Chapter 4
Lexical Representation, Co-composition, and Linking Syntax and Semantics

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4.1 Introduction

A fundamental issue dividing theories of the syntax-semantics interface is whether the semantic representation of clauses is projected from the lexical representation of the verb which determines to a large extent the syntactic structure of the clause or whether it is constructed or composed based on the NPs and PPs co-occurring with the verb in a clause; in the latter view, the verb has a very general or underspecified meaning. The empirical problem underlying this dispute concerns the ability of a single verb to occur in a variety of morphosyntactic contexts, as illustrated with the English verb *shatter* in (1).

(1) a. The window shattered.
b. The burglar shattered the window.
c. The burglar shattered the window with a crowbar.
d. The crowbar shattered the window.
e. *The window shattered with a crowbar.

This verb occurs as an intransitive verb in (1a), as a transitive verb in (1b–d), with an optional instrumental PP in (1c), and with an instrumental subject in (1d); the optional instrumental PP is only possible with the transitive version, as (1e) shows. Are the verbs in (1a–d) represented in distinct lexical entries in the lexicon, or is there a single lexical entry underlying all four uses? If there is only one lexical entry, then how are the various patterns to be accounted for? Are the four patterns

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related by means of lexical rules? Or are they a function of an underspecified lexical representation plus the information supplied by the NPs and PPs in the clause?

The first approach mentioned above, which has been dubbed the 'projectionist approach,' has been advanced by Foley and Van Valin (1984), Pinker (1989), Levin and Rappaport Hovav (1994), Rappaport Hovav and Levin (1998), Van Valin (1993, 2005), and Van Valin and LaPolla (1997), among others, while the second, which has been termed the 'constructionist approach,' has been championed by Goldberg (1995), Pustejovsky (1995) and Michaelis and Ruppenhofer (2001), among others.[1] The two approaches have often been viewed as conflicting and incompatible with each other, but in this paper it will be argued that they are in fact complementary and therefore not necessarily in conflict with each other. In the discussion, the projectionist view will be represented by Role and Reference Grammar [RRG] (Van Valin 1993, 2005; Van Valin and LaPolla 1997) and its theory of semantic representation and theory of linking between syntax and semantics, and the constructionist perspective will be represented by the Generative Lexicon [GL] theory and in particular its notion of co-composition (Pustejovsky 1995, 1998).

The discussion will proceed as follows. In Sect. 4.2, two different verbal alternations will be presented, the activity-active accomplishment alternation and the causative alternation; in addition, the ability of the same forms to license optional PPs such as instruments and comitatives will be taken as a further issue for the two approaches. In Sect. 4.3, the RRG projectionist analysis of these alternations will be explicated, and then in Sect. 4.4 the GL analysis of them will be laid out. In Sect. 4.5 the two approaches will be reconciled with each other, and in Sect. 4.6 an RRG account of co-composition will be developed. Conclusions will be presented in Sect. 4.7.

4.2 The Verbal Alternations

4.2.1 The Activity-Active Accomplishment Alternation

The first alternation to be discussed concerns the atelic and telic use of activity verbs such as *run, walk, eat, drink,* and *write.* These two uses can be distinguished by their co-occurrence with the temporal adverbial PPs *for an hour* (atelic) and *in an hour* (telic). This is exemplified in (2)–(4).

[1] Rappaport Hovav and Levin (1998) contrast projectionist accounts with what they call 'constructional' approaches, which derive sentence meaning from a general verb meaning plus the meaning of the syntactic construction in which the verb occurs. The term 'constructionist' as used here is meant to cover both constructional approaches as well as other approaches which attempt to derive the meaning of sentences from the verb plus co-occurring elements, regardless of whether they posit constructional meanings or not. Goldberg (1995) and Michaelis and Ruppenhofer (2001) would be an example of the first approach, which may also be termed 'enriched compositionalist' (Jackendoff 1997), and Pustejovsky (1995) of the second.

(2) a. The soldiers marched (in the park) for an hour/*in an hour. Atelic
b. The soldiers marched to the park in an hour.[2] Telic

(3) a. Sandy wrote (poetry) for an hour/*in an hour. Atelic
b. Sandy wrote the poem in an hour. Telic

(4) a. Chris drank (beer) for an hour/*in an hour. Atelic
b. Chris drank the beer in an hour. Telic

With atelic motion activity verbs, as in (2a), the locative PP is optional, and only *for an hour* is possible. When there is a goal PP, as in (2b), the verb behaves like a telic verb; the PP cannot be omitted, if the telic reading is to be maintained, and an *in* temporal PP is possible. With atelic creation activity verbs, as in (3a), the object is non-referential and omissible, and only a *for*-temporal PP is possible. When the object is specific or quantified, as in (3b), the verb behaves like a telic verb, and *in an hour* is possible. Finally, with a consumption activity verb, as in (4a), the object is likewise non-referential, just as in (3a), and only a *for* temporal PP is permitted. Again, as in (3b), when the object is specific or quantified, as in (4b), the verb behaves like a telic verb, and an *in* temporal PP may appear with it. In RRG, the telic uses of activity verbs are termed 'active accomplishments', and this term will be used hereafter to refer to the *Aktionsart* of the verbs in sentences like (2b)–(4b).

Early discussions of the alternations in (3) and (4) attributed the crucial difference to the referential status of the object NP, e.g. Verkuyl (1972), but if this were the case, then such an analysis would predict that the contrast observed in (3) and (4) would not be found in languages without articles indicating the referentiality of NPs. But this is not the case. In Russian and Georgian, for example, this contrast is signalled by changes in the verb, not by changes in the object NP. This is exemplified in (5) for Russian[3] and (6) for Georgian (Holisky 1981).

[2]With some of these verbs a *for* PP is possible, e.g. *The soldiers marched to the park for an hour*. However, the meaning here is either that the soldiers marched back and forth from somewhere to the park for an hour, which is an iterative, atelic reading, or it means that they marched to the park and stayed there for an hour, in which case the for PP modifies the result of the action and not the action itself. The crucial distinction is that the atelic uses of these verbs can only take *for* and not *in,* while the telic uses take *in.*

[3]Russian data are from Viktoriya Lyakh (personal communication).

(5) a. Ja jë-l (kaš-u) decjat' minut. Atelic
1sgNOM eat.IMPF-PAST kasha-ACC ten minutes
'I ate (kasha) for ten minutes.'[4]
b. Ja s"-jë-l kaš-u za decjat' minut. Telic
1sgNOM PRFV-eat-PAST kasha-ACC in ten minutes
'I ate the kasha in ten minutes.'

(6) a. K'ac-i (c'eril-s) c'er-s xuti saati. Atelic
man-NOM (letter-DAT) write.PRES-3sg five hours
'The man is writing (letters) for five hours.'
b. K'ac-i c'eril-s da-c'er-s at c'ut-ši. Telic
man-NOM letter-DAT PRV-write.PRES-3sg ten minutes-in
'The man will write the letter in ten minutes.'[5]

In both pairs of sentences, there is no difference in the coding of the direct object, despite the differences in interpretation. There is, however, a difference in the verb in both languages: the telic form of the Russian verb for 'eat', *jest',* takes the prefix *s-,* and the telic form of the Georgian verb for 'write', *c'er-,* takes the preverb *da-*. In both languages, as in English, the object NP is optional with the atelic verbs but obligatory with the telic verbs.

Further examples can be found in languages from other parts of the world. The Amazonian language Pirahã (Everett 1986) has distinct telic and atelic suffixes for verbs, as illustrated in (7).

(7) *(xápiso) xaho-aí-* 'eat (bark)' *xápiso xaho-áo-* 'eat the bark'
(bark) eat-ATELIC bark eat-TELIC

In some syntactically ergative languages, the base form of verbs like 'eat' and 'drink' appears to be telic, and in order to get the atelic reading, the verbs must be antipassivized. The examples in (8) are from Dyirbal (Dixon 1972), an Australian Aboriginal language, and the ones in (9) are from Sama (Walton 1986), a Philippine language.

[4]Abbreviations: ABS 'absolutive', ACC 'accusative', ANTI 'antipassive', COM 'comitative', DAT 'dative', ERG 'ergative', IMPF 'imperfective', IND 'indicative', INST 'instrumental', LOC 'locative case', MR 'macrorole', NFUT 'non-future tense', NM 'noun marker', NMR 'non-macrorole', NOM 'nominative', PAST 'past tense', PRES 'present tense', PRFV 'perfective', PRT 'particle', PRV 'preverb'.

[5]The reason this sentence has a future interpretation is that despite being present tense, it is also telic, which entails completion of the action. Since the action cannot be both in progress and completed at the moment of speaking, it is given a future interpretation. Also, in this sentence 'in ten minutes' refers to the length of time it will take to write the letter, not the length of the interval until the writing begins.

(8) a. Balam wudyu-Ø baŋgul yaŗa-ŋu dyaŋga-ɲu. Telic
NM.ABS fruit-ABS NM.ERG man-ERG eat-NFUT
'The man is eating the fruit.'
b. Bayi yaŗa-Ø dyaŋgay-mari-ɲu (bagum wudyu-gu). Atelic
NM.ABS man-ABS eat-ANTI-NFUT NM.DAT fruit-DAT
'The man is eating (fruit).'

(9) a. Inum na d'nda kahawa. Telic
drink PRT woman coffee
'The woman already drank the coffee.'
b. N-inum na d'nda (kahawa) Atelic
ANTI-drink PRT woman coffee
'The woman is now drinking (coffee).'

In (8a) and (9a), the verb has a telic interpretation, the patient NPs are interpreted as referentially specific, and they are obligatory. In the antipassive forms in (8b) and (9b), the verb has an atelic interpretation, the patient NPs are interpreted as non-referential, and they are omissible.

Thus, in all five of these languages the locus of the coding of the activity-active accomplishment alternation is on the verb, not on the patient NP. Only in Dyirbal, in which the patient shifts from absolutive to dative case, is there any change in the morphosyntactic coding of the patient, and it is not related to the referential or quantification status of the NP. Hence the claim that this alternation is primarily related to and signaled by the referential or quantification status of the object NP is incorrect. In these five languages, changes in the marking of the verb results in changes in the interpretation of the object NP.

4.2.2 The Causative Alternation

The basic causative alternation in English was illustrated in (1a, b), repeated in (10) below.

(10) a. The window shattered.
b. The burglar shattered the window.

There are at least five ways the verbs in these two sentences could be related to each other. First, one could claim that they are listed separately in the lexicon, on the analogy of semantically similar pairs like *die* and *kill* which bear no formal resemblance to each other. Second, one could claim that there is a single representation in the lexicon which is underspecified for transitivity underlying both forms (Pustejovsky 1995). Third, one could claim that there is an alternating stem form from which the two are derived; in such an analysis, neither form is considered to be basic (Piñón 2001). Fourth, one could claim that the transitive form in (1b) is

derived from the intransitive form in (1a) by a causativization rule, on the analogy of languages like Huallaga Quechua (Weber 1989); the operation of this rule is exemplified in (11).

(11) a. *hatunya:-* *hatunya:-chi-*
become.big become.big-cause
'become bigger' 'make something bigger'
b. *wañu-* *wañu-chi-*
die die-cause
'die' 'kill'
c. *yacha-* *yacha-chi-*
learn learn-cause
'learn' 'teach'

Fifth, one could claim that the intransitive form is derived from the transitive form, on the analogy to languages like Russian, French and Yagua (Payne and Payne 1989), in which such a derivational relationship is explicit in the morphology of the two forms. This is sometimes referred to as the 'anticausative alternation'.

