

Abstract

Although the original framework of HPSG is mostly compatible with independent theoretical claims or analyses in lexeme base morphology (Anderson 1992, Aronoff & Fudeman 2004, Beard 1995, Booij 2005, Carstairs-McCarthy 1992, Fradin 2003, Haspelmath 2002, Matthews 1991, Plag 2003, for example), so far, most morphological research in morphology has been done on inflexional phenomena (Orgun & Inkelas 2002, Bonami & Boyé 2006), and few on derivational morphology has been addressed by only a few (Koenig 1999, Riehemann 1998). Yet, we believe it is worth investigating how the formal and theoretical apparatus of HPSG deals with capturing multilevel constraints that apply in the lexeme formation of French Verb-Noun nominal compounds in French (, such as as GRILLE-PAIN, (lit. grill-bread, ‘toaster’), PERCE-OREILLE, (lit. pierce-ear, ‘earwig’), TOURNEVIS, (lit. turn-screw, ‘screwdriver’), or LÈCHE-VITRINE, (lit. lick-window, ‘window-shopping’), can be captured by the formal and theoretical apparatus of HPSG. Contrary to the view what has often expressed in the past been said, we argue that VN lexemes formation comes under is subject to morphological constraints rather than to but not under syntactic mechanisms. Our analysis integrates VN lexemes into a multiple-dimensional typed- hierarchy of lexemes and provides an account for of semantic generalizations involved in different types of lexeme formation (compounding, derivation, and conversion).

Morphological compounding is a mechanism of lexeme formation that has been studied less within HPSG compared to derivational and inflexional phenomena. In this paper, we propose a morphological treatment of French Verb-Noun compounds (as in 1), which have been frequently considered as lexicalized syntactic phrases in the literature. We present an HPSG analysis¹ that integrates compounding in a general lexeme typed-hierarchy, and captures some generalities about the semantics needed in most deverbal lexeme formations, in particular, in VN lexemes, derived lexemes, and convert lexemes.

- (1) a. GRILLE-PAIN² (lit. grill-bread, ‘toaster’)
- b. PERCE-OREILLE (lit. pierce-ear, ‘earwig’)
- c. TOURNEVIS (lit. turn-screw, ‘screwdriver’)
- d. LÈCHE-VITRINE (lit. lick-window ‘window-shopping’)

1 Why VN compounds are not syntactic formations

In the literature, French VN compounds are commonly considered as syntactic formations (Di-Sciullo & Williams 1987, Barbaud 1994, Lieber 1992, Zwanenburg 1992, among others). However, following Corbin (1992), Fradin (2005) and Villoing (2009), we argue that VN compounds do not

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² By convention, lexemes are in small capitals.

show the properties expected of lexicalized syntactic phrases, a fact which argues in favor of the idea that they are formed morphologically rather than syntactically.

First, compounding as the morphological formation of lexemes does not typically involve functional words. Determiners, prepositions, and pronouns (including clitic forms, which are inflexional forms, see Miller & Sag 1997) never realize in a compound. Remarkably, the type of nouns selected by the VN compounding rule always appears with a determiner in the corresponding sentence (cf. 2), while determiners never realize with the N in VN nominals, cf. (3).

- (2) Cet objet grille **le** pain. / *Cet objet grille pain.
lit. this object grill **the** bread. / this object grill bread
- (3) GRILLE-PAIN_N (lit. grill-bread, 'toaster')
Cet objet est un grille-pain / *Cet objet est un grille-**le**-pain.
lit. this object is a grill-bread. / *This object is a grill **the** bread

In contrast, syntactic lexicalization of verb phrases, including those involving the same categories (V and N) as VN compounds (cf. 5), do characteristically preserve functional words of the original syntactic phrase, including prepositions (4a), pronouns (4b,c), and determiners (5):

- (4) a. BOIT-SANS-SOIF_N (lit. drinks-without-thirst, 'drunkard')
b. RENDEZ-VOUS_N (lit. go-you, 'appointment')
c. SOT-L'Y-LAISSE_N (lit. silly-it-there-leaves, 'chicken oyster')
- (5) a. TROMPE L'OEIL_N (lit. deceives-the-eye, 'trompe l'oeil')
b. TROMPE-LA-MORT_N (lit. deceives-the-death, 'daredevil')
c. CRÈVE-LA-FAIM_N (lit. dies-the-hunger, 'beggar, destitute person')
d. PUE-LA-SUEUR_N (lit. stinks the perspiration, 'poor laborer')

In addition, if VN compounds were lexicalized phrases, inherent reflexive pronouns that are obligatorily realized in the syntax would be expected to appear. However, this is not the case, as demonstrated in (6):

- (6) a. Il **se** casse la tête. (lit. he _{REFLX} breaks the head)
b. C'est un casse-tête. (lit. it's a break-head)
c. *C'est un **se** casse-tête (lit. it's a _{REFLEX} break-head)

Second, lexicalized phrases preserve in their structure the original SVO word order of the source sentence, as in (7). In light of this property, it is interesting to observe that many Verb-Noun compounds cannot appear as such in a sentence, specifically because the N realized on the right of the verb does not satisfy the syntactic constraints on the realization of the semantic arguments of the verb. The N of the VN lexemes in (8), for example, is understood as an agent and would be realized in a sentence as a subject on the left of the verb.

