cannot occur in a predicative position.

(40)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon}\ \langle \textit{yellow} \rangle \\ \textsc{syn} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{aux} & - \\ \textsc{inv} & - \\ \textsc{form} & \textit{none} \\ \textsc{case} & \textit{none} \end{bmatrix} \\ \textsc{val} \quad \langle\,\rangle \\ \textsc{xarg} \quad \textit{none} \\ \textsc{sel} \quad \mathrm{N}_x[\textsc{label}\ l_1] \\ \textsc{crd} \quad - \end{bmatrix} \\ \textsc{sem} \begin{bmatrix} \textsc{index}\ s \\ \textsc{label}\ l_2 \\ \textsc{frames} \left\langle [l_1 : \exists s(l_2)], [l_2 : \textit{yellow}(s,x)] \right\rangle \end{bmatrix} \end{bmatrix}$$

The two adjective uses need not be listed in the grammar as two distinct lexemes. One could be derived from the other, or each could be a sub-type of a more general and abstract lexeme type, as in the analysis for alternations proposed by Sag (2012).

A predicative use of a preposition is given in (41). This preposition combines with an NP complement in the usual way and yields a PP that is a suitable complement for (37).

(41)
$$\begin{bmatrix} \textit{word} \\ \textsc{phon}\ \langle \textit{on} \rangle \\ \textsc{syn} \begin{bmatrix} \textsc{cat} \begin{bmatrix} \textsc{case} & - \\ \textsc{aux} & - \\ \textsc{inv} & - \\ \textsc{case} & \textit{none} \\ \textsc{form} & \textit{none} \end{bmatrix} \\ \textsc{val} \quad \left\langle \mathrm{NP}_y \left[\textsc{case}\ \textit{acc} \right] \right\rangle \\ \textsc{xarg} \quad \mathrm{NP}_x \\ \textsc{sel} \quad \textit{none} \\ \textsc{crd} \quad - \end{bmatrix} \\ \textsc{sem} \begin{bmatrix} \textsc{index} & s \\ \textsc{label} & l_2 \\ \textsc{frames} & \left\langle [l_1 : \exists s(l_2)], [l_2 : \textit{on}(s,x,y)] \right\rangle \end{bmatrix} \end{bmatrix}$$

Predicative NPs are obtained by a *pred-nom-cx* construction that takes any N_x sign (lexical or phrasal) and coerces it into a predicative nominal sign. This is essentially a semantic process. For example, a nominal predicate like $\textit{republican}(x)$ specified as [INDEX x] and [XARG *none*] then becomes $\textit{republican}(s,x)$ where [INDEX s] and [XARG NP_x]. The construction is shown in (42).

(42) Predicative Nominal Construction

pred-nom-cx ⇒

$$\begin{bmatrix} \text{MTR} & \begin{bmatrix} \textit{phrase} \\ \text{PHON } P \\ \text{SYN } X!\Big[\text{XARG NP}_{x_1}\Big] \\ \text{SEM} & \begin{bmatrix} \text{INDEX } s \\ \text{LABEL } l \\ \text{FRAMES } L_1 \oplus \langle [l : R(s, x_1, ..., x_n)] \rangle \oplus L_2 \end{bmatrix} \end{bmatrix} \\ \text{DTRS} & \left\langle \begin{bmatrix} \text{PHON } P \\ \text{SYN } X\text{:}\begin{bmatrix} \text{VAL} & \langle\,\rangle \\ \text{XARG} & \textit{none} \end{bmatrix} \\ \text{SEM} & \begin{bmatrix} \text{INDEX } x_1 \\ \text{LABEL } l \\ \text{FRAMES } L_1 \oplus \langle [l : R(x_1, ..., x_n)] \rangle \oplus L_2 \end{bmatrix} \end{bmatrix} \right\rangle \\ \text{CX-CONTENT} & \langle\rangle \end{bmatrix}$$

It is important that this process can apply to phrases as well as words. This way, adnominal phrases like adjectives can combine and modify the nominal index of the N before the coercion changes the value of INDEX from x to s. Thus, (42) can apply to complex non-predicative nominal expressions like *a* [*great and wonderful woman who put her heart and soul into creating a better world*] and create a predicative counterpart. For illustration, the derivation of the predicative counterpart of the noun *genius* is shown in Figure 5.

This case is fairly simple, but (42) can handle cases where the noun is relational and cases where the nominal expression is not lexical. Since the index s of the predicative nominal expression is not bound, this phrase must combine with a determiner before it can function as an NP. However, because it denotes a (stative) eventuality and has a nominal external argument NP_x, it can only occur in predicative environments, such as the complement of a copula.

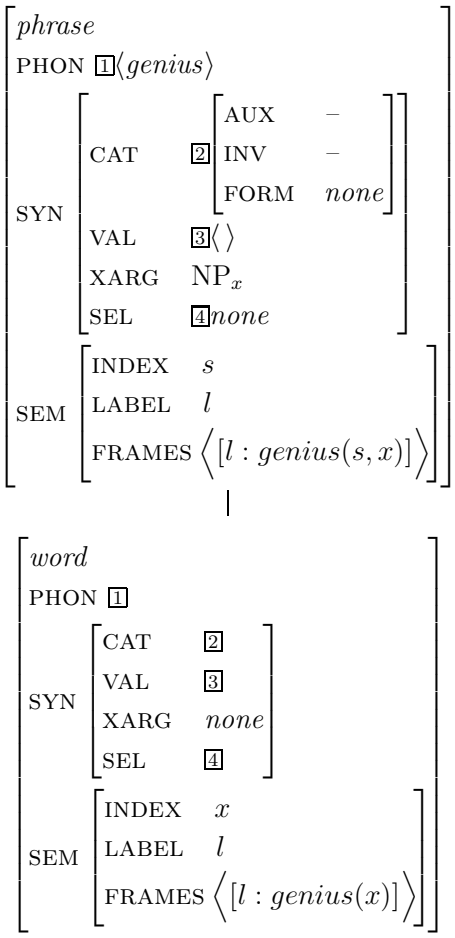


Figure 5: A predicative lexical construct licensed by (42)

Passive verbs can be obtained via the familiar lexical construction in (43). Note that this construction suppresses the passive subject Y from VAL, although it is still recorded in XARG. As a consequence, passive phrases never combine with their syntactic subjects. The function f_{pass} computes the phonological form of the passive.[13]

[13]This construction is part of a family of related constructions. For example, a variant of (43) licenses passive verb forms that are specified as SEL NP$_x$. This allows such verbs to project adnominal modifier phrases, as in [[*the squirrel and the chipmunk*] *chased by the dog*] *are still on the tree*. Yet another construction models prepositional passives, like *this bed was slept on by George Washington*.