(12) a. Russian *razbit'* 'break [TR]' *razbit'sja* 'break [INTR]'
b. French *briser* 'break [TR]' *se briser* 'break [INTR]'
c. Yagua *-muta-* 'open [TR]' - *muta-y-* 'open [INTR]'

In Russian and French the addition of reflexive morphology yields the intransitive equivalent of the transitive, causative verb, and in the Peruvian language Yagua the suffix *-y-* serves the same function. See Haspelmath (1993) for a cross-linguistic survey of the morphological patterns that verbs in this alternation exhibit. The English verbs that enter into this alternation do not show any morphological differences; they are often referred to as 'labile' verbs. Given this lack of any overt morphological derivation, it is not obvious which, if any, of these derivational analyses applies appropriately to the English situation.

It should be noted that these first two alternations can combine to generate up to four possible interpretations for a single English verb. Consider *march* in (13).

(13) a. The soldiers marched in the field. Activity
b. The sergeant marched the soldiers in the field. Causative activity
c. The soldiers marched to the field. Active accomplishment
d. The sergeant marched the soldiers to the field. Causative active accomplishment

Since English marks neither alternation overtly, the questions raised in this section and the last apply jointly to the verb *march* and others like it.

4.2.3 Optional Instruments and Comitatives

The last issue to be discussed is the occurrence of optional instrumental and comitative PPs with certain verbs. The interaction of instrumental PPs with the causative alternation was shown in (1c–e), repeated in (14).

(14) a. The burglar shattered the window with a crowbar.
b. The crowbar shattered the window.
c. *The window shattered with a crowbar.

The instrumental NP *crowbar* can appear with the transitive form of *shatter*, either as a part of an optional PP or as subject. It cannot, however, occur with the intransitive form of the verb. This raises the issue of what licenses the occurrence of an instrumental NP, especially as an optional PP. Similar issues arise with respect to comitative NPs, as shown in (15).

(15) a. Chris and Pat went to the movies.
b. Chris went to the movies with Pat.
c. Pat went to the movies with Chris.

(16) a. The gangster robbed the bank (together) with the corrupt policeman.
b. The bank was robbed by the gangster (together) with the corrupt policeman.
c. *The bank was robbed (together) with the corrupt policeman.

The NP in a comitative PP can also appear as part of a conjoined subject in sentences like (15). Here again there is an NP that can occur either in an optional PP or as subject.

The question that is relevant for this discussion is, how are these optional instruments and comitatives licensed? Are they adjuncts, in which case they are not directly tied to the verb's argument structure, or are they a kind of optional argument? If they are adjuncts, then how are (14c) and (16c) to be explained?

4.2.4 Summary

None of the alternations discussed in this section are normally coded on the verb in languages like English, but there are languages in which there are overt morphological indicators of the alternation. In the next section the relevant aspects of Role and Reference Grammar will be introduced along with an analysis of these phenomena. Then the Generative Lexicon co-composition analysis will be presented.

4.3 The Role and Reference Grammar Theory of Lexical Representation and Linking

Role and Reference Grammar is a monostratal theory of syntax which posits a single syntactic representation for each sentence, which is linked to a semantic representation by means of a set of linking rules called the linking algorithm. Discourse-pragmatics may play a role in the linking, but it will not be discussed in this paper. The organization of the theory is given in Fig. 4.1.

The arrow on the linking algorithm is double-headed, because the linking system maps a semantic representation into the appropriate syntactic representation, and also maps a syntactic representation into the appropriate semantic representation.

4.3.1 Basic Principles of Role and Reference Grammar[6]

Little will be said about the nature of the syntactic representation in RRG, since the focus in this paper is on semantic representation and linking. Termed 'the layered structure of the clause', the syntactic representation of clauses is based on the set of semantic contrasts summarized in Table 4.1.

An example of the layered structure of a simple English sentence is given in Fig. 4.2.

The verb *show* is the predicate in the nucleus of the clause, and its three arguments, *Scully*, *the photo* and *Mulder*, are all arguments in the core of the clause. The two adjuncts, *at the office* and *yesterday*, occur in the periphery of the clause. Syntactic structures are stored as 'syntactic templates' in the syntactic inventory, and these templates are combined to create the structure of a sentence.

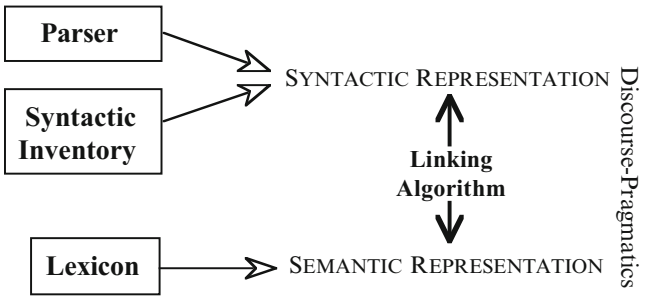


Fig. 4.1 The organization of Role and Reference Grammar

[6]Detailed presentations of RRG can be found in Van Valin (2005) and Van Valin and LaPolla (1997). A bibliography of work in the theory, along with copies of recent papers, dissertations and theses can be found on the RRG web site: http://linguistics.buffalo.edu/research/rrg.html.

Table 4.1 Semantic units underlying the syntactic units of the layered structure of the clause

Semantic element(s)	Syntactic unit
Predicate	Nucleus
Argument in semantic representation of predicate	Core argument
Non-arguments	Periphery
Predicate + arguments	Core
Predicate + arguments + non-arguments	Clause (=core + periphery)

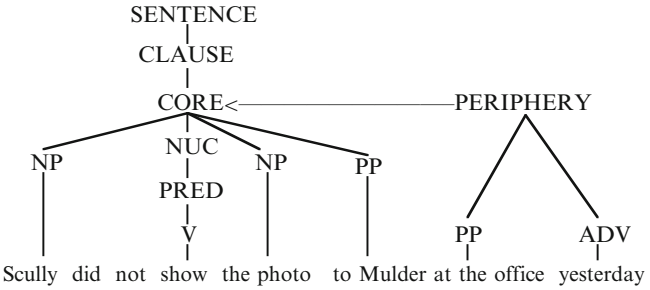


Fig. 4.2 The layered structure of the clause in English (Grammatical categories such as tense and negation, called 'operators' in RRG, are represented in a separate projection of the clause. It is not included, since it is not directly relevant to the topic of this paper. Also, the internal structure of PPs and NPs will not be represented unless relevant to the point at hand)

The semantic representation in RRG is built around the lexical representation of the predicate in the nucleus, which is an *Aktionsart*-based decompositional representation. The *Aktionsart* classes together with examples from English are given in (17).

(17)	a	State:	The boy is scared.
	a´	Causative state:	The dog scares the boy.
	b.	Achievement:	The balloon popped.
	b´	Causative achievement:	The cat popped the balloon.
	c.	Semelfactive	The cane tapped on the tabletop.
	c´.	Causative semelfactive	The man tapped the cane on the tabletop.
	d.	Accomplishment:	The ice melted.
	d´.	Causative accomplishment:	The hot water melted the ice.
	e.	Activity:	The soldiers marched in the field.
	e´.	Causative activity:	The sergeant marched the soldiers in the field.
	f.	Active accomplishment:	The soldiers marched to the field.
	f´.	Causative active accomplishment:	The sergeant marched the soldiers to the field.

Table 4.2 Lexical representations for *Aktionsart* categories

Logical structure	Verb class
STATE	**predicate´** (x) or (x, y)
ACTIVITY	**do´** (x, [**predicate´** (x) or (x, y)])
ACHIEVEMENT	INGR **predicate´** (x) or (x, y), or INGR **do´** (x, [**predicate´** (x) or (x, y)])
SEMELFACTIVE	SEML **predicate´** (x) or (x, y) SEML **do´** (x, [**predicate´** (x) or (x, y)])
ACCOMPLISHMENT	BECOME **predicate´** (x) or (x, y), or BECOME **do´** (x, [**predicate´** (x) or (x, y)])
ACTIVE ACCOMPLISHMENT[a]	**do´** (x, [**predicate$_1$´** (x, (y))]) & INGR **predicate$_2$´** (z, x) or (y)[b]
CAUSATIVE	α CAUSE β, where α, β are LSs of any type

[a]The telic use of activity verbs is often classified as an accomplishment in the literature, and accordingly, a modified version of this term will be used here, despite the fact that the logical structure actually contains INGR rather than BECOME. See Van Valin (2005), section 2.1 for discussion

[b]'&' is a connective meaning 'and then'; it contrasts with '∧', which means 'and simultaneously'

The decompositions for the different *Aktionsart* categories are given in Table 4.2. These representations are called 'logical structures' [LSs].

Examples of verbs and their LSs from English are given in (18).

(18) a. STATES

Pat is a fool.	**be´** (Pat, [**fool´**])
The window is shattered.	**shattered´** (window)
Kim is in the library.	**be-in´** (library, Kim)
Dana saw the picture.	**see´** (Dana, picture)

b. ACTIVITIES

The children cried.	**do´** (children, [**cry´** (children)])
Carl ate pizza.	**do´** (Carl, [**eat´** (Carl, pizza)])

c. ACHIEVEMENTS

The window shattered.	INGR **shattered´** (window)
The balloon popped.	INGR **popped´** (balloon)

d. SEMELFACTIVES

Dana glimpsed the picture.	SEML **see´** (Dana, picture)
The light flashed.	SEML **do´** (light, [**flash´** (light)])

e. ACCOMPLISHMENTS

The snow melted.	BECOME **melted´** (snow)
Mary learned French.	BECOME **know´** (Mary, French)

f. ACTIVE ACCOMPLISHMENTS
Chris ran to the park.
do´ (Chris, [**run´** (Chris)]) & INGR **be-at´** (park, Chris)
Carl ate the pizza.
do´ (Carl, [**eat´** (Carl, pizza)]) & INGR **consumed´** (pizza)

g. CAUSATIVES
The dog scared the boy.
[**do´** (dog, Ø)] CAUSE [**feel´** (boy, [**afraid´**])]
The burglar shattered the window.
[**do´** (burglar, Ø)] CAUSE [INGR **shattered´** (window)]
Sam flashed the light.
[**do´** (Sam, Ø)] CAUSE [SEML **do´** (light, [**flash´** (light)])]
Max melted the ice.
[**do´** (Max, Ø)] CAUSE [BECOME **melted´** (ice)]
Felix bounced the ball.
[**do´** (Felix, Ø)] CAUSE [**do´** (ball, [**bounce´** (ball)])]
Mary fed the pizza to the child.
[**do´** (Mary, Ø)] CAUSE [**do´** (child, [**eat´** (child, pizza)]) &
INGR **consumed´** (pizza)]

The semantic representation of a clause is based on these LSs; a full representation contains information about operators like illocutionary force, tense, negative and aspect (see Van Valin and LaPolla 1997:171–2). The selection of the syntactic template for the core is determined by the following general principle (Van Valin and LaPolla 1997:173).

(19) Syntactic template selection principle:
The number of syntactic slots for arguments within the core is equal to the number of distinct specified argument positions in the semantic representation of the core.

There are a number of language-specific and construction-specific qualifications for this principle, but it underlies the projection of the syntactic structure of the clause from its semantic representation, as it determines which syntactic template is appropriate.

The semantic representation of nominals is based on the theory of nominal qualia proposed in GL in Pustejovsky (1991, 1995). Four qualia are posited: constitutive, which is the relation between an object and its constituents, or proper parts; formal, which distinguishes the object within a larger domain; telic, which is the purpose and function of the object; and agentive, which includes factors involved in the origin or creation of an object. Pustejovsky gives the following representation for the noun *novel*; the values of the qualia are given using the RRG representational system.

(20) **novel** (x)
  a. Const: **narrative´** (x)
  b. Form: **book´** (x), **disk´** (x)
  c. Telic: **do´** (y, [**read´** (y, x)])
  d. Agentive: **artifact´** (x), **do´** (y, [**write´** (y, x)]) & INGR **exist´** (x)

Qualia may also be linked to argument positions in LSs, in order to express the selectional restrictions of the predicate.