- (7) a. **JE NE SAIS QUOI**_N (lit. I don't know what, 'something')
 b. **JE SAIS TOUT**_N (lit. I know all, 'smart-aleck' 'know all')
- (8) a. **HURLE-LOUP**_N (lit. howl-wolf, toponym)
 b. **GOBE-MOUTON**_N (lit. swallow sheep, kind of poisonous plant)
 c. **PISSE-CHIEN**_N (lit. pee-dog, 'type of plant')

In lexeme compounds, the semantic relations between the verb and noun is not absolutely uniform, nor as predictable as it would be in a syntactic structure. While the N in a VN compound most frequently denotes the patient of the verb (cf. 9a), it can also denote other roles, such as the agent (cf. 8), spatial localization (cf. 9b), or temporal localization (cf. 9c):

- (9) a. **OUVRE-BOÎTE**_N (lit. open-tin, 'tin opener')
 b. **TRAÎNE-BUISSON**_N (lit. hang around on-bush, 'animal')
 c. **REVEILLE-MATIN**_N (it. wake up-morning, 'alarm clock')

In fact, this relative plasticity of argument interpretation is a characteristic of lexeme compounding, and contrasts with the limited range of interpretation exhibited by the argument structure of a given verb in a sentence. As another illustration of this phenomenon, we observe that the resulting interpretation of a VN compound may also vary, even for a given verb-noun semantic relation. For example, among the patient relations in (10), VN (10a) denotes a patient, VN (10b) denotes an event, and VN (10c) an agent (and others may denote an instrument, or a localization).

- (10) a. **GOBE-MOUTON**_N (lit. swallow-sheep, 'poisonous plant')
 b. **LECHE-VITRINE**_N (lit. lick-window, 'window shopping')
 c. **GRATTE-PAPIER**_N (lit. scratch-paper, 'pen pusher')

As VN compounds do not exhibit syntactic constraints that are preserved in lexicalized phrases, we conclude that these compounds are morphological constructs in French (Corbin 1992, Villoing 2003, Fradin 2005).

2 The lexeme properties of VN compounds

2.1 General properties

Verb-Noun compounds are nominals. As morphological constructs, they are formed of two lexemes: a verbal base-lexeme and a nominal base-lexeme. The semantics of the whole compound (S3, in Table 1) involves the semantics of the base-lexemes AND the semantics of the morphological rule.

LEXEME 1	LEXEME 2		LEXEME 3
F1: x	F2: y	⇔	F3: xy
Cat 1: V	Cat 2: N		Cat 3: N
S1	S2		S3

Table (1): The morphological French VN lexeme compound formation pattern, where F = phonology; Cat = syntactic category; S = semantics

We observe that the VN rule has two possible semantic outputs: event-denoting nominals as in (11) or object-denoting nominals as in (12); the latter may denote humans as in (12a), instruments as in (12b), or spatial localizations as in (12c).

(11) (*faire du*) LECHE-VITRINE_N (lit. (to do some) lick-window, 'window shopping')

- (12) a. GRATTE-PAPIER_N (lit. scratch-paper, 'pen pusher')
b. GRILLE-PAIN_N (lit. grill-bread, 'toaster')
c. COUPE-GORGE_N (lit. cut-throat, 'dangerous back alley')

2.2 VN compounds: a property of Romance languages

VN compounding is characteristic of Romance languages (see examples in Italian (13) and Spanish (14)). This process is much less productive in Germanic languages, which typically employs another compounding process, the so-called "synthetic compounding", combining two nouns, the second of which is deverbal ([NV-er]_N; cf. examples in English (15) and Dutch (16)).

- (13) a. SPREMI_V-LIMONI_N (lit. press-lemon, 'lemon squeezer')
b. ROMPI_V-COLLO_N (lit. break-neck, 'daredevil')
(14) a. LANZA_V-COHETES_N (lit. throw-rocket, 'rocket launcher')
b. COME_V-CURAS_N (lit. eat-priest, 'anticlerical')
(15) a. TRUCK_N-DRIVER_N
b. DISH_N-WASHER_N
c. WHALE_N-HUNTING_N
(16) a. BRAND_N-BLUSSER_N (lit. fire-extinguisher, 'extinguisher')
b. GIF_N-MENDER_N (lit. poison-mixer, 'poisoner')
c. GRAPPEN_N-MAKER_N (lit. jokes-maker, 'comedian')

2.3 VN compounds as word forms

As word forms, VN compounds have all the expected syntactic functions of nominals. They can function as be objects, such as in (16a), or subjects, such as in (16b).

- (16) a. Paul a acheté un **grille-pain**. (Obj: Spec+N)
lit. Paul bought a grill-bread ('toaster')

- b. Le **grille-pain** est cassé. (Subj: Spec+N)
lit. The grill-bread ('toaster') is broken.

The same properties are observed for event-denoting VNs, as in (17a-c):

- (17) a. Le **lèche-vitrine** est mon loisir préféré (Subj: Spec+N)
lit. the window-shopping is my favorite hobby
b. Marie adore le **lèche-vitrine** (Obj: Spec+N)
lit. Mary loves window-shopping
c. Lola fait du **lèche-vitrine** (Obj : Spec indef +N)
lit. Lola goes window-shopping

The semantics of the compounding rule allow object-denoting VNs to be predicative (18a, b) or attributive (18c):

- (18) a. Paul a acheté du papier **tue-mouche**.
lit. Paul bought some kill-fly paper ('flypaper')
b. Ce couloir a trois portes **coupe-feu**.
lit. This corridor has three cut-fire doors ('firebreak door')
c. Pierre est **rabat-joie**.
lit. Peter is reduce-joy ('spoilsport').

In this case, the modified N (*papier* in (18a), *portes* in (18b)) or the subject (*Pierre* in (18c)) is the Proto-agent of the verbal base-lexeme (in the sense of Dowty 1991). In the predicative use, the paper is seen as the killer of flies (18a) and the door as the one that cuts fire (18b). In the attributive use, Pierre, a human, is seen as the one who causes the reduction of joy (18c).

Event-denoting VNs can also have attributive or predicative uses, since French allows the construction of VNs denoting a property from an event, cf. (19) and (20). But, this is neither direct nor systematic, and requires some semantic accommodation.