(43) Passive Lexical Construction

$$\textit{pass-lcx} \Rightarrow \left[\begin{array}{l} \text{MTR} \left[\begin{array}{l} \textit{lexeme} \\ \text{PHON } \langle f_{pass}(F)\rangle \\ \text{SYN } X! \left[\begin{array}{l} \text{CAT } \left[\text{FORM } \ \textit{pass}\right] \\ \text{VAL } L \oplus \left\langle (\text{PP}_x[\textit{by}]) \right\rangle \\ \text{XARG } Y \end{array}\right] \\ \text{SEM } Z \end{array}\right] \\ \text{DTRS} \left\langle \left[\begin{array}{l} \textit{lexeme} \\ \text{PHON } \langle F\rangle \\ \text{SYN } X\text{:} \left[\begin{array}{l} \text{CAT } \left[\begin{array}{ll} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{base} \\ \text{CASE} & \textit{none} \end{array}\right] \\ \text{VAL } \left\langle \text{NP}_x,\ Y \right\rangle \oplus L \end{array}\right] \\ \text{SEM } Z \end{array}\right] \right\rangle \end{array}\right]$$

Passive verb phrases are suitable copula complements because they satisfy all the constraints in (37). Verbs like *remain* are essentially like *be*, but other linking verbs like *become*, *grow*, and *seem* impose additional semantic constraints on their complements. For example, following Maling (1983, 282,ft.9), *become* selects gradable stative non-locative complements. This excludes action-denoting or location-denoting expressions, as in (44).

(44) a. Robin [became/remained] [wealthy/wealthier/a priest].

b.*Robin became [in bed/standing/loved by everyone].

c. Robin remained [in bed/standing /loved by everyone].

The verb *seem* has a similar distribution, with some idiosyncratic exceptions perhaps best seen as conventionalized structures (e.g. *At this point he seems *[in the water]/*[in panic]/ [in pain]/[in good spirits]*). Conversely, *grow* requires a complement that denotes a scalar property, as the data in (45) indicate.

(45) a. Robin grew [wealthy/wealthier].

b.*Robin grew [dead/a Republican/smoking/in bed/loved by everyone].

Of course, the denotation of the complement must be compatible with the subject's. For example, the oddness of **Kim grew a temperature* ('Kim gradually changed into

being a temperature') follows from the fact that the scalar property denoted by the predicative NP *a temperature* is not compatible with the subject's denotation. Whereas the subject *Kim* denotes a concrete animate entity, the predicate requires an abstract numerical value that can be changed into a temperature value. The same goes for **Kim is orthogonal* or **Robin became null*.

A reviewer claims that this cannot be right, given uses like *Juno of Rome grew pregnant at the touch of a flower* or *our choices grew infinite*. In these examples the meaning of *grow* is essentially the same as *become*. However, corpora evidence indicates that such uses are non-standard: they are non-existent in the Switchboard, Brown, and Wall Street Journal, and are mostly restricted to religious and poetic writing according to COCA (http://corpus.byu.edu/coca/) and Google Books (http://googlebooks.byu.edu/). This rare and stylistically restricted use of *grow* can indeed combine with predicative NPs as shown in (46).

(46) a. She very soon grew a woman of note.
[`www.archives.nd.edu/Scholastic/VOL_0005/VOL_0005_ISSUE_0009.pdf`]

b. The place I grew a man was the farm of Brendan and Mary Whelan.
[`www.smashwords.com/extreader/read/84752/8/the-bleeding-hills`]

Other predicative environments are even more constrained. Resultatives like (47) select objects denoting a gradable physical state (see Wechsler 2001).

(47) I cut the bread [thin/into slices/*tasty/*twenty slices].

2.6 Gerunds

The *-ing* suffix is assumed to take a verb stem and to coerce it to something more nominal – both semantically and morphosyntactically. The result is an alignment of semantic and morphosyntactic constraints that has mixed properties. In this work, four types of gerund are distinguished (verbal, predicative, nominal, and noun-gerund), and modeled as a family of lexical constructions, shown in Figure 6.

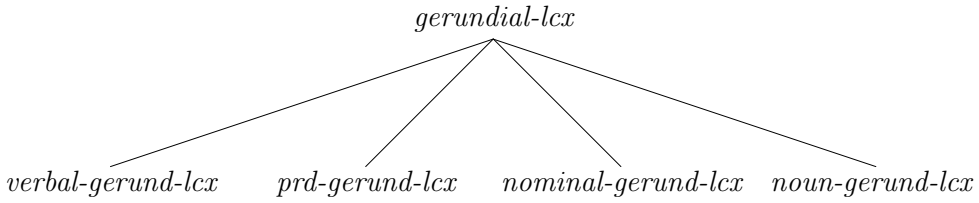


Figure 6: Type hierarchy of gerundial constructions

The various types of gerundial formation share a number of properties, which are captured by the construction in (48). All types of gerund inherit these constraints.

Note that lexical constructions are not subtypes of *phrasal-cxt* and therefore not subject to rules like (23) and (24).

(48)

$$\textit{gerundial-lcx} \Rightarrow \left[\begin{array}{l} \textsc{mtr} \left[\begin{array}{l} \textit{word} \\ \textsc{phon}\ \langle F, \textit{ing}\rangle \\ \textsc{syn}\ \left[\textsc{cat}\ X!\left[\begin{array}{ll}\textsc{form} & \textit{prp}\\ \textsc{case} & \textit{case}\end{array}\right]\right] \\ \textsc{sem}\ \left[\textsc{index}\ y\left[\begin{array}{ll}\textsc{per} & \textit{3rd}\\ \textsc{num} & \textit{sg}\\ \textsc{gen} & \textit{neut}\end{array}\right]\right]\end{array}\right] \\ \textsc{dtrs}\left\langle \left[\begin{array}{l}\textit{lexeme}\\ \textsc{phon}\ \langle F\rangle \\ \textsc{syn}\ \left[\begin{array}{l}\textsc{cat}\ X:\left[\begin{array}{ll}\textsc{aux} & -\\ \textsc{inv} & -\\ \textsc{form} & \textit{base}\\ \textsc{case} & \textit{none}\end{array}\right] \\ \textsc{val}\left\langle \textsc{np}_x\left[\textsc{case}\ \textit{nom}\right],\ \ldots\right\rangle\end{array}\right]\end{array}\right]\right\rangle \end{array}\right]$$

Let us first consider the verbal gerund type (*verbal-gerund-lcx*), illustrated in (49). These are verbal gerunds because they allow adverbial modifiers, disallow adjectival modifiers, select an NP complement, and take a subject. Semantically, verbal gerunds correspond to concepts with spatiotemporal properties and as such can be modified by spatiotemporal adverbials as (49c,d) illustrate.