The most important component of the RRG theory of semantic roles is the two semantic macroroles, actor and undergoer.[7] They are the two primary arguments of a transitive predication, and an intransitive verb may take an actor or an undergoer as its single argument, depending on its semantics. This is illustrated in (21).

(21) a. Maria [Actor] closed the door [Undergoer].
  b. The door [Undergoer] was closed by Maria [Actor].
  c. Maria [Actor] sang.
  d. Maria [Undergoer] died.

Transitivity in RRG is defined in terms of the number of macroroles that a verb takes: a transitive verb takes two, an intransitive verb takes one, and an atransitive verb has no macrorole arguments. The transitivity of verbs and other predicates is determined by the following macrorole assignment principles.

(22) Default Macrorole Assignment Principles
  a. Number: the number of macroroles a verb takes is less than or equal to the number of arguments in its logical structure
    1. If a verb has two or more arguments in its LS, it will take two macroroles.
    2. If a verb has one argument in its LS, it will take one macrorole.
  b. Nature: for verbs which take one macrorole,
    1. If the verb has an activity predicate in its LS, the macrorole is actor.
    2. If the verb has no activity predicate in its LS, the macrorole is undergoer.

These are default assignment principles, because there are many exceptions to (22a); transitivity is, as has long been recognized, a very idiosyncratic lexical property of verbs.

The selection of actor and undergoer in a LS is governed by the Actor-Undergoer Hierarchy given in Fig. 4.3.

This hierarchy says that given the LS for a transitive verb, the leftmost argument in it will be the actor and the rightmost will be the undergoer. Hence in the LSs in (18g), *the dog* is the actor of *scare* and *the boy* the undergoer, *the cat* the actor of *pop*

[7] See Van Valin (1999, 2004) for more detailed discussion of semantic macroroles, including a comparison of them with analogous notions in other theories.

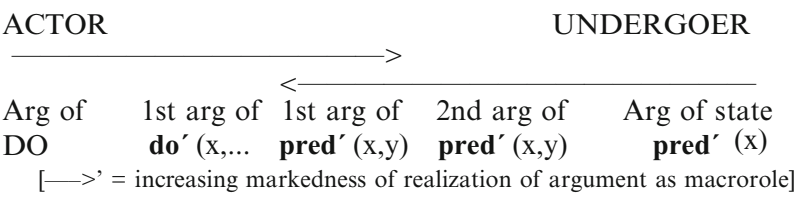


Fig. 4.3 The Actor-Undergoer Hierarchy

and *the balloon* the undergoer, *Sam* the actor of *flash* and *the light* the undergoer, *Max* is the actor of *melt* and *the ice* the undergoer, *Felix* is the actor of *bounce* and *the ball* is the undergoer, and *Mary* is the actor of *feed* and *the pizza* is the undergoer.

With three-place LSs, such as those with verbs like *give*, *show*, and *present*, the lowest ranking argument in the LS is only the default choice for undergoer with many verbs in English. It is possible to select the second-lowest ranking argument to function as undergoer, which is a marked selection.[8] This is illustrated in (23) and (24) with the verbs *give* and *present*.

(23) a [**do´** (Pat, Ø)] CAUSE [BECOME **have´** (Kim, book)]
b. Pat [Actor] gave the book [Undergoer] to Kim. Default choice
c. Pat [Actor] gave Kim [Undergoer] the book. Marked choice

(24) a [**do´** (Pat, Ø)] CAUSE [BECOME **have´** (Kim, book)]
b. Pat [Actor] presented the book [Undergoer] to Kim. Default choice
c. Pat [Actor] presented Kim [Undergoer] with the book. Marked choice

Thus, the highest ranking argument in the LS in terms of the Actor-Undergoer Hierarchy is always the actor, whereas the lowest ranking argument is the undergoer with two-place predicates but the default or unmarked choice with three-place predicates.

Actor and undergoer are always direct arguments, when they occur in the core. In languages like English, non-macrorole core arguments are typically marked by prepositions; they are termed oblique core arguments. The primary exception is the non-macrorole direct core argument *the book* in (23c). There are preposition assignment rules in RRG (Jolly 1991, 1993, Van Valin and LaPolla 1997), and the ones for *to* and *with* are given in (25).

[8]Primary object languages (Dryer 1986) work somewhat differently; see Guerrero and Van Valin (2004) for an analysis of primary-object languages in RRG terms.

(25) a. Assign *to* to non-MR *x* argument in LS segment:
. . . BECOME/INGR **pred´** (x, y)
b. Assign *with* to non-MR argument which is a possible actor or the default choice for undergoer but which is not selected as a MR.

The formulation of the *with* rule in (25b) is simplified, but it is adequate for the purposes of this discussion; see Van Valin and LaPolla (1997:381). In (23b) and (24b) the second argument of BECOME **have´** is selected as undergoer, and this leaves the first argument (*Kim*) as a non-macrorole core argument. The conditions for the rule in (25a) are met, and accordingly *Kim* is assigned the preposition *to*. In (23c) and (24c), on the other hand, the first argument of BECOME **have´** is selected as undergoer. The default choice for undergoer, the second argument of BECOME **have´** is a non-macrorole core argument, and the conditions for the application of the *with* rule in (25b) are met. It applies with most verbs in English but not with the group of dative shift verbs like *give* and *show*. Hence the non-macrorole core argument is marked by *with* in (24c) but not in (23c). The rule in (25b) also applies to verbs taking instrumental arguments. Consider the sentence in (1c), repeated in (26a), and its LS in (26b).

(26) a. The burglar shattered the window with the crowbar.
b. [**do´** (burglar, Ø)] CAUSE [**do´** (crowbar, Ø)] CAUSE
[INGR **shattered´** (window)]

Both *the burglar* and *the crowbar* are potential actors, as (1c) and (1d) show, but only *the burglar* can be selected as actor, as it is the highest ranking argument in the LS. *The crowbar* has been outranked for actor, and the rule in (25b) applies, assigning *with*.

It is important to distinguish instrument-like NPs which can serve as actor and those that cannot. Contrast (1d) with (27b).

(27) a. Chris ate the soup with the spoon.
b. *The spoon ate the soup.

The crucial difference between the *with* PP in (26a) and the one in (27a) is that there is no causal chain in the event in (27), whereas there is one in (26). That is, in (26), the burglar acts on the crowbar, and the crowbar does something to the window which causes the window to shatter. It is the crowbar that actually does the shattering action. This is not the case in (27): it is not the case that Chris acts on the spoon, the spoon acts on the soup, which causes the soup to be eaten. The soup does not do the eating action; Chris does. Because there is no causal chain, the spoon is not an argument of **do´** and therefore cannot be an actor. The LS for (27) is given in (28).

(28) **do´** (Chris, [**eat´** (Chris, soup) ∧ **use´** (Chris, spoon)]) &
INGR **consumed´** (soup)

In (27a), *Chris* would be the actor and *soup* the undergoer, and because *spoon* has been outranked for both macroroles and the conditions for the *to* rule are not met, the *with* rule applies, yielding *with the spoon*. In Van Valin and LaPolla (1997) the two types of *with* PPs are distinguished as 'instrument' PPs (e.g. *with the crowbar* in (26a), which is part of a causal chain) versus 'implement' PPs (e.g. *with the spoon* in (27a), which is not part of a causal chain).

It is important to note the fundamental difference between the two prepositions in these examples: *to* has a LS associated with it, while *with* does not. All locative prepositions have a LS, but *with* is associated with the outcome of certain linking options, rather than a specific LS. Hence it can occur more than once in a single core, as in (29).

(29) The man loaded the truck *with* hay *with* a pitchfork *with* Bill.

This sentence contains optional implement and comitative PPs, both headed by *with*.

In syntactically accusative languages like English, the default choice for subject (the privileged syntactic argument [PSA], in RRG terms) with a transitive verb is the actor, and the undergoer may function as subject in a passive construction, as (21a, b) illustrate.[9] In syntactically ergative languages like Dyirbal, on the other hand, the undergoer is the default choice for subject.

The linking between syntax and semantics is governed by the Completeness Constraint, which is stated in (30).

(30) Completeness Constraint:
All of the arguments explicitly specified in the semantic representation of a sentence must be realized syntactically in the sentence, and all of the referring expressions in the syntactic representation of a sentence must be linked to an argument position in a logical structure in the semantic representation of the sentence.

The main components of the RRG linking system are summarized in Fig. 4.4. The actual steps in the linking algorithm for simple sentences, both for linking from semantics to syntax and from syntax to semantics, are given in Van Valin (2005), sections 5.1.2 and 5.1.3.

4.3.2 The Role and Reference Grammar Account of Verb Alternations and Optional PPs

In Sect. 4.1, RRG was described as a 'projectionist' theory in which the semantic representation of the clause is projected from the lexical representation of the

[9]RRG does not posit the traditional grammatical relations of subject and direct object as theoretical constructs, but because this paper is not concerned with grammatical relations, the traditional terms will be used for ease of presentation.

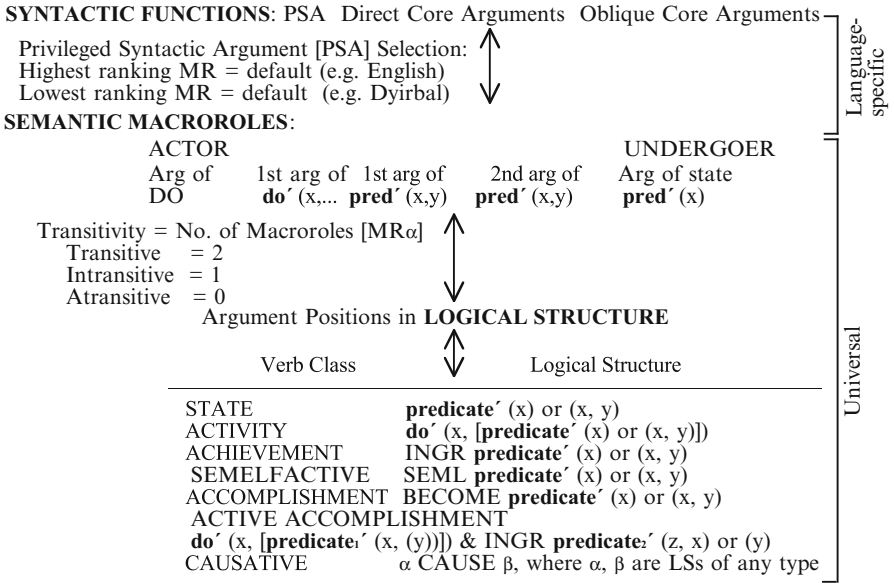


Fig. 4.4 Summary of components of RRG linking system

verb, and this semantic representation determines to a large extent the syntactic representation of the clause. The lexical representations for the verbs in the activity-active accomplishment and the causative alternations are those given in Table 4.2 and (18). Simplified semantic representations for the pairs of sentences in (2), (4) and (10) are given in (31)–(33).

(31) a. The soldiers marched in the park. Activity
a´. **be-in´** (park, [**do´** (soldiers, [**march´** (soldiers)])])
b. The soldiers marched to the park. Active accomplishment
b´. **do´** (soldiers, [**march´** (soldiers)]) & INGR **be-at´** (park, soldiers)

(32) a. Chris drank (beer). Activity
a´. **do´** (Chris, [**drink´** (Chris, (beer))])[10]
b. Chris drank the beer. Active accomplishment
b´. **do´** (Chris, [**drink´** (Chris, beer)]) & INGR **consumed´** (beer)

[10]A complete semantic representation of the NPs filling the argument positions would include their definiteness, quantification, and other values. See Van Valin and LaPolla (1997:194-5).