- (19) a. On part pour une journée **lèche-vitrine**. (web)
lit. We are going for a day window-shopping
(20) Il est très **baise-main**.
lit. He is very kiss-hand

2.4 The phonological properties of VN compounds

Many discussions have focused on the nature of the verb in VN compounds, especially on the question whether it is a stem or a word-form (see Villouing 1999 for an overview). Since VN verb forms are not marked for inflection, we consider them stems. As for their phonological properties, we follow

Bonami & Boyé's (2003) account of verbal inflection in French. In their perspective (following, among others, Aronoff 1994 for Latin conjugation), verbal lexemes are associated in the lexicon with a vector of different possible phonological representations. These phonological representations are distinct stems, which Bonami & Boyé (2003) call the “stem space”.

Lexeme	Stem 1 (PRST. SG)	Stem 2 (PRST.3.PL)	Stem 3 (PRST. 1/2 PL IMPARF.)
BOIRE ‘to drink’	/bwa/	/bwav/	/byv/

Table (2): The phonological verb stem of the verb BOIRE

Each lexical or inflectional morphological rule selects for a specific stem as input. From the possible stems of the verb, the VN compounding rule always selects for stem 1. The verb lexeme SOUTENIR, for example, has at least two stems /s u t ə n/ and /s u t ʒ ẽ /; the rule selects for the first, which is also used to form the present singular.

Verb lexeme	Stem 1 (PRST SG)	VN compound	
COUPER ‘to cut’	/k u p/	COUPE-PAPIER _N	lit. cut-paper, ‘paper knife’
LECHER ‘to lick’	/l ɛ ʃ/	LÈCHE-VITRINE _N	lit.lick-window, ‘window-shopping’
ESSUYER ‘to wipe’	/ɛ s ɥ i/	ESSUIE-GLACE _N	lit.wipe-window, ‘windshield wiper’
OUVRIR ‘to open’	/u v r/	OUVRE-BOÎTE _N	lit. open-tin, ‘tin opener’
SOUTENIR ‘to support’	/s u t ʒ ẽ /	SOUTIEN-GORGE _N	lit.support-bosom, ‘bra’
TORDRE ‘to wring’	/t ɔ r/	TORD-BOYAU _N	lit.wring-gut, ‘rotgut’

Table (3): The phonological verb stem of VN compounds

The first stem is the default phonological stem for all verbs involved in the VN compounding rule, while the default stem for derivational rules is commonly stem 3, used for the present plural or for the perfect tense.

Verb lexeme	Stem 1 (PRST SG)	VN compound	Stem 3 (PERFECT)	Deverbal nouns
ESSUYER 'to wipe'	/es ɥ i/	ESSUIE- GLACE _N	/es ɥ i j/	ESSUYAGE 'drying up' ESSUYEUR 'dryer'
SOUTENIR 'to support'	/s u t j ẽ/	SOUTIEN- GORGE _N	/s u t ə n/	SOUTENABLE 'bearable' SOUTENANCE 'academic defense'
TORDRE 'to wring'	/t ɔ r /	TORD-BOYAU _N	/t ɔ r d/	TORDABLE '°wringable' TORDEUR 'wringer'

Table (4): The phonological verb stem of VN compounds and deverbal nouns

The noun can, in most cases, be analyzed as a stem, but may sometimes look like a word form marked for plural:

- (21) a. ESSUIE-MAINS_N (lit. dry-hands, 'hand towel')
b. PRESSE-FRUIT_S_N (lit. press-fruits, 'squeeze')
c. PROTÈGE-YEUX_N (lit. protect-eyes, 'eye mask')

We believe that this is not syntactic marking, but an inherent inflection (such as described by Booij, 1996). Inherent inflection is required by the semantics and not by the syntax. The choice of singular or plural marking by the rule does not really change the semantics of the whole VN.

2.5 The semantic properties of VN

2.5.1 The semantics of the verbal base-lexeme

The verbal base-lexeme of a VN is dynamic (following Vendler 1967 and Dowty 1979). Stative verbs are, therefore, bad candidates for VN compounding:

- (22) a. ?? Paul est un véritable **sait**-latin.
lit. Paul is a true know-Latin
b. ?? Le Béluga, les **aime**-caviar russes en sont fous.
approx. The Beluga, Russian love-caviars are crazy about it

Most verb bases are transitive and present an agent/patient relation. Therefore, unaccusative verbs (23) and unergative verbs (24) are typically bad candidates as well:

- (23) a. ?? °ARRIVE-TRAIN_N (lit. arrive-train)
b. ?? °TOMBE-PLUIE_N (lit. fall-rain)

- (24) a. ?? °**ABOIE**-CHIEN_N (lit. bark-dog)
 b. ?? °**JONGLE**-CLOWN_N (lit. juggle-clown)

Nevertheless, some VN compounds are built on unaccusative or unergative verb bases; in this case, the interpretation is causative, through an agent participant variable added by the rule (see 37-40 below).

2.5.2 The semantics of the nominal base-lexeme

In most cases, the semantic role of the noun-base is the Proto-patient³ argument of the verbal base-lexeme, as in (25). So, the noun base denotes what is affected by the process described by the verb. In rare cases, it may be understood as another argument: agent, spatial or temporal localization. All the possibilities are summed up in Table (5).