(49) a. I remember [(his/him) constantly questioning Tom's motives].

b. [His/Him quickly proving the theorem] astonished everyone.

c. Tom proving the theorem [in class]/[in under 10 seconds] was amazing.

d. [(Madonna) singing that song [for half an hour]/[in London]] was amazing.

Gerunds retain some of the eventuality-like properties of their stems, and therefore behave like a mixed category because they describe regions of the conceptual space that have both nominal- and verb-like properties. Lees (1960, 65) argues verbal gerunds denote facts, as suggested by the paraphrase in (50). I further conjecture that the nominal-like properties of gerunds follow if facts are conceptualized as stable and referential entities.

(50) Kim's drawing Sue surprised me.
(the fact that he drew Sue surprised me)

In order to model verbal gerundial formation, I assume the lexical construction in (51). The first non-nominal NP valent is the subject, and it is licensed in the usual way, via the SUBJECT-PREDICATE CONSTRUCTION in (23). Note that the verbal gerund has no external argument, as there is no need for one (e.g. verbal gerunds do not allow tag questions). Any other valents in L remain complements, as in the verb stem.

(51) VERBAL GERUND LEXICAL CONSTRUCTION

verbal-gerund-cx $\Rightarrow$

$$\left[\begin{array}{l}\textsc{mtr}\ \left[\begin{array}{ll}\textsc{syn} & \left[\begin{array}{l}\textsc{val}\ \left\langle \mathrm{NP}_x\left[\textsc{case}\ \mathit{acc}\vee\mathit{gen}\right]\right\rangle\oplus L\\ \textsc{xarg}\ \mathit{none}\end{array}\right]\\ \textsc{sem} & \left[\begin{array}{l}\textsc{index}\ y\\ \textsc{label}\ l_1\\ \textsc{frames}\ \langle : [l_1 : \exists y(l_2)],\ [l_2 : \mathit{fact}(y, l_3)]\rangle \oplus Y\end{array}\right]\end{array}\right]\\ \textsc{dtrs}\ \left\langle \left[\begin{array}{ll}\textsc{syn} & \left[\textsc{val}\ \left\langle \mathrm{NP}_x\right\rangle\oplus L\right]\\ \textsc{sem} & \left[\begin{array}{l}\textsc{label}\ l_3\\ \textsc{frames}\ Y\end{array}\right]\end{array}\right]\right\rangle\end{array}\right]$$

The predicate $\mathit{fact}(y, l_3)$ embeds the semantics of the verb stem, labeled as l_3. Although y describes something that is stable, referential, and spatially located, it also has certain semantic properties that are typical of eventualities, such as being temporally located (Lees, 1960). This is what enables verbal gerunds to be selected by adverbials rather than by adjectives. This follows from the particular semantic constraints imposed by such modifiers. On the other hand, verbal gerunds can have structural case, and their referents are quantificationally bound. As a consequence, a verbal gerund phrase is compatible with the abbreviation 'NP' in (25) in §2.4. This explains why their distribution overlaps with the distribution of more canonical NPs. For example, verbs like *remember* and *astonish* impose few semantic constraints on their subjects (perhaps simply requiring that they denote stable and referential manifestations) and gerundial phrases are suitable subjects, as well as more canonical nominal subjects. The result of the hybrid grammatical alignment that gerunds have is that the phrases they project are verbal to modifiers and nominal to verbs.

There is a related use of verbal gerunds which is restricted to predicative environments, as in (52).[14]

(52) Tom was singing a song.

Such predicative gerunds can be modeled with the rule in (53).

(53) Predicative gerund lexical construction

predicative-gerund-cx ⇒

$$\left[\begin{array}{l}\textsc{mtr}\left[\begin{array}{l}\textsc{syn}\left[\begin{array}{ll}\textsc{val} & L\\ \textsc{xarg} & X\end{array}\right]\\ \textsc{sem}\left[\begin{array}{l}\textsc{index}\ y\\ \textsc{label}\ l_1\\ \textsc{frames}\ \langle\ [l_1 : \exists y(l_2)],\ [l_2 : \mathit{fact}(y, l_3)]\rangle \oplus Y\end{array}\right]\end{array}\right]\\ \textsc{dtrs}\left\langle\left[\begin{array}{l}\textsc{syn}\left[\textsc{val}\left\langle X{:}\mathrm{NP}_x\right\rangle \oplus L\right]\\ \textsc{sem}\left[\begin{array}{l}\textsc{label}\ l_3\\ \textsc{frames}\ Y\end{array}\right]\end{array}\right]\right\rangle\end{array}\right]$$

A derivation of a predicative gerund is shown in Figure 7, licensed by (53) and (48). Note that XARG corresponds to the subject, and INDEX is a existentially quantified index that has both eventuality-like and individual-like properties. The result is a verbal gerund that can combine with its complements and project a phrase suitable for the post-copular environment, as specified in (37). This SYN specification makes this type of gerund unsuitable for non-predicative nominal environments (cf. with in (25) in §2.4).

In (54), we see a nominal gerund use. It allows adjectival modifiers, prohibits adverbial modifiers, selects an oblique complement, and exhibits number inflection.

(54) a. [His quick/*quickly proving of the theorem] astonished everyone.

b. I resented [his constant/*constantly questioning of my motives].

c. [Tom's proving of the theorem] was in class/took twenty minutes.

[14]There are various other verbal gerund uses. For example, in *I remember constantly questioning Tom's motives*, the unexpressed subject of the gerund must be understood as the matrix subject. In this case, the verb *remember* must link its subject to the subject of the VP. Other uses are *No playing loud music!* and *There's no mistaking that voice*. Here, *no* combines with a verbal gerund with an understood subject, and yields a main-clause prohibition structure (Jørgensen, 1981; Quirk et al., 1985).