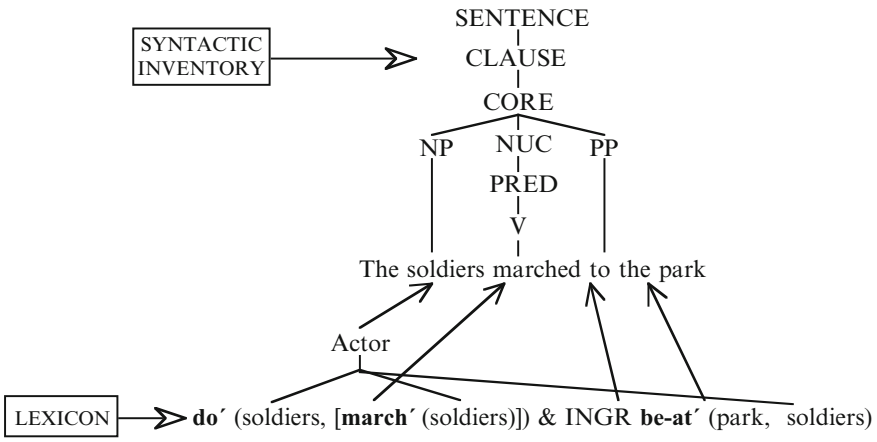


Fig. 4.5 Linking from semantics to syntax in (31b)

(33) a. The window shattered. Non-causative
a´ INGR **shattered´** (window)
b. The burglar shattered the window. Causative
b´. [**do´** (burglar, Ø)] CAUSE [INGR **shattered´** (window)]

Together with the syntactic template selection principle in (19) and the RRG linking algorithm, these representations determine the syntactic form of a sentence. The linking to the syntax for (31b) is given in Fig. 4.5.[11]

Because the LS has two arguments in it, namely *the soldiers* and *the park*, a core template with two argument slots is selected from the syntactic inventory. *March* is an intransitive verb, and therefore it has only one macrorole, an actor, following (22b).[12] The actor NP, *the soldiers*, will be the subject and linked to the initial argument position in the core. The NP *the park* is a non-macrorole argument, and the conditions for the *to* rule in (25a) are met; consequently it is assigned *to*, yielding the PP *to the park*. This PP is a kind of argument, not an adjunct, because its LS shares the argument *the soldiers* with the LS for *march*; contrast this LS with the one for the adjunct PP *in the park* in (31a´), in which the entire LS for *march* is an argument of the prepositional LS.

The linking from semantics to syntax for (32b) is given in Fig. 4.6.

This LS has two arguments in it, namely *Chris* and *the beer*, and consequently a core template with two argument positions is selected from the syntactic inventory.

[11]Certain aspects of the syntactic representation have been simplified; and these simplifications are irrelevant to the points under discussion.

[12]Note that if the verb has been *reach*, as in *The soldiers reached the park*, then two macroroles would have been assigned, because *reach* is transitive. The LS is basically the same for both verbs, however, with *reach* having an unspecified verb of motion in the activity part of the LS.

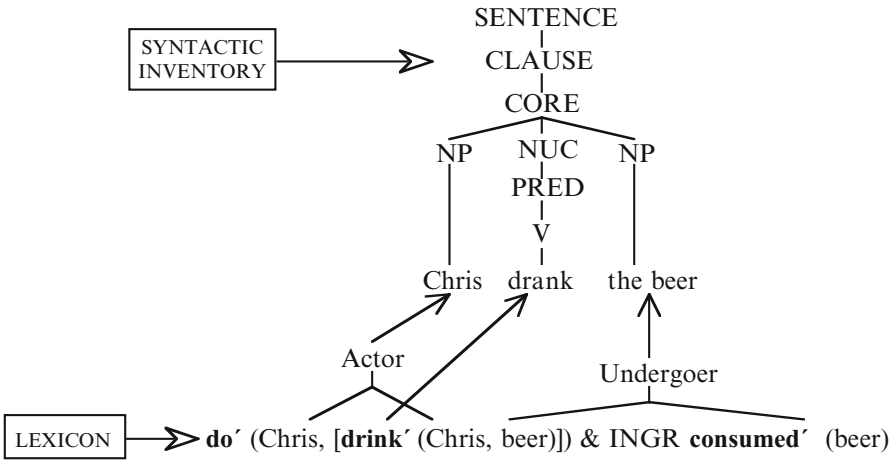
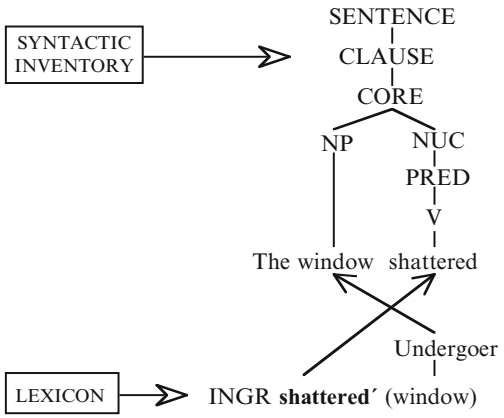


Fig. 4.6 Linking from semantics to syntax in (32b)

Fig. 4.7 Linking from semantics to syntax in (33a)



The active accomplishment form of *drink* is transitive, and accordingly it takes two macroroles. In terms of the Actor-undergoer Hierarchy in Fig. 4.3, *Chris* as the highest ranking argument will be the actor, and *the beer*, as the lowest ranking argument, will be the undergoer. These macroroles are then linked to the subject and direct object positions in the core.

The linking in (33a) is given in Fig. 4.7.

This LS has only one argument in it, and therefore a core template with only one argument position is selected from the syntactic inventory. *Shatter* is here an intransitive verb, which means that it has only one macrorole, and following the principles in (22b), it must be undergoer. It is the only macrorole argument, and consequently it appears as subject, as in Fig. 4.7.

These three examples have illustrated the projectionist nature of RRG: starting from the semantic representation of a clause, based on the lexical representation of the verb or other predicating element, a syntactic template is selected, macroroles are assigned, and the core arguments are linked into the syntactic representation. The next question to be asked is, how are the variant forms of *march*, *drink* and *shatter* in (31)–(33) related to each other? RRG expresses the relationship between these forms by means of lexical rules (see Van Valin and LaPolla 1997, section 4.6). The lexical rule which relates the two uses of *march* in (31) is given in (34a), while the one which relates the two uses of *drink* in (32) is given in (34b); along with the rule in (34c) for the two uses of *write* in (3), these rules capture the three alternations between activity and active accomplishment verbs presented in (2)–(4).

(34) a. Activity [motion] ⇒ Active Accomplishment:
do´ (x, [**pred´** (x)]) ⇒ **do´** (x, [**pred´** (x)]) & INGR **be-LOC´** (y, x)
b. Activity [consumption] ⇒ Active Accomplishment:
do´ (x, [**pred´** (x, y)]) ⇒ **do´** (x, [**pred´** (x, y)]) & INGR **consumed´** (y)
c. Activity [creation] ⇒ Active Accomplishment:
do´ (x, [**pred´** (x, y)]) ⇒ **do´** (x, [**pred´** (x, y)]) & INGR **exist´** (y)

These rules embody the claim that verbs like *march, drink* and *write* are basically activity verbs and that their active accomplishment uses are derivative. In this, these two verbs contrast with *reach* (cf. fn. 12) and *devour*, which are non-derived active accomplishment verbs.

What kind of evidence is there that a verb is basically one type or the other? One fact that helps to distinguish lexically telic verbs from lexically atelic verbs concerns the behavior of such verbs with mass noun or bare plural objects. It has long been known that telic verbs behave like atelic verbs when they have a mass noun or bare plural object, but unlike inherently atelic verbs, telic verbs necessarily have a iterative interpretation in this case. This contrast is exemplified in (35).

(35)	a.	Pat crushed the can in ten seconds.	Telic
	a´.	Pat crushed cans (over and over again) for/*in ten minutes.	Atelic
	b.	Chris ate the spaghetti in five minutes.	Telic
	b´.	Chris ate spaghetti ((*)over and over again) for an hour.	Atelic
	c.	Sandy devoured the spaghetti in five minutes.	Telic
	c´.	Sandy devoured spaghetti (over and over again) for an hour.	Atelic

The verb *crush* is a causative accomplishment verb, and its telic nature is shown in (35a). When it occurs with a bare plural object, as in (a´), it takes a *for* rather than an *in* time adverbial, which is indicative of an atelic use. However, this sentence has a necessarily iterative reading, i.e. there must be serial events of can crushing, not a single, temporally unbounded event of can crushing. The crucial contrast for this discussion is between (35b´) and (c´), in which the objects are mass nouns. The sentence with *eat* is compatible with two readings, an iterative one, in which Chris

eats plate after plate of spaghetti, and a non-iterative one, in which there is a single large plate of spaghetti from which she eats for an hour with no implication that she finished it. The iterative adverb *over and over again* is compatible only with the iterative interpretation. With *devour* in (c´), on the other hand, only the iterative reading is possible: Sandy eats plate after plate of spaghetti, and the eating of each plateful constitutes a distinct event in the sequence. Hence *devour* is inherently telic, while *eat* is not.[13]

Thus, RRG would posit one entry for *march* and one entry for *drink* in the lexicon, with the active accomplishment uses derived by the lexical rules in (34). If one assumes that overt derivational morphology signals the operation of a lexical process, then the postulation of such rules is supported by languages like Georgian and Russian, as exemplified in (5) and (6), in which the base form of verbs like *eat* and *write* are activities and the derivation of their active accomplishment uses is indicated overtly morphologically. In languages like Dyirbal and Sama, as illustrated in (8) and (9), on the other hand, it appears that the base form of verbs like *eat* and *drink* are telic, hence active accomplishments, and therefore their atelic (activity) uses would be derived; in these languages, the direction of the arrow in the rules in (34) would be reversed. In these languages too, special morphology marks the derived forms.

The contrast in interpretation with mass noun or bare plural objects obviously does not apply to motion verbs, which are intransitive for the most part in English. However, the behavior of these verbs when they occur without any kind of accompanying PP suggests that they are basically activity verbs. This is shown in (36).

(36) a. Pat walked for/*in an hour.
b. The soldiers marched for/*in an hour.
c. Kim ran for/*in an hour.

All three verbs are perfectly fine when cooccurring with a *for* time adverbial but not with an *in* PP. This follows, if they are activity verbs. Thus, the lexical rules in (34) serve to derive the active accomplishment uses of activity verbs.

The other alternation discussed in Sect. 4.2 is the causative alternation, as in (33). Because the verbs undergoing this alternation in English show no morphological marking, unlike Huallaga Quechua in (11) and French, Russian and Yagua in (12), there is no obvious evidence as to which of the two forms is basic. Positing one form as basic raises a couple of problems, as Piñón (2001) points out. First, there is the fundamental issue of justifying the selection of the basic alternant, and different analyses have proposed different choices. For example, Levin and Rappaport Hovav (1994) and Rappaport Hovav and Levin (1998) propose an analysis in which the

[13] A consequence of the fact that these atelic uses of telic verbs are necessarily iterative, as in (35a´, c´), is that there is no change in their LS in the two uses. Hence there is no need to posit a lexical rule to relate these pairs of sentences.

causative version is basic, while Van Valin and LaPolla (1997) argue that the non-causative form is basic. Second, whichever form is taken as basic, it is necessary to account for the verbs which fall into one class or the other but do not alternate, e.g. *dirty* has only a causative form, while *disappear* has only a non-causative form.

The approach that will be taken here follows a suggestion of Piñón (2001), although it is implemented rather differently. The idea is that there is no basic form; rather, there is a general rule expressing the alternation, which is given in (37).