- (25) a. **LÈCHE**-**VITRINE**_N (lit. lick-window, ‘window-shopping’)
 b. **OUVRE**-**BOÎTE**_N (lit. open-tin, ‘tin opener’)
 c. **GRATTE**-**PAPIER**_N (lit. scratch-paper, ‘pen pusher’)
 d. **COUPE**-**GORGE**_N (lit. cut-throat, ‘dangerous back alley’)
 e. **TROTTE**-**BÉBÉ**_N (lit. toddle-along-baby, ‘baby walker’)

Patient ⁴	Agent	Location	Temporal
LÈCHE-VITRINE	GOBE-MOUTON	TRAÎNE-BUISSON	RÉVEILLE-MATIN
OUVRE-BOÎTE	HURLE-LOUP		
GRATTE-PAPIER	PISSE-VACHE		
COUPE-GORGE	TROTTE-BÉBÉ		

Table (5): The semantic role of the N in a VN compound

2.5.3 Semantic properties of the whole VN

As we said above, VN compounding has two possible types of semantic output: event-denoting nominals and object-denoting nominals. Event-denoting nominals, as in (26), denote a subset of events:

- (26) a. **LECHE**-**VITRINE**_N (lit. lick-window, ‘window-shopping’)
 b. **REMUE**-**MENAGE**_N (lit. move-household, ‘commotion’)

³ The Proto-patient, as well as the Proto-agent, are defined according to the criteria given by Dowty (1991) and Davis & Koenig (2000)

⁴ Boldface indicates the most common interpretation.

Object-denoting nominals are obtained from two different types of semantic rules.

- The first rule operates the abstraction of a participant variable of the verbal base-lexeme. In this case, VN compounds are mostly interpreted as the Proto-agent, as in (27):

- (27) a. OUVRE-BOITE_N (lit. open-tin, ‘tin opener’)
 b. REVEILLE-MATIN_N (lit. wake up-morning, ‘alarm clock’)
 c. GRATTE-PAPIER_N (lit. scratch-paper, ‘pen pusher’)
 d. GARDE-COTE_N (lit. watch-coast, ‘coastguard’)

But, in a few other cases, it may also be a patient (cf. 28) or a spatial localization (cf. 29) , as noted above. Table (6) sums up the various denotation types available for object-denoting VNs that correspond to the abstraction of a variable.

- (28) a. GOBE-MOUTON_N (lit. swallow-sheep, ‘kind of poisonous plant’)
 b. BROUTE-BIQUET_N (lit. graze-kid (young goat), ‘honeysuckle’)
 (29) a. COUPE-GORGE_N (lit. cut-throat ‘dangerous back alley’)
 b. HURLE-LOUP_N (lit. howl-wolf, ‘toponym’)

(proto)Agent	(proto)Patient	Location
GRATTE-PAPIER	GOBE-MOUTON	HURLE-LOUP
TRAÎNE-SAVATE	BROUTE-BIQUET	COUPE-GORGE
OUVRE-BOÎTE		GARDE-MEUBLE.
RÉVEILLE-MATIN		

Table (6): The semantic role of VN compounds (select a participant)

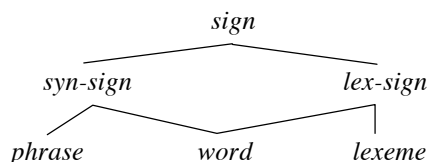
- The second semantic rule involved in object-denoting VNs adds an agent participant variable to the verbal base-lexeme relation, *via* a causative relation in the case of a non-agentive verb base-lexeme (inaccusative), as in (30), or an instrumental relation in the case of unergative verbal bases, as in (31):

- (30) a. COULE-SANG_N (lit. flow-blood, ‘type of plant’)
 b. SAUTE-BOUCHON_N (lit. jump-cork, ‘champagne’)
 (31) a. PISSE-CHIEN_N (lit. pee-dog, ‘type of plant’)
 b. TROTTE-BÉBÉ_N (lit. toddle-along-baby, ‘baby walker’)

3 Analysis

3.1. A type hierarchy for morphologically complex lexemes

In Bonami & Boyer's (2006) *sign* type hierarchy that we choose to use⁵, lexemic properties of a *lex-sign* (i.e., words and lexemes) are expressed *via* the attribute MORPHOLOGICAL-DAUGHTERS. This allows us to express that a word is a syntactic sign with a lexemic identity. This hierarchy also allows the distinction between words and lexeme signs, stipulating that PHONOLOGY is an attribute of syntactic signs (i.e. phrases and words), whereas the phonological identity of *lexeme* signs is expressed *via* the STEMS feature (see table (7) below).



Fig(1). Bonami & Boyé's (2006) *sign* type hierarchy

TYPE	CONSTRAINT	ISA
<i>syn-sign</i>	[PHON <i>phon</i>]	<i>sign</i>
<i>lex-sign</i>	[M-DTRS <i>list(lexeme)</i>]	<i>sign</i>
<i>phrase</i>	[DTRS <i>list(syn-sign)</i>]	<i>syn-sign</i>
<i>word</i>	[M-DTRS < <i>lexeme</i> >]	<i>syn-sign</i> & <i>lex-sign</i>
<i>lexeme</i>	[STEMS <i>stem-space</i>]	<i>lex-sign</i>

Table (7): Constraints on the *sign* type hierarchy

The lexicon of languages builds lexemes by different means; this includes a widespread distinction (in French, as in other European languages) between simple lexemes (*simplex*) and morphologically complex ones. We propose to account for this variety of organization by using a further dimension of classification, called FORMATION, in addition to the PART-OF-SPEECH and VALENCE dimensions, see Fig. (2).

Lexemes with a complex morphology (*morph-complex-lex*) are classified into compound, derived and converted lexemes⁶. This analysis is based on several recent works in morphology; in particular, we integrate the results of Tribout (forthcoming) on converted lexemes, Fradin & Kerleroux (2002) and

⁵ Our analysis could also be mapped onto the SBCG framework (Sag, 2007), considering *vn-lex* as a type of construct.

⁶ We believe that inflected signs are *syntactic-signs*, hence, INFLECTION should be a dimension of *word* type hierarchy.