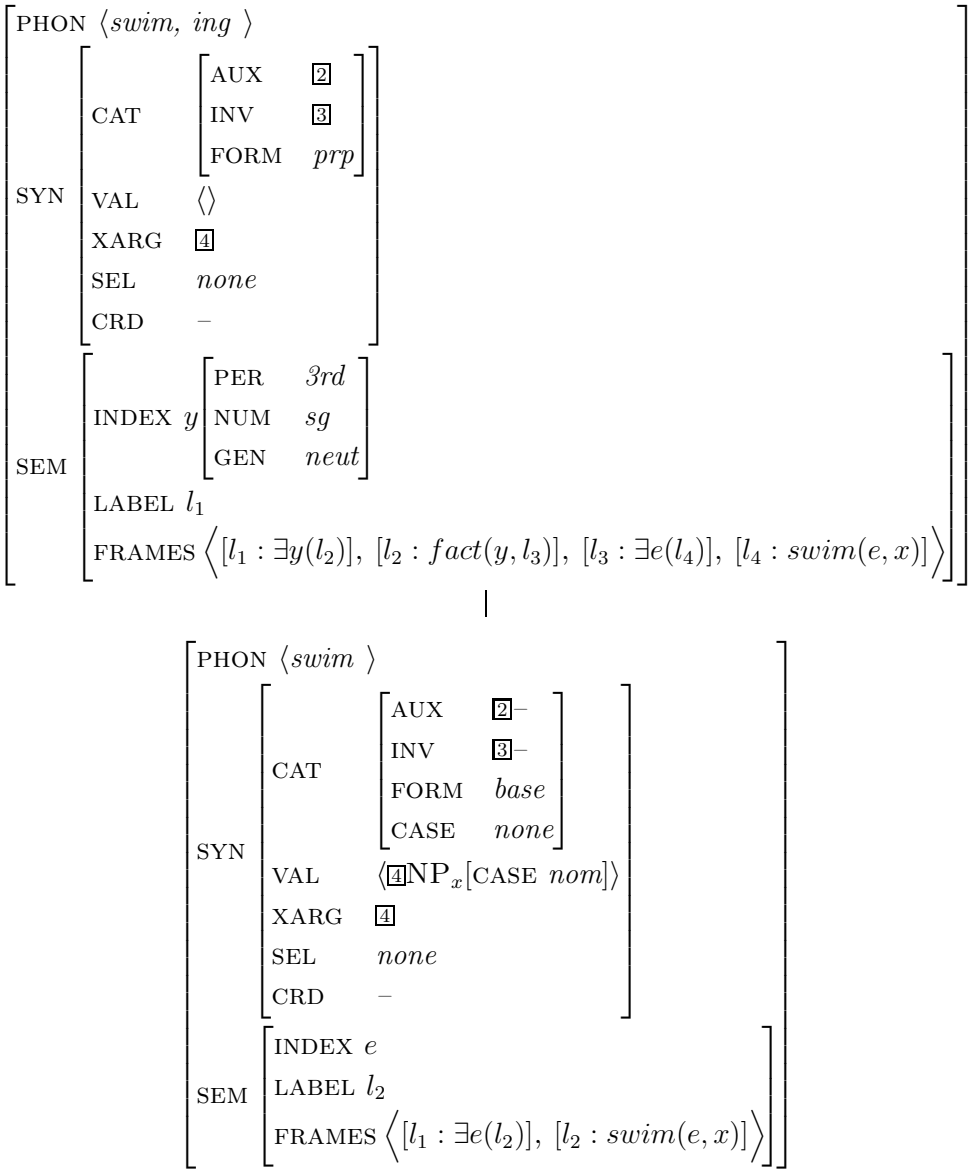


Figure 7: Derivation of a nominal gerund construct

d. [Tom's sightings of UFOs] make me nervous.

Lees (1960, 65–66) argues that nominal gerunds contrast with verbal gerunds in that the former denote actions. This is illustrated in (55).

(55) Kim's drawing of Sue fascinated me.
(the way he drew Sue fascinated me)

Only action-verbs can be converted to nominal gerunds (compare **his believing of it* and **his admiring of her* with *his having a hat* and *his admiring her*). I therefore assume that nominal gerunds denote actions and that actions are nominal-like in that they correspond to stable and referential denotata. They retain very few verb-like properties from the verb stem. Nominal gerund formation is modeled by the construction in (56).

(56) NOMINAL GERUND LEXICAL CONSTRUCTION

nominal-gerund-cx ⇒

$$\left[\begin{array}{l}\text{MTR}\ \left[\begin{array}{ll}\text{SYN} & \left[\begin{array}{l}\text{VAL}\ \left\langle (\text{PP}_y[of]) \right\rangle \oplus L \\ \text{XARG}\ \textit{none}\end{array}\right] \\ \text{SEM} & \left[\begin{array}{l}\text{INDEX}\ w \\ \text{LABEL}\ l_1 \\ \text{FRAMES}\ \langle [l_1 : \textit{action}(w, l_2)] \rangle \oplus Y\end{array}\right]\end{array}\right] \\ \text{DTRS}\ \left\langle \left[\begin{array}{ll}\text{SYN} & \left[\text{VAL}\ \left\langle \text{NP}_x\ (,\text{NP}_y) \right\rangle \oplus L\right] \\ \text{SEM} & \left[\begin{array}{l}\text{LABEL}\ l_2 \\ \text{FRAMES}\ Y\end{array}\right]\end{array}\right] \right\rangle\end{array}\right]$$

The NP_x subject is dropped from the valence list, and the resulting sign is not quantificationally determined. Hence, the nominal gerund cannot yet function as an NP; it must first combine with a determiner phrase via the HEAD-FUNCTOR CONSTRUCTION in (67) so that the index is quantificationally bound. The condition $\textit{action}(x, l)$ ensures both that the stem predication l is an action-verb and that the gerund denotes an action. I conjecture that actions are more individual-like entities than facts, conceptually. Hence, number inflection is possible and adjectival modifiers are allowed.

A final type of nominal gerund is shown in (57). Here, the logical subject is realized as an oblique complement, and non-possessive determiners like *the* and *each* are allowed.

(57) a. I recall [the constant questioning (by John) (about the movie)].

b. [The quick proving of the theorem (by John)] astonished everyone.

I capture this kind of gerund with (58). Since there is no external argument, none of the valents is realized in subject position, as ensured by the *sat-head-comp-cxt* in (31). This use of the nominal gerund is different from the above in that the x variable is not quantified. This means that this kind of gerund must combine with a determiner to project an NP. Of course, any number of adnominal phrases are allowed in between.