(37) General lexical rule for causative alternations
[**do´** (x, Ø)] CAUSE [BECOME/INGR **pred´** (y (,z))]
$\Longleftrightarrow$ BECOME/INGR **pred´** (y (,z))

The lexical entry for a verb like *shatter* in (33) would not contain a LS; rather, it would contain a pointer to the rule in (37) along with the specifications 'INGR', '**pred´** (y (,z))' = '**shattered´** (y)'. In the linking for (33a) the right-hand element of the rule would be selected, while in the linking for (33b) the left-hand element would be selected. Neither is considered to be basic or derived. For non-alternating verbs, their lexical entry would simply have the appropriate LS, causative or non-causative, and because there was no reference to (37), the verbs would not alternate.[14]

In languages like Huallaga Quechua and Yagua in which there is clear evidence of derivation from the morphology, the rule in (37) can be interpreted directionally. In Huallaga Quechua the causative morpheme *–chi-* signals the operation of the rule, deriving the left-hand LS from the right-hand one, while in Yagua the anti-causative morpheme *–y-* indicates the operation of the rule in the reverse direction, deriving the right-hand LS from the left-hand one.

There is an interesting and striking asymmetry between the two verb classes listed above and activity and active accomplishment verbs with respect to the causative alternation: there seems to be a clear basic form, namely, the activity form, because the majority of activity verbs do not alternate with a causative counterpart. Furthermore, there appear to be far more active accomplishments than causative active accomplishments. The simplest solution is to analyze causative activity and active accomplishment verbs as being derived from their non-causative counterparts by means of the rule in (38); in this rule '. . .' refers to the '& INGR **be-at´** (z, y)' component of active accomplishments.

(38) Lexical rule for causative alternations involving activity verbs
do´ (y, [**pred´** (y)]) . . . $\Rightarrow$ [**do´** (x, Ø)] CAUSE [**do´** (y, [**pred´** (y)]) . . .]

Since only a minority of activity verbs undergo this alternation, the simplest way to account for those verbs which alternate and those which do not is to adopt the

[14]The question of why verbs fail to alternate is an important and much discussed issue; see e.g. Levin and Rappaport Hovav (1994), Piñón (2001). It is beyond the scope of this discussion and will not be addressed here.

approach proposed above for the causative alternation: non-alternating verbs would have the appropriate LS in their lexical entry, and alternating verbs would not have a LS in their lexical entry, only a pointer to the rule in (38), along with a specification of the value of '**pred´**'.

It might seem odd to posit no basic form for the causative alternation involving achievement and accomplishments verbs and a causativization rule for activity verbs, but in fact when one looks at languages in which there is overt morphology expressing this relationship, causativization is far more common than decausativization with activity verbs. In Russian and French, the reflexivization pattern illustrated in (12a, b) is not generally found with activity verbs. In French, for example, the causative equivalents of *bondir* 'bounce', *marcher* 'walk' and *courir* 'run' are created by combining *faire* 'make, cause' with these verbs, which are intransitive, in a complex construction; these verbs do not have transitive causative versions. Analogous morphological derivations are illustrated in (39).

(39) a. Mparntwe Arrernte (Australia; Wilkins 1989)
unthe- 'go walkabout' *unthe-lhile* 'make someone go walkabout'
b. Tepehua (Totonacan, Mexico; Watters 1988)
pu:pu- 'boil [intransitive] *ma-pu:pu-* 'make something boil'

Thus, it seems reasonable to postulate that activity verbs undergo the causativization rule in (38), rather than a decausativization rule.

There are two lexical rules involving activity verbs, and their interaction yields the four possible interpretations of verbs like *march*, as shown in (40).

(40) a.	*march* activity, as in (13a)	Basic, underived LS
b.	*march* causative activity, as in (13b)	(38)
c.	*march* active accomplishment, as in (13c)	(34a)
d.	*march* causative active accomplishment, as in (13d)	(34a) + (38)

The final issue raised in Sect. 4.2 is optional instrument, implement and comitative PPs, as in (14a), (27a) and (15b, c). Each of these is handled differently in RRG. As discussed in Sect. 4.3.1, instrument arguments are part of a causal chain, and therefore the full LS for the causative version of a verb like *shatter* would be as in (26a), repeated in (41).

(41) [**do´** (x, Ø)] CAUSE [**do´** (y, Ø)] CAUSE [INGR **shattered´** (z)]

In this LS, the *x* and *y* variables have important selectional restrictions: the *x* variable must be filled by animate, normally human argument, while the *y* variable must be filled by an inanimate argument. If the *y* variable is lexically filled, the result is a sentence with an instrument PP like (26a), *The burglar shattered the window with a crowbar*. As discussed in Sect. 4.3.1, the NP *a crowbar* is a non-macrorole core argument which has been outranked by *the burglar* for actor selection, and therefore the *with* rule in (25b) applies. If it is not lexically filled, then the result is

a sentence like (1b), *The burglar shattered the window*. Finally, if the *x* argument is not lexically filled but the *y* argument is, then the result is a sentence like (1d), *The crowbar shattered the window*. These LSs are given in (42).

(42) a. [**do´** (burglar,Ø)] CAUSE [**do´** (crowbar, Ø)] CAUSE
[INGR **shattered´** (window)] = (26a)
b. [**do´** (burglar, Ø)] CAUSE [**do´** (Ø, Ø)] CAUSE
[INGR **shattered´** (window)] = (1b)
c. [**do´** (Ø,(Ø)] CAUSE [**do´** (crowbar, Ø)] CAUSE
[INGR **shattered´** (window)] = (1d)

In addition to instruments, at least one other kind of intermediate LS is possible, as illustrated in (43).

(43) a. Max shattered the teacup against the wall.
a´. [**do´** (Max, Ø)] CAUSE [INGR **be-against´** (wall, teacup)]
& [INGR **shattered´** (teacup)]
b. The teacup shattered against the wall.
b´. [INGR **be-against´** (wall, teacup)] & [INGR **shattered´** (teacup)]

In both (43a, b) the undergoer comes into contact with something and undergoes a change of state. The sentence in (43a) treats this contact as induced by the actor *Max*, while (b) makes no reference to the cause of the teacup coming into contact with the wall.

This analysis of the LS of *shatter* as containing a causal chain with an instrument or location argument requires a modification of the lexical rule in (37); it is given in (44).

(44) Lexical rule for causative alternations (revised)
[**do´** (x, Ø)] CAUSE {[. . .]} [BECOME/INGR **pred´** (y (,z))]
$\Longleftrightarrow$ BECOME/INGR **pred´** (y (,z))

The '{[. . .]}' represents the optional intermediate cause and the instrument or location argument, which some verbs of the kind may have.[15] These optional arguments may be represented by the following lexical templates. In (45a), the *w* argument must be inanimate, as noted with respect to (41).

(45) a. Lexical template for optional instrument: . . . [**do´** (w, Ø)] CAUSE . . .
b. Lexical template for optional location: . . .
[INGR **be-LOC´** (v, w)] & . . . w = y

[15]The notation is taken from Wunderlich (1997).

The primary part of the rule is unaffected, and this rule provides an explanation for the ungrammaticality of (1e), **The window shattered with a crowbar*. The *with a crowbar* PP requires the full LS; the BECOME/INGR **pred´** (y (, z)) output LS has no place for an instrument argument. It should be noted, however, that a middle construction like *The window shatters easily with a crowbar* has a different LS; it is given in (46).[16]

(46) **be´** ([[**do´** (Ø, Ø)] CAUSE [**do´** (crowbar, Ø)] CAUSE
[INGR **shattered´** (window)]],[**easy´**])

This LS contains the full causative achievement LS for *shatter*, which is why the instrument PP is possible.

Implement PPs, as argued in Sect. 4.3.1, have a different semantic representation. The earlier example in (27a) is repeated in (47a) together with its LS from (28).

(47) a. Chris ate the soup with the spoon.
b. **do´** (Chris, [**eat´** (Chris, soup) ∧ **use´** (Chris, spoon)])
& INGR **consumed´** (soup)

The occurrence of implement PPs is restricted to activity verbs (and their active accomplishment counterparts), and it may be accounted for by the following lexical rule.

(48) Lexical rule for implement PPs
do´ (x, [**pred´** (x, (y)) . . . ⇒ **do´** (x, [**pred´** (x, (y)) ∧ **use´** (x, z)]) . . .

This rule adds **use´** (x, z) to the LS of an activity predicate, *z* being the implement argument. Because it is not selected as actor or undergoer, the *with* rule in (25b) applies. Two things follow from this rule: first, implement PPs can only occur with activity or active accomplishment verbs, and second, because the implement is not part of a causal chain, it cannot function as actor; as the second argument of a two-place predicate, it is not a candidate for actor selection in terms of the Actor-Undergoer Hierarchy.

Comitative PPs do not require any kind of special rule; they follow from linking possibilities already available in the theory. The relevant examples from (15) and (16) are repeated below.

(49) a. Chris and Pat went to the movies.
b. Chris went to the movies with Pat.
c. Pat went to the movies with Chris.

[16] See Van Valin and LaPolla (1997: 416-7) for justification of this LS for middle constructions.

(50) a. The gangster robbed the bank (together) with the corrupt policeman.
b. The bank was robbed by the gangster (together) with the corrupt policeman.
c. *The bank was robbed (together) with the corrupt policeman.

The LS for all of the sentences in (49) is given in (51).

(51) **do´** (Chris ∧ Pat, [**go´** (Chris ∧ Pat)]) & INGR **be-at´**
(movies, Chris ∧ Pat)

There are three linking possibilities: if both *Chris* and *Pat* are selected as actor, i.e. as a conjoined NP, then the result is (49a); if only one of them is selected as the actor, then the other is left as a non-macrorole core argument, and the *with* rule in (25b) applies, yielding (49b) or (c). The LSs for the examples in (50) are given in (52).

(52) a. [**do´** (gangster ∧ corrupt policeman, Ø)] CAUSE
[BECOME NOT **have´** (bank, Ø)]
b. [**do´** (Ø ∧ corrupt policeman, Ø)] CAUSE
[BECOME NOT **have´** (bank, Ø)]

In (50a, b), which have (52a) as their LS, *the gangster* is selected as actor, leaving *the corrupt policeman* as a non-macrorole core argument to be marked by with, following (25b). It does not matter whether the linking is active voice, as in (50a), or passive voice, as in (50b). If both arguments had been selected as actor, the result would have been *The gangster and the corrupt policeman robbed the bank*. However, in an agentless passive like (50c), the actor argument is unspecified in the LS, and this yields the impossible LS in (52b) for the ungrammatical (50c). That this is impossible can be seen straightforwardly in the ungrammaticality of **Ø and the corrupt policeman robbed the bank*. Hence the fact that a comitative PP is only possible with a specified actor follows naturally from this account.

In this section the RRG projectionist account of these verb alternations and three types of optional PPs has been given. Lexical rules relating one LS to another are an essential part of the analysis. In the account of the causative alternation and of optional instrument PPs, the different possibilities, as in (1) are analyzed as the result of a selecting one of the alternants, based on (44), of instantiating certain optional argument variables in the LS, or of leaving certain variable lexically unspecified, as in (42). Mairal and Faber (2002) show how this approach can successfully account for the different morphosyntactic patterns associated with English verbs of cutting, which exhibit a much more complex set of forms than what has been considered here. In the next section, a constructionist account of the same phenomena will be given, based on Pustejovsky's Generative Lexicon theory.

4.4 The Generative Lexicon and Co-composition

The GL approach to these phenomena exemplifies the constructionist perspective on verbal alternations, and the crucial theoretical tool is the notion of co-composition. It is well illustrated by the GL analysis of the activity-active accomplishment alternation with motion verbs. Pustejovsky (1995) analyzes the active accomplishment clause *The bottle floated into the cave* as the result of co-composing the directional PP *into the cave* with the verb *float*, and he states explicitly that "the conflated sense for the verb float exists only phrasally and not lexically"(1995:126). The semantic representations for *float* and *into the cave* are given in Fig. 4.8.