Kerleroux (2004) on derived lexemes with the suffix *-eur*, Namer & Villoing (2008) on lexemes with the suffix *-oir(e)*, Ferret, Soares & Villoing (2009) on lexemes with the suffix *-age*, Plénat (2005) on lexemes with the suffix *-ette*, and Roché (2003) on lexemes with suffix *-on*.

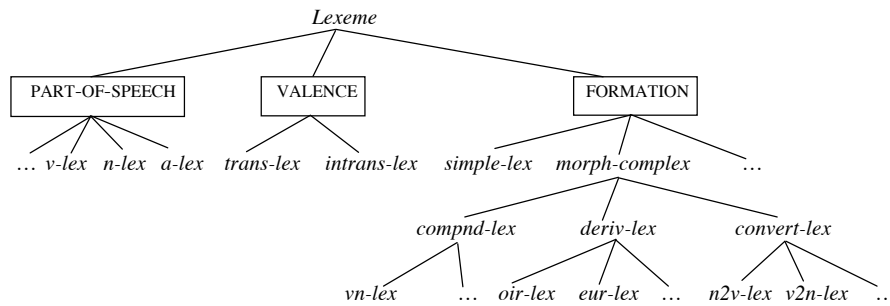


Fig (2). A multi-dimensional *lexeme* type hierarchy

3.2. Semantic rules available for deverbal lexeme formation

What emerges from these analyses is the fact that semantic rules involved in the formation of deverbal lexemes have much in common, whether these are compound, derived or converted lexemes. First, these always involve the semantic argument structure of the verb base. To account for this factor, we propose to use a type hierarchy for semantic roles *à la* Davis and Koenig (2000), as follow:

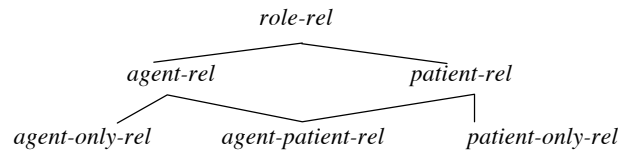


Fig (3). The *role-relation* (partial) type hierarchy

Second, two general semantic patterns are evident: deverbal lexemes may denote an event (or a set of events) or a referential index. The latter may be abstracted from the semantic argument structure of the verb base or be an additional argument. These general semantic patterns are captured in the *complex-nominal-relation* type hierarchy we propose:

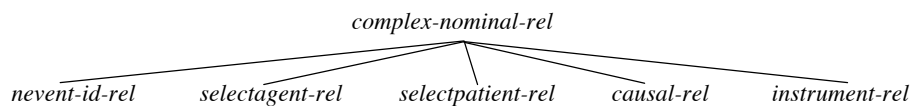


Fig (4). The *complex-nom-rel* (partial) type hierarchy

Constraints on *complex-nominal-relation*, given in (32), are rather general, since each specific lexeme imposes its own particular semantics. *Nominal-event-id-relation* is an identity relation that takes an *austinian* as an

argument⁷ whose SITUATION index, corresponding to the index of the verb base, is identified with the INSTANCE value of the relation. This relation applies to event nominalizations in general: in addition to VN lexemes (like LÈCHE-VITRINE ‘window shopping’ or SAUTE-MOUTON ‘leapfrog’), it also applies to converted lexemes (NAGE ‘swimming’, CHUTE ‘downfall’), and to derived lexemes with the suffix *-ette* (BRONZETTE ‘sunbathing’), with the suffix *-age* (BALAYAGE ‘sweeping’) or with the suffix *-on* (PLONGEON ‘dive’).

(32) <i>nevent-id-rel</i> =>	$\begin{bmatrix} \text{INST} & [1] \\ \text{ARG} & \text{austinian}[\text{SIT } [1]] \end{bmatrix}$
<i>selectagent-rel</i> =>	$\begin{bmatrix} \text{INST} & [1] \\ \text{ARG} & \text{NUCL } [\text{AGT } [1]] \end{bmatrix}$
<i>selectpatient-rel</i> =>	$\begin{bmatrix} \text{INST} & [1] \\ \text{ARG} & \text{NUCL } [\text{PAT } [1]] \end{bmatrix}$
<i>causal-rel</i> =>	$\begin{bmatrix} \text{INST} & [1] \\ \text{ARG} & \text{austinian} \end{bmatrix}$
<i>instrument-rel</i> =>	$\begin{bmatrix} \text{INST} & [1] \\ \text{ARG} & \text{NUCL } [\text{AGT } [2]] \end{bmatrix}$

Selectagent-rel, *selectpatient-rel*, and *selectloc-rel* are relations in which a particular semantic argument is abstracted from a verb base relation. It may denote an agent, as in the VN lexemes GRATTE-PAPIER (‘pen pusher’), GARDE-BARRIÈRE (‘gate keeper’), and in derived lexemes with the suffix *-eur* (MARCHEUR ‘walker’, CHANTEUR ‘singer’), with the suffix *-on* (GROGNON ‘grumbling’, BROUILLON ‘draft’), or in converted lexemes (JUGE ‘judge’, GARDE ‘guard’). It may denote a patient, as in the VN lexeme GOBE-MOUTON (‘kind of poisonous plant’), in derived lexemes with the suffix *-oir* (TIROIR ‘drawer’), with the suffix *-ette* (SUCETTE ‘lollypop’), with the suffix *-on* (NOURRISSON ‘infant’, SUÇON ‘hickey’), or in converted lexemes (AFFICHE ‘poster’, PARCOURS ‘route’). The abstracted semantic argument may also denote the localization of an event (or a set of events), as in the VN lexeme GARDE-MEUBLE (‘storage’), in derived lexemes with the suffix *-oir* (LAVOIR ‘wash house’, FUMOIR ‘smocking room’), in lexemes with the suffix *-ette* (BUVETTE ‘taproom’, CACHETTE ‘hiding place’), or in converted lexemes (INSTITUT ‘institute’, ARRIVÉE ‘arrival’).