(58) Noun gerund lexical construction

noun-gerund-cx ⇒

$$\left[\begin{array}{l}\textsc{mtr}\ \left[\begin{array}{l}\textsc{syn}\ \left[\begin{array}{l}\textsc{val}\ \left\langle (\mathrm{PP}_y[of]) \right\rangle \oplus L \oplus \left\langle (\mathrm{PP}_x[by]) \right\rangle \\ \textsc{xarg}\ \textit{none}\end{array}\right] \\ \textsc{sem}\ \left[\begin{array}{l}\textsc{index}\ y \\ \textsc{label}\ l_1 \\ \textsc{frames}\ \langle Z : [l_1 : \textit{action}(y, l_2)] \rangle \oplus Y\end{array}\right]\end{array}\right] \\ \textsc{dtrs}\ \left\langle \left[\begin{array}{l}\textsc{syn}\ \left[\textsc{val}\ \left\langle \mathrm{NP}_x\ (,\mathrm{NP}_y) \right\rangle \oplus L\right] \\ \textsc{sem}\ \left[\textsc{label}\ l_2\right]\end{array}\right] \right\rangle\end{array}\right]$$

2.7 Complementizers

Kim and Sag (2005) assume that complementizers correspond to a mixed formal category located somewhere between nominal and verbal. Since the present work rejects the existence of part of speech labels, their distribution must instead reflect independently motivated semantic and morphosyntactic properties.

Ginzburg and Sag (2000) argue that clauses and complementizer phrases oscillate between various ontological (*austinian*) entities. As usual, different verbs impose different semantic constraints on the objects they combine with. Verbs like *ask*, *wonder* and *investigate* only combine with question-denoting objects, verbs like *believe*, *deny* and *prove* combine with proposition-denoting objects, verbs *know*, *discover* and *forget* require fact-denoting objects, and *demand*, *require* and *want* select outcome-denoting objects. But since propositions can be realized as S or as CP, there is no obvious way to prevent S subjects and allow CP subjects. Observe the data in (59), from Webelhuth (2012, 210). The fact that S is not a suitable subject, but CP and the pronoun *that* are, indicates that CPs and pronominal *that* have a different meaning from S.

(59) a. [That Sandy tried to cheat] is true.

b.*[Sandy tried to cheat] is true.

c. A: [Sandy tried to cheat].
B: [That] / [That claim] is true.

In this work, I assume a finer-grained multi-inheritance ontology of *austinian* entities than Ginzburg and Sag (2000), so that the complementizer *that* introduces a certain kind of propositional content that is compatible with various *austinian*

entities, but is not exactly the same as the propositional content of an S clause (see Ginzburg and Sag (2000, 121) for related discussion). I propose that the semantic contribution of *that* is conceptualized as a semantic relation $fact(x, l)$, which is different from what Ginzburg and Sag (2000) view as a 'fact'. I take this denotation to correspond to a stable, non-concrete, non-temporal, non-scalar propositional entity. Because this meaning has individual-like semantic features, CPs occur in some environments typical of NPs, as shown in (60).

(60) $\left\{\begin{array}{c}\text{The fact that he proved the theorem}\\ \text{That he proved the theorem}\end{array}\right\}$ $\left\{\begin{array}{c}\text{was surprising}\\ \text{*lasted a long time}\\ \text{*took place in class}\end{array}\right\}$

Spatiotemporal modifiers are disallowed because $fact(x, l)$ denotes a concept without spatiotemporal properties. Adnominal modifiers, such as adjectives and prepositional phrases, cannot combine with CPs, either, because of similar semantic conditions. Although $fact(x, l)$ describes an individual-like stable and referential denotation, it also has other semantic properties which are not consistent with prototypical individuals.

The lexical entry for *that* is given in (61), based on Ginzburg and Sag's (2000, 46, 50) entry. The fact that finite CPs can have case and denote individual-like properties allows them to occur in nominal environments that do not impose very restrictive semantic constraints.

(61)
$$\left[\begin{array}{ll}\textit{word}\\ \textsc{phon} & \langle \textit{that} \rangle\\ \textsc{syn} & \left[\begin{array}{ll}\textsc{cat} & \left[\begin{array}{ll}\textsc{aux} & -\\ \textsc{inv} & -\\ \textsc{form} & \textit{fin}\end{array}\right]\\ \textsc{val} & \langle\ \rangle\\ \textsc{xarg} & \textit{none}\\ \textsc{sel} & \mathrm{S}\left[\begin{array}{ll}\textsc{syn} & \left[\textsc{cat}\left[\begin{array}{ll}\textsc{inv} & -\\ \textsc{form} & \textit{fin}\\ \textsc{case} & \textit{none}\end{array}\right]\right]\\ \textsc{sem} & \left[\textsc{label}\ l_3\right]\end{array}\right]\end{array}\right]\\ \textsc{sem} & \left[\begin{array}{ll}\textsc{index} & x\\ \textsc{label} & l_1\\ \textsc{frames} & \left\langle [l_1 : \exists x(l_2)],\ [l_2 : fact(x, l_3)]\right\rangle\end{array}\right]\end{array}\right]$$

This allows some control over the distribution of CPs. For example, certain predicates verbs are well-known to be compatible with CP complements, but not with S or NP complements, as in (62). Hence, *alleged, confident* and *insistent* must impose restrictive semantic constraints on their objects, requiring *message*-denoting propositions with some verbal properties (e.g. bearing finite tense).

(62) a. Robin marveled *(that) Kim was now ten years old.

b.*Robin marveled it/that claim.

c. Sue objected *(that) it was too cold outside.

d.*Sue objected it/that claim.

e. Kim alleged *(that) Tom proved the theorem.

f.*Kim alleged it/that claim.

Other predicates like *confident*, *sure* and *certain* can combine with S and CP, but not with NP. This is shown in (63). One possibility is that these adjectives require a finite proposition-denoting complement with saturated valence.[15]

(63) a. Bob is confident (that) Kim is now ten years old.

b.*Bob is confident it/that claim.

Finally, verbs like *remember* are much less restricted and therefore compatible with a wide range of complements, as shown in (64). As long as the complement denotes stable individual-like properties, it can function as an object.

(64) a. I remember (that) [he used to play that song for me].

b. I remember [(him) playing me that song]/[the building of the airport].

c. I remember [the day that we met]/[the prediction that the world would end].

The same account may be used for non-finite complementizers. For example, assuming that *for* also corresponds to some outcome-based propositional content that individuates both nominal and verbal properties, then the nominal-like distribution of infinitival CPs emerges as a consequence, as in (65).

(65) a. [For us to win] would be amazing.

b. Robin asked [for us to be fired].

[15]A related use of *confident* requires PP[*of*] complements denoting a proposition.

Because the complementizer has individual- and verbal-like semantic properties, the result is an infinitival clause that can occur in some environments.[16] Similarly, I assume that infinitivals, like that in (66), can also have a use in which they are associated with mixed semantic content.

(66) a. [To do otherwise] would be a mistake.

b. Robin said [to do otherwise].