When the verb and PP cooccur in the syntax, an interpretive process, co-composition, combines their representations to yield the active accomplishment interpretation of *float into the cave*. The resulting representation is in Fig. 4.9.

Thus, an active accomplishment predication like *float into the cave* is not derived from an activity predication in the lexicon, as in the projectionist RRG account, but rather it is the result of semantic interpretive processes applying to a combination of verb plus PP in the syntax.

The activity-active accomplishment involving consumption and creation verbs like *drink* and *write* would also be handled via co-composition. The lexical representations for the verb *drink* and the noun *beer* are given in Fig. 4.10.

For a language like English, a constructionist approach like GL would have to take the quantificational properties of the object NP as the decisive factor in

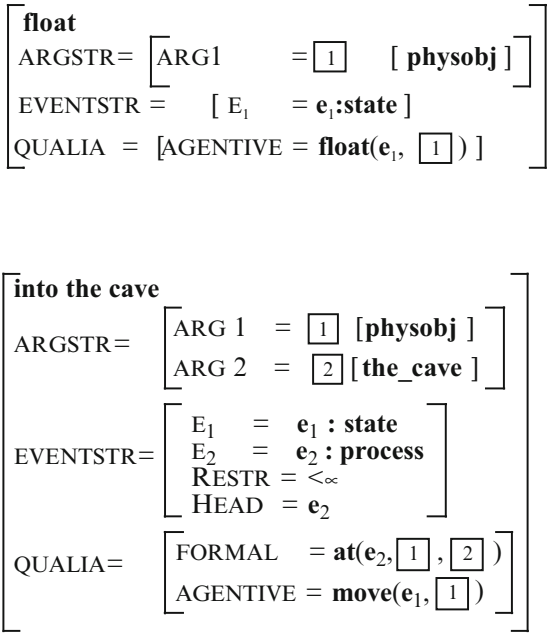


Fig. 4.8 Semantic representations for *float* and *into the cave* in GL (Pustejovsky 1995)

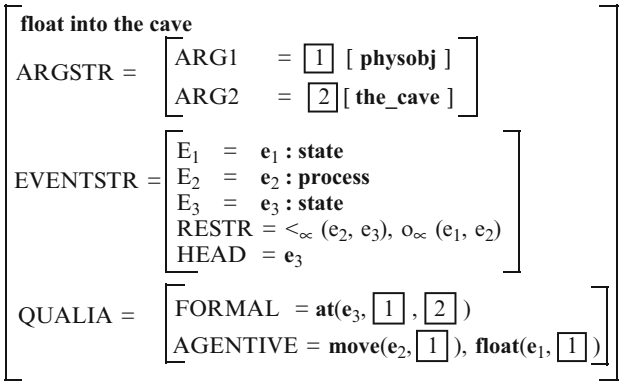


Fig. 4.9 Semantic representation of *float into the cave* in GL

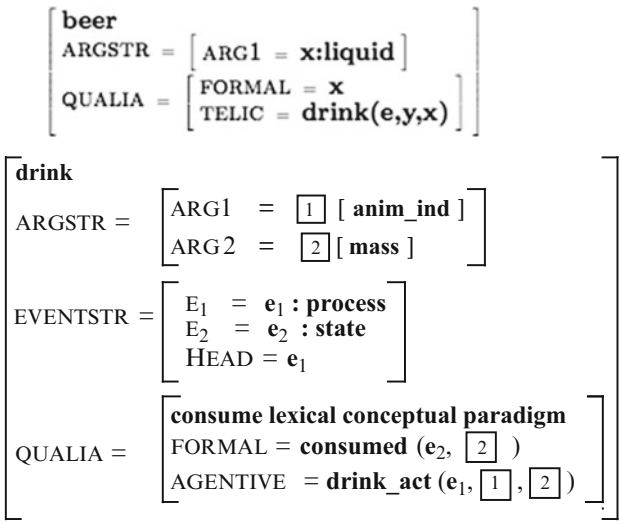


Fig. 4.10 Lexical representations for *drink* and *beer*

determining whether the verb is to be interpreted as telic or atelic. When the verb takes a mass noun object, it receives an activity, i.e. process without a result state, interpretation. That is, only E_1 in the event structure and the agentive quale are realized. The telic use of *drink* would be represented basically the same way, except on the telic interpretation E_2 and the formal quale are also realized. Exactly how this follows from the quantification properties of ARG 2 is not clear (Fig. 4.11).

Co-composition does not figure into the GL analysis of the causative alternation; it takes a projectionist approach and assumes that alternating verbs like *shatter* have a single, underspecified lexical representation. The event structure of such a verb can be represented as in Fig. 4.12.

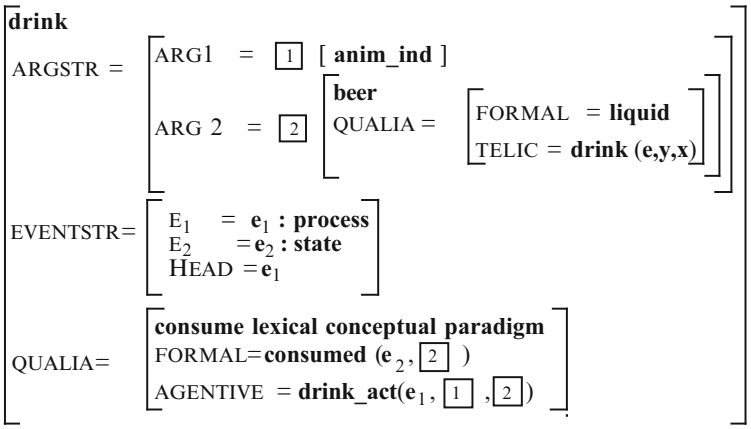
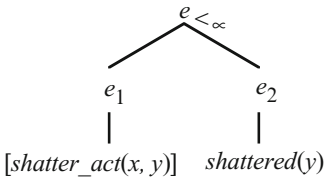


Fig. 4.11 Semantic representation for *drink (a) beer*

Fig. 4.12 Event structure of English verb *shatter*



The event structure of shatter has two subevents, a shattering action and a result state, and either may be selected as the 'head' of the structure. If e_2, the result state, is taken as the head, then the result is a sentence like (1a), *The window shattered*. If e_1, the shattering action is taken as the head, then the full causative structure is involved, and the result is a sentence like (1b), *The burglar shattered the window*. Hence the verb *shatter*, and other verbs like it, has a single lexical representation underlying both its causative and non-causative uses; it is given in Fig. 4.13.

The first argument of *shatter* is an event (J. Pustejovsky, p.c.), which may be expressed directly as in *John's throwing a rock shattered the window* or metonymically as in *John shattered the window*. Since this representation does not specify a head in the event structure (compare it with the one for *drink* in Fig. 4.11), either $\mathbf{e}_2$ with just the formal quale or both $\mathbf{e}_1$ and $\mathbf{e}_2$ with both formal and agentive qualia may be expressed, yielding the two possibilities in (1a) and (1b). This contrasts with the RRG approach, in which the verb *shatter* has distinct lexical representations in these two sentences, which are related by the lexical rule in (37).

The three types of arguments discussed in previous sections are handled in different ways. Instruments are not distinguished from implements, and they would be the optional argument 4 in semantic representations like those in Fig. 4.13. Comitatives, on the other hand, would be derived via co-composition, analogous

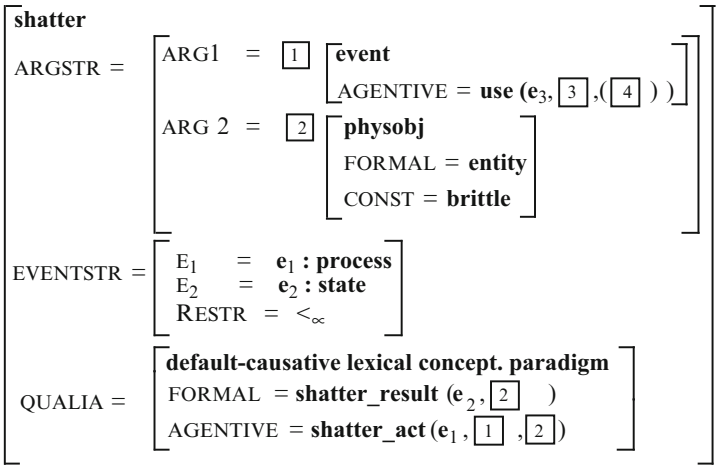


Fig. 4.13 Semantic representation for causative/non-causative verb *shatter*

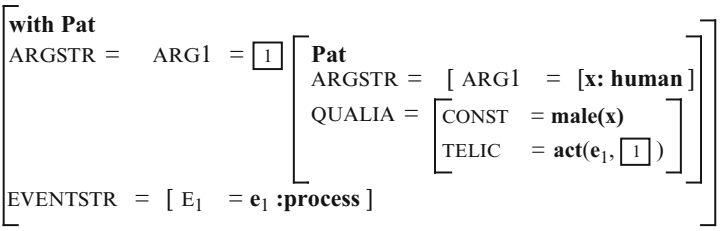


Fig. 4.14 Semantic representation of comitative PP *with Pat*

to the treatment of *float into the cave* in Fig. 4.9. Crucial to the interpretation of a comitative PP like *with Pat* in a sentence like *Chris drank beer with Pat* are the qualia properties of the NP; the relevant ones for a human referent are given in (53).

(53) **Pat (x)**
a. Const: **male (x)**
b. Telic: **act (e_1, x**

With presents an interesting problem for lexical semantics because of all of its uses, e.g. comitative, instrument, implement, manner adverb (e.g. *with enthusiasm*), and oblique object (e.g. *presented Mary with flowers*). GL is opposed to simply listing an item multiple times in the lexicon, each with a different sense (Pustejovsky 1995), and so it may be assumed that some kind of underspecified entry for this preposition would be required, and the particular interpretation would be derived from the qualia properties of its object along with the verb with which it cooccurs. It would occur with a human referent normally only in a comitative sense. A partial semantic representation for *with Pat* is given in Fig. 4.14.

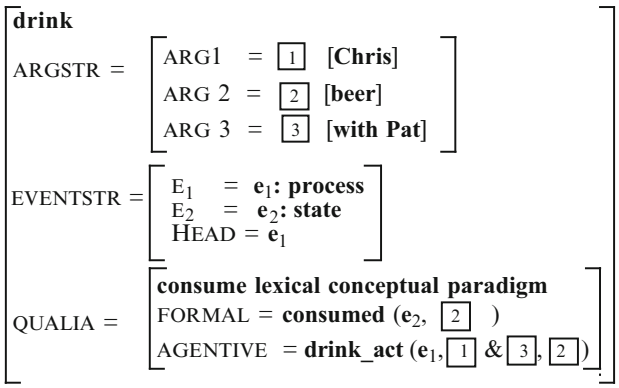


Fig. 4.15 Semantic representation for *Chris drank beer with Pat*

This PP co-composes with the semantic representation for *drink beer* from Fig. 4.11, yielding the representation in Fig. 4.15 (aspects of the argument structures have been simplified).

Pat is added as a third argument, and thanks to its telic quale it is interpreted as a co-agent with *Chris*. As with *float into the cave*, this representation exists only phrasally, not lexically.

The GL approach to the phenomena under consideration has employed co-composition, a quintessentially constructionist mechanism, as well as underspecified lexical entries for both verbs and prepositions. This contrasts with the RRG approach presented in the previous section, which is consistently projectionist. The two approaches appear to make quite contradictory claims with respect to some of these phenomena: GL claims that active accomplishment predications and comitative expressions do not exist in the lexicon and are created from the syntactic structure via co-composition, whereas RRG maintains that both are projected from the lexicon, and that the alternations involve the application of lexical rules to derive the lexical forms from which they are projected. But are these two approaches as different and incompatible as they appear?