The *causal-relation* and *instrumental-relation* are mostly used in cases where an ‘external’ agent is added to the argument structure of a verb base. The

⁷ We borrow the *austinian* type from Ginzburg and Sag (2000).

causal-relation adds a cause argument, mostly to a *patient-only* type of verb base, like the VN lexeme COULE-SANG (‘plant’, lit. leek–blood). The *instrumental-relation* adds an argument understood as an instrument or a mean to a verb base that has an *agent-rel* type of relation, like the VN lexeme TROTTE-BÉBÉ (‘baby walker’), or in derived lexemes with the suffix *-oire* (PASOIRE ‘strainer’, MACHOIRE ‘jaw’), with the suffix *-eur* (CHARGEUR ‘cartridge’, INTERRUPTEUR ‘switch’), with the suffix *-ette* (ALLUMETTE ‘matchstick’), or with the suffix *-on* (GUIDON ‘handlebar’, TORCHON ‘dishcloth’).

3.3. A type hierarchy for VN compounds

As expected, the first partition of the *vn-lexeme* type hierarchy we propose is between event-denoting nouns (*nevent-vn-lex*) and object denoting nouns (*nobj-vn-lex*). There are three subtypes of *nobj-vn-lexeme*: *agent-vn-lex*, *patient-vn-lex* and *localization-vn-lex*. Many VN lexemes are of the general *agent-vn-lex* type (that selects the agent argument of a transitive verb base), and some other *agent-vn-lex* are built by adding a cause or an instrument argument to the argument structure of the verb base.

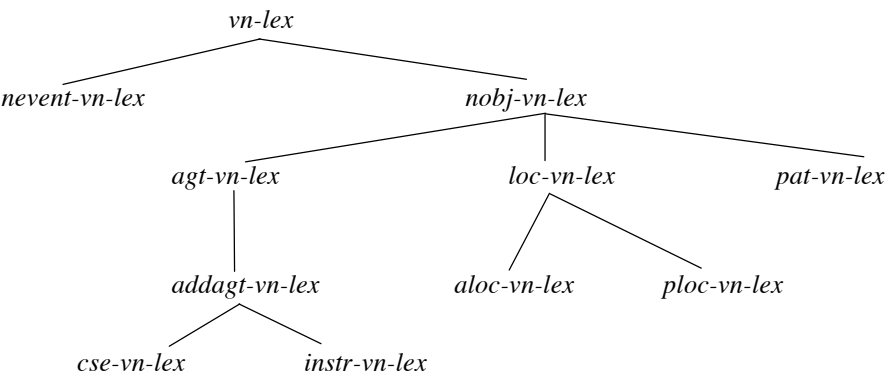


Fig (5). The *vn-lexeme* type hierarchy

The following table lists these subtypes with examples of VN lexemes:

<i>nevent-vn-lex</i>	<i>agt-vn-lex</i>	<i>pat-vn-lex</i>	<i>aloc-vn-lex</i>	<i>ploc-vn-lex</i>	<i>cse-vn-lex</i>	<i>instr-vn-lex</i>
LECHE-VITRINE	GRATTE-PAPIER GRILLE-PAIN	GOBE-MOUTON	HURLE-LOUP	GARDE-MEUBLE	COULE-SANG	TROTTE-BEBE

Table (9). Illustration of the different types of VN lexemes

Before looking at the detailed constraints on *vn-lex*, we must discuss the fact that the inheritance principled hierarchy allows us to adequately express the repartition between common and particular properties among the different VN lexemes we analyzed. And yet, the descriptive generalities hierarchically

ordered (as in fig. 5) fail to match the intuitive or desired picture according to which the most productive VN types should be ranked higher than the less productive ones. Indeed, considering the productivity of these lexemes, *agent-vn-lex* should be the highest super type, or be the default type. However, that would lead to problems of descriptive congruency in the representation of other types (*nvent-vn-lex*, *loc-vn-lex* and *pat-vn-lex*) as subtypes. A possible solution, to be explored in later work, would be to include a PRODUCTIVITY feature with a variable of weight as value, that would integrate results obtained from a robust corpus study of VN lexeme productivity, based on Baayen's (1992 and 2008) methods.

Constraints associated with the different *vn-lexeme* subtypes integrate the general semantic rules proposed earlier. The constraints in (33) stipulate that a lexeme *vn-lexeme* is a noun with a *complex-nominal-relation* and two morphological daughters: a verbal base-lexeme and a nominal base-lexeme. The verbal base has a *dynamic-rel* semantic relation and, by default, it has a *patient-relation*, which means it minimally has a patient argument, and may possibly have an agent-patient relation. In addition, the value of its semantic argument PATIENT is, by default, the same as the INDEX of the nominal base-lexeme. Stem phonology is preceded by concatenation, in the standard way.

(33) *vn-lexeme* =>

$$\left[\begin{array}{ll} \text{STEMS} & [\text{SLOT1 } [3] \oplus [4]] \\ \text{SYNSEM} & \left[\begin{array}{l} \text{CAT } [\text{HEAD } \textit{noun}] \\ \text{CONT } \left[\begin{array}{l} \text{IND } [1] \\ \text{RESTR } \{ [\text{INST } [1]] \} \end{array} \right] \end{array} \right] \\ \text{M-DTRS} < \textit{v-lex} & \left[\begin{array}{l} \text{STEMS } [\text{SLOT1 } [3]] \\ \text{SS} \mid \text{CONT } \left[\begin{array}{l} \text{NULC } \textit{dynamic-rel} / \left[\begin{array}{l} \textit{patient-rel} \\ \text{PAT } [2] \end{array} \right] \end{array} \right] \end{array} \right] , \\ \textit{n-lex} & \left[\begin{array}{l} \text{STEMS } [\text{SLOT1 } [4]] \\ \text{SS} \mid \text{CONT } [\text{IND } [2]] \end{array} \right] > \end{array} \right]$$

In (34), constraints on *nominal-event-vn-lexeme* (*nevent-vn-lex*) stipulate that the value of the *austinian* ARGUMENT of its *relation* is the same as the CONTENT value of the verb base.