In Ginzburg and Sag 2000, such infinitival phrases can have a variety of different types of austinian properties. I propose that a unary branching rule takes infinitival *to*-phrases and embeds their semantics under a suitable propositional meaning like $\exists x(statement(x, l))$. Such a rule would make sure that the unexpressed subject is generically quantified, and that both AUX and CASE are underspecified. This analysis would enable the infinitival to occur in (non)auxiliary verbal environments as well as in certain nominal environments.

3 Coordination

Let us now consider how the theory sketched above can handle the categorial flexibility observed in coordinate structures, discussed in §1.1. The coordination of unlikes phenomena will emerge from the morphosyntactic and semantic constraints that are required of the coordinate phrase by a functor external to the coordination. In this account, any semantic constraints imposed on the coordination structure distribute to each conjunct without further stipulations.

I start by assuming that words like *and*, *or* and *but* are markers, and as such do not subcategorize any valents. Instead, they select their hosts via SEL and therefore combine with them via the HEAD-FUNCTOR CONSTRUCTION from §2.4. The conjunction *and* is shown in (67).

[16]Since the for-CP clause has verbal morphosyntactic properties (saturated valence and an infinitival FORM) it can be selected as a verbal complement of *though*-movement predicates (e.g. *Robin is easy* [(*for us*) *to please*]). Following Levine (2001), I assume that *for* selects an infinitival S and projects an infinitival CP. The feature XARG allows *easy* to access the subject of the CP.

(67)
$$\begin{bmatrix} \textit{word} \\ \text{PHON} \ \langle \ \textit{and} \ \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle \, \rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \begin{bmatrix} \text{SYN} \left[\text{CRD} \ - \right] \\ \text{SEM} \left[\text{INDEX} \ \beta \right] \end{bmatrix} \\ \text{CRD} \ + \end{bmatrix} \\ \text{SEM} \begin{bmatrix} \text{INDEX} & \beta \\ \text{FRAMES} & \langle \rangle \end{bmatrix} \end{bmatrix}$$

The feature CRD can take various values, according to the coordinator type. Thus, [CRD +] corresponds to a Non-Boolean Linkean sum conjunction and [CRD $\vee$] corresponds to disjunction.

The coordination construction is essentially a phrase structure rule of the form $X \rightarrow X_0 ... X_n$, implemented as seen in (68). The conjuncts and the mother must have the same SYN information, modulus the CRD marking value. Only the last conjunct is marked by a coordinator.[17]

(68) COORDINATION CONSTRUCTION

coord-cxt $\Rightarrow$

$$\begin{bmatrix} \text{MTR} \begin{bmatrix} \text{SYN} \ X! \left[\text{CRD} \ - \right] \\ \text{SEM} \begin{bmatrix} \text{INDEX} \ \alpha \\ \text{LABEL} \ l \end{bmatrix} \end{bmatrix} \\ \text{DTRS} \left\langle \begin{bmatrix} \text{SYN} \ X! \left[\text{CRD} \ - \right] \\ \text{SEM} \left[\text{INDEX} \ \beta_0 \right] \end{bmatrix}, ..., \begin{bmatrix} \text{SYN} \ X! \left[\text{CRD} \ - \right] \\ \text{SEM} \left[\text{INDEX} \ \beta_{n-1} \right] \end{bmatrix}, \begin{bmatrix} \text{SYN} \ X! \left[\text{CRD} \ R \right] \\ \text{SEM} \left[\text{INDEX} \ \beta_n \right] \end{bmatrix} \right\rangle \\ \text{CX-CONTENT} \left\langle Y : \begin{bmatrix} \text{LABEL} & l \\ \text{RELN} & R \\ \text{INDEX} & \alpha \\ \text{ARGS} & \langle \beta_0, ..., \beta_{n-1}, \beta_n \rangle \end{bmatrix} \right\rangle \end{bmatrix}$$

[17] I assume that polysyndetic coordinations like *Tom and Sue and Fred* obtain trough multiple applications of the construction in (68).

Semantically, the coordination construction adds the semantics $R(\beta_0, ..., \beta_{n-1}, \beta_n)$ via CX-CONTENT, where β_n $(n \geq 1)$ is the index of the each conjunct. If the value of the last conjunct's CRD is an i-sum '+', then α is a plurality formed with $\beta_0, ..., \beta_{n-1}, \beta_n$ as shown in (69a). If the value of CRD is a disjunction (i.e. '$\vee$'), then α is identical to one of the β indices, as in (69b).

(69) a. $\begin{bmatrix} \text{RELN} & + \\ \text{INDEX} & \alpha \\ \text{ARGS} & \langle \beta_1, \beta_2 \rangle \end{bmatrix} \equiv \alpha = (\beta_1 + \beta_2)$

b. $\begin{bmatrix} \text{RELN} & \vee \\ \text{INDEX} & \alpha \\ \text{ARGS} & \langle \beta_1, \beta_2 \rangle \end{bmatrix} \equiv (\alpha = \beta_1) \vee (\alpha = \beta_2)$

The effect of the coordination construction is shown in Figure 8. If the conjunct's indices are nominal, then it follows that the plurality that they form via the i-sum $z = x+y$ is also nominal. Similarly, if the conjuncts are eventualities, then the plurality they form is also an eventuality. For example, the coordination of predicative NPs is essentially identical to the coordination of non-predicative NPs. The main syntactic difference is that the conjuncts and the mother node are specified [XARG NP_y] instead of [XARG *none*]. For more discussion on non-nominal pluralities, see Bach (1986, 9), Link (1998a, 240), Carlson (1987, 540–542), Lasersohn (1995, 273) and Eckardt (1995). Evidence that conjunction can form non-nominal pluralities appears in (70).

(70) a. John is alternately [hot and cold].

b. They meet alternately [in Berlin and in Italy].

c. Robin is both [a physician and a dentist].

d. You can't simultaneously [drive a car and talk on the phone].

e. [Sue drank a beer and Robin ate a burger] in exactly twenty seconds.

Any coordination is possible as long as the value of the mother's SYN can be unified with the SYN values of the daughters, modulus CRD. This is illustrated by (71), where '$\perp$' indicates unification failure. Only the conflicting features are shown, for perspicuity.