4.5 The Place of Lexical Rules and Co-composition in the Grammar

Lexical rules and co-composition are different ways at arriving at semantic representations; they relate to different parts of the grammar. Lexical rules, by definition, operate in the lexicon, while co-composition operates on syntactic phrases. One way of conceptualizing the distinction runs as follows. A speaker has a message that she or he wants to communicate, and the first step in the construction of an appropriate expression for it is the constitution of a semantic representation, made

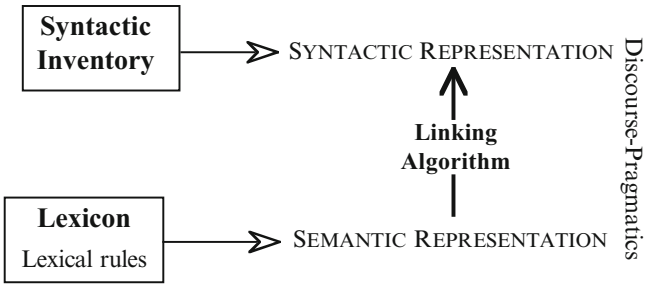


Fig. 4.16 Lexical rules as part of the semantics-to-syntax linking

up of the lexical representations of the predicate, the arguments and modifiers to be used. This means that if a speaker wants to say *Chris ran to the park*, he or she puts together a semantic representation for that sentence, which means, in RRG terms, constituting a logical structure like the one in (18f). This semantic representation is then mapped into the appropriate syntactic representation, as in Fig. 4.5. The projectionist perspective thus represents what the speaker does in putting a sentence together.

The hearer, on the other hand, does not know what the speaker is going to say, and in particular does not know, having heard *Chris ran*, whether it will be followed by *in the park* or *to the park*. That is, the hearer does not know whether *ran* is an activity or active accomplishment until he or she has heard the PP which follows it. Consequently, the hearer must arrive at the meaning via co-composition. Thus, the constructionist perspective represents what the hearer does in determining the meaning of a sentence.

Because the linking algorithm in RRG goes both from the semantic representation to the syntactic representation and from the syntactic representation to the semantic representation (see Fig. 4.1), it provides a natural way to capture this contrast. Lexical rules are part of the semantics-to-syntax linking, as in Fig. 4.16.

The role of lexical rules in the linking from semantics to syntax is illustrated in the analysis of the sentences in (31)–(33), as presented in Figs. 4.5, 4.6, and 4.7. They are crucial to the formation of the lexical representation of the verb. There is also a lexical rule for adding an implement argument to activity verb LSs.[17]

Co-composition, on the other hand, is part of the syntax-to-semantics linking. Here the hearer has to rely on overt morphosyntactic cues in the sentence in order to determine its meaning. Whether a verb is being used as causative or non-causative is directly a function of whether it has two arguments or one in a language like English

[17]This raises an interesting issue about the structure of the lexicon. The LSs created by the lexical rules are not stored in the lexicon, unlike the input LSs, and therefore it appears that the lexicon must be divided into at least two parts, one in which lexical items and morphemes are stored, and another in which lexical rules operate and create items which are not stored permanently in the lexicon.

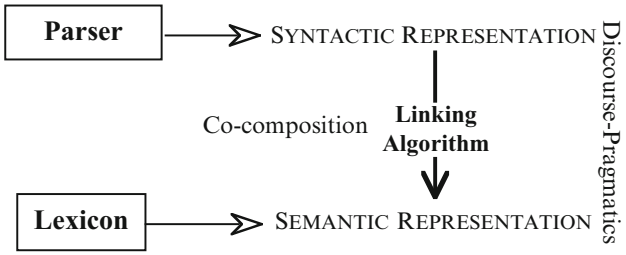


Fig. 4.17 Co-composition as part of the syntax-to-semantics linking

with no overt (anti-)causative morphology on alternating verbs. Whether a verb is being used as an activity or active accomplishment is directly a function either of the quantification of the object NP (consumption and creation verbs) or of the PP that accompanies it (motion verbs). This is represented as in Fig. 4.17.

Thus from this perspective, lexical rules and co-composition are not incompatible concepts at all; rather, they complement each other, in that they play roles in different aspects of the linking.

GL employs co-composition but not lexical rules; where lexical rules are used in RRG to capture the contrast between causative and non-causative verbs, GL uses underspecified lexical entries, as in Fig. 4.13. Pustejovsky (1995) leaves open the possibility that lexical rules could be used in GL in certain cases.

All of the RRG machinery introduced in Sect. 4.3.1 is described in terms of its role in the linking from semantics to syntax; it is purely projectionist. The interpretation issue addressed by co-composition is crucial for syntax-to-semantics linking in RRG, and therefore an RRG approach to co-composition is needed. It will be developed in the next section.

4.6 Co-composition in Role and Reference Grammar

Before a notion of co-composition can be implemented in RRG, it is first necessary to present the syntax-to-semantics linking algorithm as developed in Van Valin and LaPolla (1997) and Van Valin (2005).

4.6.1 Linking from Syntax to Semantics in Role and Reference Grammar

For a language like English, the syntax-to-semantics linking algorithm works basically as follows. The first step is that the parser outputs a labeled tree structure of

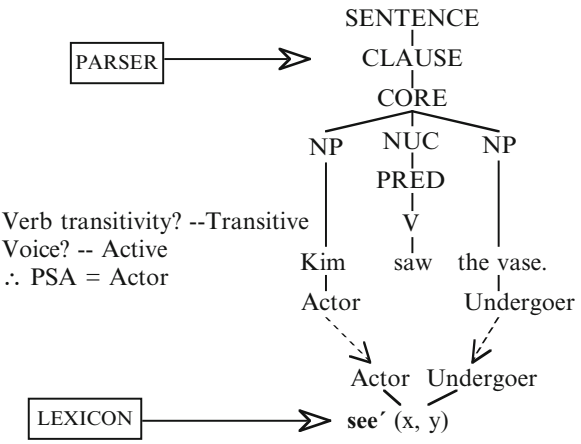


Fig. 4.18 Syntax to semantics linking in simple English sentence

the type in Fig. 4.2.[18] The next step is to identify the predicate, usually a verb, in the nucleus and determine its transitivity. If the predicate is intransitive, then the subject is a macrorole argument. If the predicate is a transitive verb, then it is necessary to determine its voice: if it is active voice, then the subject is an actor, and if it is passive voice, the subject is an undergoer. If it is active voice, then the other direct core argument is an undergoer. At this point it is necessary to go to the lexicon and access the LS of the predicate; the number and nature of the macroroles associated with the LS is determined by the principles in (22), and macroroles are assigned following the Actor-Undergoer Hierarchy in Fig. 4.3. At this point, the actor in the sentence is linked to the actor in the LS, and the undergoer in the sentence is linked to the undergoer in the LS, completing the linking and satisfying the Completeness Constraint in (30). This is illustrated in Fig. 4.18 for the English sentence *Kim saw the vase*.

4.6.2 Co-composition

Suppose the sentence were *Kim shattered the vase* instead of the one in Fig. 4.18. One of the major issues of concern in this paper arises in this example at the point at which the LS of the verb is accessed in the lexicon. *Shatter* can be transitive (causative) or intransitive (non-causative), and the analysis of the alternation presented in Sect. 4.3.2 has no full LS in the lexical entry for *shatter*, only a pointer to the rule in (44) and the specifications 'INGR' and **'pred´** (y (,z))' = **'shattered´** (y)'. Which of the alternants should be selected? Here is where co-composition comes into play. First, the fact that there are two direct core arguments in the clause

[18] See Van Valin (2006) for discussion of how a parser based on RRG could be constructed.

necessitates selecting the causative LS. Moreover, Kim has already been identified as a human noun, and the telic quale associated with a human being was given in (53b), which would be formulated in RRG terms as in (54).

(54) a. **Kim** (a)
b. Telic: **do´** (a, [. . .])

This means simply that humans act, do things, are potential actors. Given the presence of a human referent in the sentence in the position where actors occur, this means that there must be an activity predicate in the LS, and consequently the causative alternant must be selected.[19] If the sentence were *The vase shattered*, the lack of a human referent does not invoke an activity predicate, and consequently the non-causative LS is selected. The rest of the linking is straightforward, as there is only one argument in the syntax and one argument position in the LS. The same considerations would go into the linking of the activity and causative activity versions of verbs like *march* in (13a,b).

If the sentence being linked were *The rock shattered the window*, the causative LS would have to be selected, because there are two arguments in the sentence. However, the inanimate NP *the rock* could not be linked to the *x* argument, because it is incompatible with the selectional restrictions of the first **do´** in the LS, which requires an animate, sentient *x* argument. Moreover, it could not be linked to the *y* argument, because the undergoer *the window* would have priority for that linking. The only way to satisfy the Completeness Constraint is to invoke one of the optional lexical templates in (45); because the preposition in the sentence is *with*, which is not a locative preposition, the template in (45b) is ruled out. In addition, it is reasonable to assume that part of the telic quale for *rock* would be the idea that one can use them in some way to do something, and this could be represented as in (55).

(55) Telic quale for **rock** (a): . . . , **do´** (x, [**use´** (x, a)]) ∧ **do´** (a, [. . .]), . . .

If the telic quale for *rock* contained information like this, then it would invoke the lexical template for an optional instrument in (45a). This would create an argument position for the rock to be linked to, thereby satisfying the Completeness Constraint. The x argument in (44) would be marked as unspecified, yielding the LS in (42c). If the sentence to be linked were *The teacup shattered against the wall*, the intransitive LS in (44) would be selected, and the locative preposition in the sentence would invoke the lexical template in (45b).

The case used to present co-composition in Pustejovsky (1995) is the active accomplishment use of activity verbs, and this is a good candidate for a co-composition analysis in RRG. In RRG terms, the LS of the verb in the nucleus

[19]The crucial role of the telic quale of the subject NP in the interpretation of this example was pointed out by James Pustejovsky (personal communication).

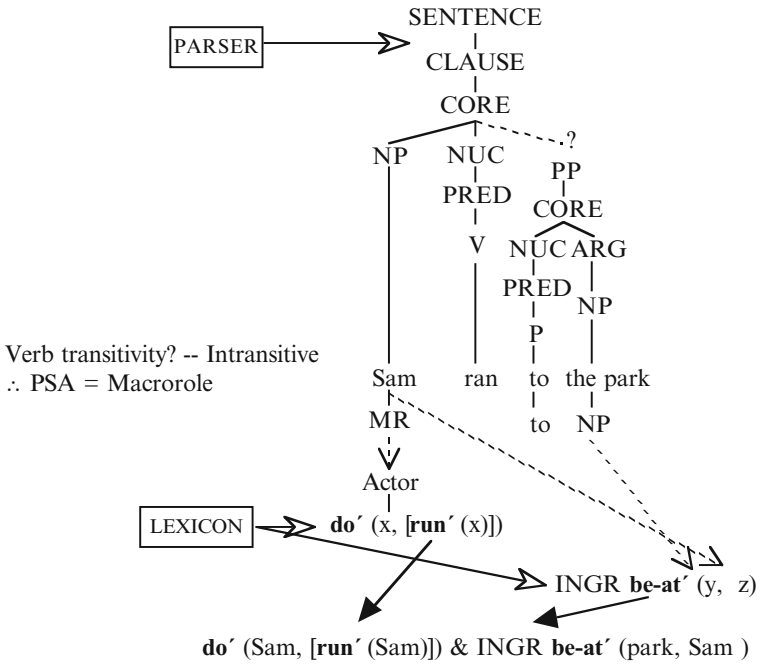


Fig. 4.19 Co-composition in the syntax-to-semantics linking of an active accomplishment

would combine with the LS of the preposition marking the goal PP to yield the appropriate active accomplishment LS. The linking in Sam ran to the park is given in Fig. 4.19.