In (35), *nominal-object-vn-lex* (*nobj-vn-lex*) has, by default⁸, an *austinian* ARGUMENT in its set of RESTRICTION, whose value is the same as the CONTENT value of the verb base.

⁸ This default is overridden by *cse-vn-lex* and *instr-vn-lex*, which needs to introduce an additional agent argument here, via a *causal-relation* or an *instrumental-relation* respectively,

$$(34) \text{ nevent-vn-lexeme} \Rightarrow \left[\begin{array}{c} \text{CONT} \left[\begin{array}{c} \text{RESTR} \left\{ \begin{array}{c} \text{nevent-id-rel} \\ \text{INST} [1] \\ \text{ARG} [5] \text{austinian} [\text{SIT} [1]] \end{array} \right\} \end{array} \right] \\ \text{M-DTRS} < v\text{-lex} \left[\text{CONT} [5] \right], [] > \end{array} \right]$$

$$(35) \text{ nobj-vn-lexeme} \Rightarrow \left[\begin{array}{c} \text{CONT} \mid \text{RESTR} \{ [\text{ARG} / [5] \text{austinian}] \} \\ \text{M-DTRS} < v\text{-lex} [\text{CONT} [5]] > \end{array} \right]$$

In (36), constraints on *agent-vn-lex* state it has a *selectagent-relation* in its set of restrictions.

$$(36) \text{ agent-vn-lexeme} \Rightarrow [\text{CONT} \mid \text{RESTR} \{ \text{selectagent-rel} \}]$$

The *addagent-vn-lex* type, in (37), is created for descriptive purposes more than for strictly formal needs, since it does not add any specification at its own level, but gives rise to two subtypes, *cse-vn-lex* (cf. 38) and *instr-vn-lex* (cf. 39). The property both these types have in common is the selection of the agent argument of an intermediary semantic relation, *causal-rel* and *instrumental-rel* respectively, that takes the CONTENT of the verb base as its second ARGUMENT.

$$(37) \text{ addagent-vn-lexeme} \Rightarrow \text{agt-vn-lex}$$

$$(38) \text{ cse-agt-vn-lex} \Rightarrow \left[\begin{array}{c} \text{CONT} \mid \text{RESTR} \left\{ \begin{array}{c} \text{selectagent-rel} \\ \text{INST} [1] \\ \text{ARG} \mid \text{NUCL} \left[\begin{array}{c} \text{causal-rel} \\ \text{AGT} [1] \\ \text{ARG} [5] \left[\begin{array}{c} \text{pat-only-rel} \\ \text{PAT} [2] \end{array} \right] \end{array} \right\} \end{array} \right\} \\ \text{M-DTRS} < [\text{CONT} [5]] , [\text{IND} [2]] > \end{array} \right]$$

$$(39) \text{ instr-agt-vn-lexeme} \Rightarrow \left[\begin{array}{c} \text{CONT} \mid \text{RESTR} \left\{ \begin{array}{c} \text{selectagent-rel} \\ \text{INST} [1] \\ \text{ARG} \mid \text{NUCL} \left[\begin{array}{c} \text{instrumental-rel} \\ \text{AGT} [1] \\ \text{ARG} [5] \left[\begin{array}{c} \text{agent-rel} \\ \text{AGT} [2] \end{array} \right] \end{array} \right\} \end{array} \right\} \\ \text{M-DTRS} < [\text{CONT} [5]] , [\text{IND} [2]] > \end{array} \right]$$

VN lexemes that express spatial localization (*loc-vn-lex*, in 40) have either an intransitive verb base (*aloc-vn-lex*, in 41) or a transitive one (*ploc-vn-lex*, in 42):

and doing so, embeds the *austinian* argument that corresponds to the content of the verb base.

$$(40) \text{ loc-vn-lexeme} \Rightarrow \left[\text{CONT} \mid \text{RESTR} \left\{ \begin{array}{l} \text{selectloc-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \mid \text{NUCL} \quad [\text{LOC} [1]] \end{array} \right\} \right]$$

$$(41) \text{ aloc-vn-lexeme} \Rightarrow \left[\text{M-DTRS} < \left[\text{CONT} \mid \text{RESTR} \left\{ \begin{array}{l} \text{ARG} \mid \text{NUCL} \left[\begin{array}{l} \text{AGT} \quad [2] \\ \text{LOC} \quad [1] \end{array} \right] \end{array} \right\} \right], [] > \right]$$

$$(42) \text{ ploc-vn-lexeme} \Rightarrow \left[\text{M-DTRS} < \left[\text{CONT} \mid \text{RESTR} \left\{ \begin{array}{l} \text{ARG} \mid \text{NUCL} \left[\begin{array}{l} \text{AGT} \quad [3] \\ \text{PAT} \quad [2] \\ \text{LOC} \quad [1] \end{array} \right] \end{array} \right\} \right], [] > \right]$$

VN lexemes that denote a patient are not productive, and not numerous. But when they correspond to a type of VN, the constraints needed are as below:

$$(43) \text{ pat-vn-lexeme} \Rightarrow \left[\begin{array}{l} \text{CONT} \mid \text{RESTR} \left\{ \begin{array}{l} \text{selectpat-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \mid \text{NUCL} \left[\begin{array}{l} \text{AGT} \quad [2] \\ \text{PAT} \quad [1] \end{array} \right] \end{array} \right\} \\ \text{M-DTRS} < [] , [\text{IND} [2]] > \end{array} \right]$$

The figures below illustrate different lexical entries: in (44), LÈCHE-VITRINE is a type of *vevent-vn-lex*; in (45), GRATTE-PAPIER is an *agent-vn-lex*; in (46), HURLE-LOUP is a toponym, a type of *aloc-vn-lex*; in (47), COULE-SANG is a *cse-vn-lex*; and in (48), TROTTE-BÉBÉ is an *instr-vn-lex*.