(71) a. *Sue $[[\text{drank a soda}]_{[\text{VAL } \langle \text{NP}^{nom} \rangle]}$
and $[\text{devoured}]_{[\text{VAL } \langle \text{NP}^{nom}, \text{ NP}^{acc} \rangle]}$ $]_{[\text{VAL } \perp]}$.
(cf. with 'Sue [drank a soda] / *[devoured]')

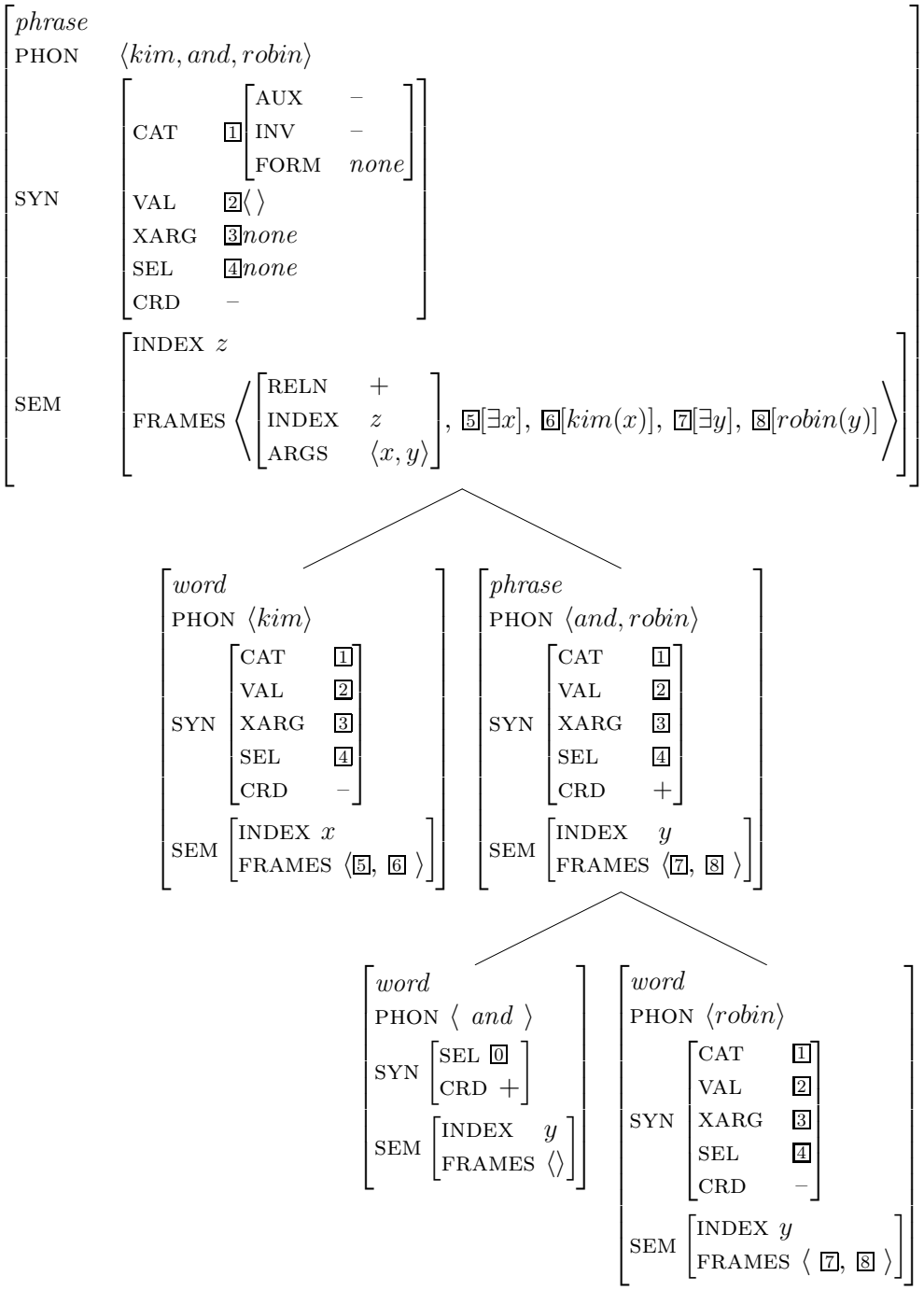


Figure 8: NP coordination construct (semantic relation labels omitted)

b. *Fred is [[happy]$_{[\text{XARG NP}]}$ and [drunken]$_{[\text{XARG } none]}$]$_{[\text{XARG } \perp]}$.
(cf. with 'Feed is happy / *drunken')

In Sag 2012, the AUX feature provides information about the environment of the sign rather than about the sign itself. Hence, non-auxiliary verbs are [AUX–], and auxiliary verbs are underspecified as [AUX *bool*]. Here, I assume instead that AUX provides information about the verbal lexical sign that feeds auxiliary lexical constructions. More specifically, all auxiliary constructions take a verb that can be unified with [AUX+] and yield a counterpart that is [AUX *bool*]. Hence, the mother node of constructions that require the verb daughter to be compatible with AUX+ will be underspecified for AUX values. For example, the rule that handles auxiliary negation in Sag 2012 takes an [AUX+] verb and yields a negative counterpart [AUX–]. In my approach, the auxiliary negation rule just described above will take a non-negative [AUX+] verb and yield a negative counterpart specified as [AUX *bool*]. Similarly, the *auxiliary initial construction* which handles subject auxiliary inversion constructions requires the daughter verb to be [AUX+] and [INV–]. The mother is required to be [AUX *bool*] and [INV+]. Hence, coordinations like (72) are unproblematic, because there is no inconsistent AUX information. The conjuncts and the mother node can resolve as [AUX–] and [INV–].

(72) Kim ate a burger and Robin did, too.

Such coordination data suggest that lexical AUX information should not be made available non-locally, across different constructions. This is achieved by the analysis just proposed, by assuming AUX to be underspecified in the mother node of auxiliary verb constructions.

The present account readily predicts a wide range of coordination of categories that are traditionally viewed as fundamentally different. Such coordinations are unremarkable because the conjuncts have identical SYN information. For example, Figure 9 shows the result of coordinating phrases with mutually compatible predicative SYN specifications.

Analogously, the phrase in Figure 10 is the result of conjoining two phrases that modify VPs. Many other unlike conjuncts are licensed in the same way, including gerunds, infinitival *to*-phrases, and complementizer phrases.

Although the coordination in (73) is well-formed, the resulting phrase is an unsuitable subject for the matrix verb *entered*. Syntactically, this verb requires the subject to be [XARG *none*] and [CASE *nom*]. Semantically, the subject is also required to correspond to an animate entity. The coordinate subject fails on both accounts. Predicative phrases denote states rather than individuals and are specified as [XARG NP] and [CASE *none*].

(73) *[A Republican and proud of it] entered the room.

In other cases, the incompatibility is semantic. Consider, for example, (74). As discussed above, the verb *become* selects complements that are not action-denoting.