The linking of *Sam ran* is straightforward. The complications involve the linking of the PP. Since the LS of *run* is fully linked, the preposition must be predicative, and therefore it is necessary to go to the lexicon and access the LS of the preposition, in this case, *to*. The LS for *to* is INGR **be-at´** (y, z); the *y* argument must be a location, and, crucially, the *z* argument must be an individual. This contrasts with the LS for prepositions like *in* and *on*, e.g. **be-in´** (y, z), in which the second argument may be either an individual or an event.[20] In the linking in Fig. 4.19, the object of *to* links to the first argument position in its LS, but what links to the second argument position? There are only two candidates: the NP *Sam* or the LS for *run*. Since *to* takes only an individual and not an event for its second argument, the only possibility is *Sam*. The final question concerns how the two LSs combine. Since the verb is intransitive, this cannot be a causative construction, and accordingly they cannot be linked by

[20]The reason for the '?' in the syntactic representation is that the PP cannot be correctly attached to the core until its meaning is determined. That is, if the PP is headed by *to*, then it would be an argument in the core, whereas if it were headed by *in*, as in *Sam ran in the park*, then it would be an adjunct in the periphery.

CAUSE (see Van Valin and LaPolla 1997:101). The only other two possibilities are '∧', which means 'and simultaneously', and '&', which means 'and sequentially'. A motion event with temporal duration could not be simultaneous with a punctual event, but they could be in a sequential relation: the punctual event could indicate the end of the motion event. Hence the two LSs must be joined by '&', yielding an active accomplishment LS, as in Fig. 4.19. Appropriately, the result of this co-composition of the verb plus PP yields the same LS as the lexical rule in (34a).

There are two other activity-active accomplishment alternations, those involving consumption and creation verbs. These would appear to be good candidates for a co-compositional analysis, since in a language like English the difference is signalled by the referential specificity or quantification value of the object NP. There are, however, a number of tricky technical problems. First, something must block a referentially specific or quantified NP from being linked to the second argument of an activity verb, e.g. **do´** (x, [**drink´** (x, y)]). This could be accomplished by specifying that the *y* argument must be a mass noun or bare plural; this would block any other kind of NP from being linked, and therefore if one tried to associate *John drank a beer* with this LS, the NP *a beer* could not be linked to the *y* argument, resulting in a Completeness Constraint violation. Second, and more problematic, however is: how does the occurrence of a referentially specific or quantified NP trigger the addition of the '& INGR **pred´** (y)' component to the LS? This was not a problem with motion verbs, since there was a predicative preposition in the core to supply the additional predicate. Is there any non-ad hoc way to associate a quantified NP object with an additional predicate? How is the nature of the additional predicate specified? The answer seems to be 'no' to the first question, at least in terms of the system of semantic representation as it currently stands. The solution proposed for the causative alternation is a possible answer to these questions: there would be a pointer in the lexical entry for consumption and creation verbs pointing to the lexical rules in (38b, c), with specifications that the activity form is used with a mass noun or bare plural *y* argument and the active accomplishment form with a quantified or specified *y* argument. In languages like Georgian, Russian, Pirahã, Dyirbal and Sama, on the other hand, the fact that the telic and atelic forms of these verbs are distinct means that each alternant would be correlated with a different form of the verb.

The other potential cases of co-composition involve optional arguments: implements and comitatives. Implement arguments are associated with activity verbs, and activity verbs do not have the complex causal structure of verbs like *shatter*. Consequently, there is no ready-made slot available for them in the LS of the verb, and co-composition must come into play. For a sentence like *Chris wrote the letter with a pen*, the problem is immediate: the LS for *write* has only two arguments, but this sentence has three. The source of the third argument position cannot be *with*, because it is never predicative in the RRG analysis (see (25b)). Rather, the source is the telic quale of the third NP, *a pen*: it specifies that the function of a pen is that one uses it for writing. The LS in the telic quale of *pen* merges with the LS of the verb *write*, yielding a LS which can accommodate the additional argument; it matches the output of the lexical rule in (48). This is represented in Fig. 4.20.

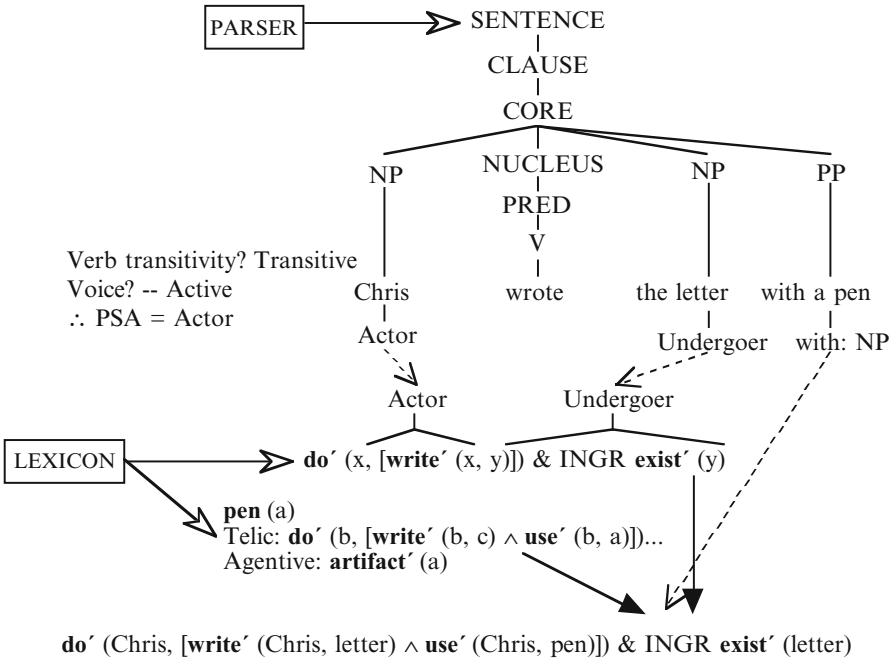


Fig. 4.20 Co-composition in sentence with an implement PP

Comitative PPs are handled in a similar fashion: the telic quale of the NP object of *with* supplies the crucial information for the interpretation. In this case, the object of with is a human, e.g. *Sam ran with Tim*, and as indicated earlier in (53b), the telic quale for a human individual is that they act, they do things; in other words, they are potential actors. This means that the interpretation of the NP *Tim* in this sentence is that it is a doer, a potential actor, and this generates a comitative interpretation. The linking from syntax to semantics for *Sam ran with Tim* is given in Fig. 4.21 above. Thus for both implement and comitative PPs, their interpretation depends upon the telic quale of the *with* NP. Again, in languages like Dyirbal and Swahili, in which the presence of instrument, implement and comitative arguments are coded on the verb, there would be little need for co-composition in the syntax-to-semantics linking.

It was mentioned in Sect. 4.3.1 that because *with* is never predicative it can occur multiple times in a single clause. The example of a clause with three *with* PPs is repeated from (29).

(56) The man loaded the truck with hay with a pitchfork with Bill.

The object of the first *with*, *hay*, is an argument of *load* and links to an argument position in the basic LS of the verb; the other two PPs are implement and comitative PPs, and their interpretations are derived via co-composition. As in the previous two examples, it is the telic quale of the NP object of *with* that underlies the NP's

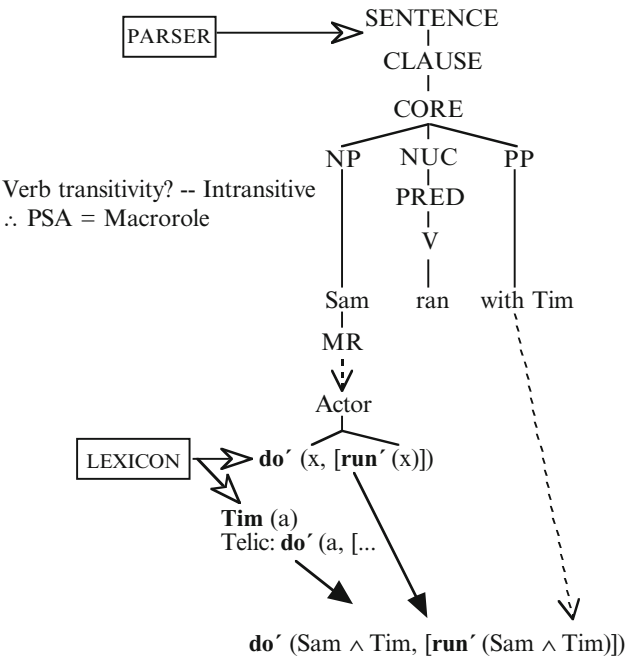


Fig. 4.21 Co-composition in a sentence with a comitative PP

interpretation. The linking from syntax to semantics of (56) is given in Fig. 4.22 below. The basic syntax-to-semantics linking algorithm can account for only the first three arguments; the other two are left unlinked, leading to a potential Completeness Constraint violation. However, by using co-composition and taking information from the telic qualia of the NPs, the additional LS components can be derived which allow the NPs to be linked, thereby avoiding a Completeness Constraint violation.

4.7 Conclusion

This paper has contrasted projectionist and constructionist views of the syntax-semantics interface, and it has been argued that, far from being incompatible and contradictory, the two approaches represent different perspectives on the construction of sentence meaning: the projectionist approach represents the speaker's perspective, while the constructionist approach represents the hearer's perspective. In RRG terms, the former fits naturally with the linking from semantics to syntax (Fig. 4.16), whereas the latter fits naturally with the linking from syntax to semantics (Fig. 4.17). The recognition of the constructionist notion of co-composition as part of the linking from syntax to semantics led to an attempt to incorporate it into

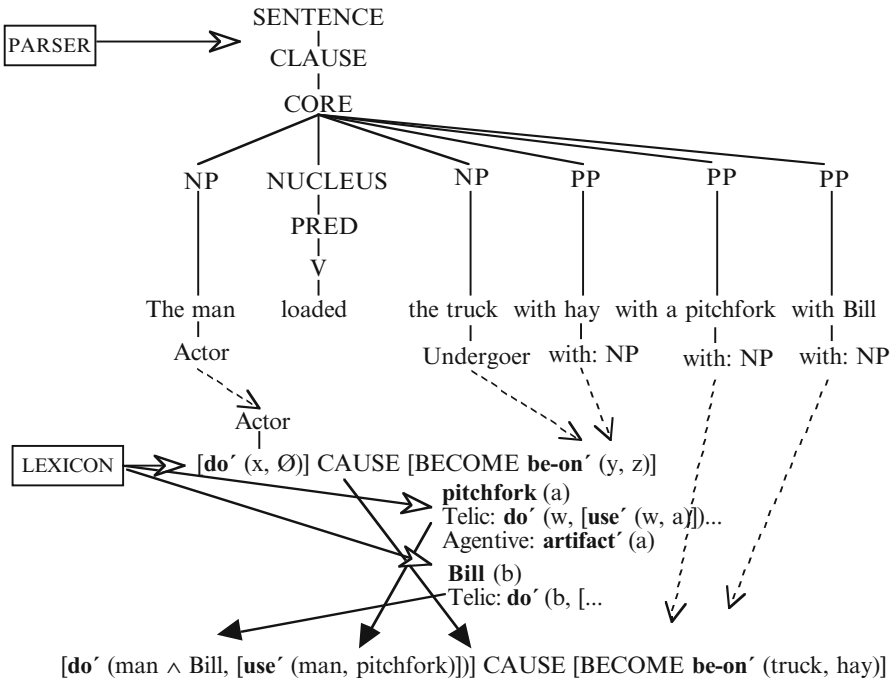


Fig. 4.22 Syntax-to-semantics linking with multiple *with* PPs

the RRG linking system. Co-compositional analyses of the causative alternation and optional instrument, implement and comitative arguments were developed for languages like English in terms of the RRG syntax-to-semantics linking system. In languages in which these alternations are coded overtly on the verb, the need for co-composition in the syntax-to-semantics linking is less obvious.

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