(44) LÈCHE-VITRINE \rightarrow

$$\left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1} [3] \oplus [4]] \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad | \quad \text{HEAD} \quad \textit{noun} \\ \text{CONT} \left[\begin{array}{l} \text{IND} \quad [1] \\ \text{RESTR} \left\{ \begin{array}{l} \textit{lèche-vitrine-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \quad [5] [\text{SIT} [1]] \end{array} \right\} \end{array} \right] \end{array} \right] \\ \text{M-DTRS} < \textit{v-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1} [3] / \textit{lèche} /] \\ \text{SS} \mid \text{CONT} [5] [\text{NULC} \textit{lèche-rel} [\text{AGT} \textit{index}, \text{PAT} [2]]] \end{array} \right], \\ \textit{n-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1} [4] / \textit{vitrine} /] \\ \text{SS} \mid \text{CONT} \quad [\text{IND} \quad [2]] \end{array} \right] > \end{array} \right]$$

(45) *GRATTE-PAPIER* →

$$\left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3] \oplus [4]] \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad | \quad \text{HEAD } \textit{noun} \\ \text{CONT} \left[\begin{array}{l} \text{IND} \quad [1] \\ \text{RESTR} \left\{ \begin{array}{l} \textit{gratte-papier-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \quad [5] \end{array} \right\} \end{array} \right] \end{array} \right] \\ \text{M-DTRS} < \textit{v-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3]/\textit{gratte} /] \\ \text{SS} | \text{CONT} [5] [\text{NULC } \textit{gratte-rel} [\text{AGT } [1], \text{PAT } [2]]] \end{array} \right], \\ \quad \quad \quad \textit{n-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [4]/\textit{papier} /] \\ \text{SS} | \text{CONT} \quad [\text{IND} \quad [2]] \end{array} \right] > \end{array} \right]$$

(45) *HURLE-LOUP* →

$$\left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3] \oplus [4]] \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad | \quad \text{HEAD } \textit{noun} \\ \text{CONT} \left[\begin{array}{l} \text{IND} \quad [1] \\ \text{RESTR} \left\{ \begin{array}{l} \textit{hurle-loup-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \quad [5] \end{array} \right\} \end{array} \right] \end{array} \right] \\ \text{M-DTRS} < \textit{v-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3]/\textit{hurle} /] \\ \text{SS} | \text{CONT} [5] [\text{NULC } \textit{hurle-rel} [\text{AGT } [2], \text{LOC } [1]]] \end{array} \right], \\ \quad \quad \quad \textit{n-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [4]/\textit{loup} /] \\ \text{SS} | \text{CONT} \quad [\text{IND} \quad [2]] \end{array} \right] > \end{array} \right]$$

(45) *COULE-SANG* →

$$\left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3] \oplus [4]] \\ \text{SYNSEM} \left[\begin{array}{l} \text{CAT} \quad | \quad \text{HEAD } \textit{noun} \\ \text{CONT} \left[\begin{array}{l} \text{IND} \quad [1] \\ \text{RESTR} \left\{ \begin{array}{l} \textit{coule-sang-rel} \\ \text{INST} \quad [1] \\ \text{ARG} \quad \left[\begin{array}{l} \text{AGT } [1] \\ \text{ARG } [5] \end{array} \right] \end{array} \right\} \end{array} \right] \end{array} \right] \\ \text{M-DTRS} < \textit{v-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [3]/\textit{coule} /] \\ \text{SS} | \text{CONT} \quad [\text{NULC } [5]\textit{coule-rel} [\text{PAT } [2]]] \end{array} \right], \\ \quad \quad \quad \textit{n-lex} \left[\begin{array}{l} \text{STEMS} \quad [\text{SLOT1 } [4]/\textit{sang} /] \\ \text{SS} | \text{CONT} \quad [\text{IND} \quad [2]] \end{array} \right] > \end{array} \right]$$

(46) *TROTTE-BÉBÉ* →

STEMS	[SLOT1 [3] ⊕ [4]]																							
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4 Conclusion

We have presented here a formalized account of French Verb-Noun compounds, in line with the morphological analysis proposed in Villoing (2009). Our analysis integrates *vn-lexeme* types into the general *lexeme* typed-hierarchy, under a FORMATION dimension that allows the expression of a general classification among lexemes. We expect that the question of lexeme productivity may be solved by the integration of specific features into lexeme entries, as the result of a corpus study of VN productivity modeled on the methods of Baayen (2008). Moreover, we have shown that the fact HPSG allows semantics to be encoded as an independent resource is an advantage in capturing the general semantic patterns that are involved in the formation of several (de)verbal lexemes. In fact, there are other systematic lexical variations, which do not come under morphology, that also involve some of the general semantic types of relations we propose here. The very productive inchoative/causative verb pattern (TO INCREASE intrans/trans), for example, involves the *causal-relation*. Consequently, it is worth considering semantics as a *lexical-sign* dimension of classification in itself, as a way to encode in the hierarchy the fact that some semantic relations are lexically productive rules, available both for words and lexemes.

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