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON } \langle \textit{wealthy, a, republican, and, from, Texas} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\,\rangle \\ \text{XARG} \quad \text{NP}^x \\ \text{SEL} \quad \textit{none} \\ \text{CRD} \quad - \end{bmatrix} \end{bmatrix}$$

Figure 9: A predicative coordinate construct (daughters omitted)

$$\begin{bmatrix} \textit{phrase} \\ \text{PHON } \langle \textit{frequently, and, with, increasing, ferocity} \rangle \\ \text{SYN} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{AUX} & - \\ \text{INV} & - \\ \text{FORM} & \textit{none} \\ \text{CASE} & \textit{none} \end{bmatrix} \\ \text{VAL} \quad \langle\,\rangle \\ \text{XARG} \quad \textit{none} \\ \text{SEL} \quad \text{VP} \\ \text{CRD} \quad - \end{bmatrix} \end{bmatrix}$$

Figure 10: A coordinate adverbial construct (daughters omitted)

As the verb combines with the plural eventuality denoted by the coordinate phrase, the semantic selection constraints distribute over to the members of the plurality and infelicity arises because of the second conjunct.

(74) *Kim became [happier and laughing].

The contrast in (75a,b) is also due to semantic restrictions rather than syntax. As discussed above, *grew* selects complements that denote scalar concepts, but *remain* imposes no such constraint. The sentence in (75a) is ruled out because one of the conjuncts does not denote a scalar concept as required by the verb *grew*.[18]

(75) a. Kim remained wealthy/a Republican.

[18]But see §2.5 for other uses of this verb.

b. Kim grew wealthy/ *a Republican.

c. Kim remained/*grew wealthy and a Republican.

When two functors are coordinated, the COORDINATION CONSTRUCTION in (68) causes any semantic conditions imposed on the shared valents to be compounded. If one verbal conjunct imposes the constraints [FRAMES $\langle l_1{:}P(e_1,x), l_1{:}P'(x)\rangle$] and the other conjunct imposes [FRAMES $\langle l_1{:}Q(e_2,x), l_1{:}Q'(x)\rangle$], then coordinate mother's FRAMES value is (76).[19]

(76) $\langle l{:}\exists z(l_1,l_2), l_1{:}P(e_1,x), l_1{:}P'(x), l_1{:}Q(e_2,x), l_1{:}Q'(x), l_1{:}z{=}e_1{+}e_2\rangle$

In other words, the shared dependent x must satisfy all the constraints imposed by both coordinate functors. This accounts for the contrasts in (77). Example (77a) is acceptable because the object adjective phrase satisfies all the syntactic and semantic constraints imposed by both verbs, whereas (77b,c) are not acceptable because one of the predicative conjuncts is incompatible with the semantic constraints imposed by the verbs. Namely, *grew* requires that the complement denotes a scalar concept, but the predicative NP *a Republican* denotes a state that is not intrinsically scalar.

(77) a. Kim grew and remained wealthy.

b.*Kim grew and remained a Republican.

c.*Kim grew and remained wealthy and a Republican.

Certain predicative adjectives, like *impressive* and *surprising*, impose no semantic constraints on their external arguments other than that they must be NP_x. This allows them to combine with a wide range of referential external arguments, including some CPs, gerundial phrases and infinitivals. This is also true for some verbs, as is the case of *mention*, as (78) shows. The bracketed argument need only refer to an individual-like entity. Hence, such functors can combine with a wide range of phrases, without appeal to enumerative disjunctive selection constraints.

(78) a. [The fusebox's hissing, the danger involved, and that the wiring had to be replaced] were clearly mentioned in the electrician's technical report.

b. The electrician's technical report clearly mentioned three problems: the fusebox's hissing, the danger involved, and that the wiring had to be replaced.

[19] As in Reyle 1996, any predications with the same label are interpreted as being conjoined. Thus, the representation obtained above is equivalent to $\lambda z.\exists z(P(e_1,x)\wedge P'(x)\wedge Q(e_2,x)\wedge Q'(x)\wedge z{=}e_1{+}e_2\wedge\phi(z))$. See Copestake et al. (2005) for more discussion. I take such labeled predications to be interpreted as underspecified Dynamic Predicate Logic, as in Bos 1996.

The oddness of (79) follows from the fact that the two case-marking prepositions introduce different role predicates (*source*(x) and *topic*(x), respectively), but the verb is incompatible with the latter. Hence, the PP[*on*] conjunct causes the VP to be odd.

(79) *Kim relies [on Sue]$_{\text{PP}[on]}$ [and of Fred]$_{\text{PP}[of]}$
(cf. with 'Kim relies on/*by Fred')

But if the verb is compatible with both case-marked PP arguments, or if the PPs are adjuncts instead, then such structures are legal.

There are also cases that seem to involve the apparent coordination of co-valents, as in (80). Here, each valent seems to satisfy a different valence constraint by the verb.

(80) a. We all heard the way she talked (both) to him and about him.

b. Every chapter of his book was written (both) by students and for students.

Note that (80a) is not equivalent to *we all heard the way she talked to him about him*. Rather, the corresponding paraphrase is *we all heard the way she talked to him and talked about him*. Perhaps (80) involve VP coordinations where the second V is deleted and *both* floats to the right. For an account of the variable linear position of correlative coordination markers like *either*, see Hofmeister (2010). I leave the proper analysis of *both* and (80) for future research.

4 Conclusion

This speculative paper suggests that constraint-based grammar frameworks like Pollard and Sag 1994 are ideally suited to model phrasal distributional classes without resorting to part of speech labels. Such labels are artificial and have never been well-defined, arguably because the linguistic entities that they are meant to classify are not categorical at all, but rather, part of a continuum with different kinds of idiosyncrasy. However, if signs are viewed as fine-grained sets of features, containing different alignments of morphological, syntactic, and semantic information, it should be in principle possible to characterize the traditional part of speech classes in an emergent and well-motivated way. This work goes on to show how distributional overlap in a wide range of environments can in principle be modeled in Sign-based Construction Grammar (Sag, 2012), as independently motivated fine-grained morphosyntactic and semantic constraints. Syntactic categories with flexible distributional environments emerge as a natural consequence of the small number of coarse-grained constraints that are imposed, whereas highly restricted environments result from the imposition of fine-grained constraints. The theory sketched in this

paper also offers a straightforward account of so-called coordination of unlike categories, building on key aspects of the feature geometry in Sag 2012. Unlike previous accounts of coordination of unlikes, the grammar does not need to enumerate the parts of speech that each coordination environment tolerates. Rather, the phenomena follow from the interaction between coordination and the information contained in each sign.

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