

THE MORPHOLOGY-SEMANTICS INTERFACE IN WORD FORMATION*

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ABSTRACT

The main purpose of this paper is to expand the proposal for lexical decomposition presented in Mairal and Ruiz de Mendoza (this volume) as to cover word-formation processes. In doing so, Lieber's conditions for a theory of lexical semantic representations is considered in detail as well as their role in the design of an adequate framework for a proper treatment of the processes that motivate semantic composition in word formation. In line with the Lexical Constructional Model, the central claim of this paper is that both free and bound morphemes are lexical predicates and, therefore, both are to be defined in terms of the same kind of semantic representation. Much like word lexical templates, affixal lexical templates are thus enriched by incorporating central aspects of Pustejovsky's Qualia Theory.

KEY WORDS: Lexical semantic decomposition, The Lexical Constructional Model, Qualia Theory, derivational morphology, compounding.

RESUMEN

El propósito principal de este artículo es extender la propuesta acerca de la descomposición léxica, presentada por Mairal and Ruiz de Mendoza (en este volumen), al estudio de los procesos de formación de palabras. Para ello, se estudian en detalle las condiciones que Lieber establece con respecto a la configuración de una teoría de representación léxica semántica y se evalúa su papel en el diseño de un marco adecuado para el tratamiento de la composición semántica en la formación de palabras. En consonancia con el Modelo Léxico Construccional, el argumento central de este artículo es que tanto los morfemas libres como los morfemas trabados constituyen predicados y, por tanto, ambos deben definirse según un mismo tipo de representación semántica. Así, al igual que las plantillas léxicas de palabras, las plantillas léxicas afijales incorporan aspectos centrales de la Teoría de Qualia de Pustejovsky.

PALABRAS CLAVE: descomposición léxica semántica, el Modelo Léxico Construccional, Teoría de Qualia, morfología derivacional, composición.

1. INTRODUCTION

The precise nature of the relationship between lexical representations and syntactic structures has provided an impetus for many of the recent studies under-



taken by grammarians. The exploration of this relationship is in fact a by-product of the design of most explanatory grammatical models, irrespective of their position on the formal-functional scale. Furthermore, the rapid increase in alternative views on the locus of the lexicon and the boundaries between lexis and grammar has provoked an even greater interest in lexical representations and their relationship to syntax. In keeping with this interest, the work of Mairal and Ruiz de Mendoza (this volume) and other contributions (Ruiz de Mendoza and Mairal, “Levels,” “High-level”; Mairal and Ruiz de Mendoza, “Internal,” “Levels”; Cortés, *English*, Cortés and Mairal, in preparation) constitute a solid proposal for the representation of meaning within a functional-constructional theory.

Most grammatical models tend to focus their interest in the semantic representation of clauses, leaving aside the question of how to account for the semantic representation of other grammatical structures such as complex and derived words. This paper aims to broaden the scope of the proposal for lexical decomposition as described in Mairal and Ruiz de Mendoza (this volume) by extending it to the realm of word formation. In doing so, not only free lexical units (i.e. words) but bound lexical morphemes are to be endowed with a semantic representation. Section 2 provides some examples of lexical templates for affixal units.

Such a proposal involves the view that the semantic representation of a complex word conjoins two semantic structures, those of the base word and the affix (in the case of derivational processes) or those of the two lexemes that form part of a compound. The mechanisms underlying the integration of both types of structures will resemble the syntagmatic (i.e. generative) processes propounded for phrasal and clausal structures by Pustejovsky (*Generative, Syntagmatic*). Such mechanisms will be addressed in Section 3.

2. THE SEMANTIC REPRESENTATION OF LEXICAL MORPHEMES

We concur with Lieber (2) that in the history of generative grammar (and this term must be understood in a wide sense as a synonym of ‘explicit models of grammar’, including both formalist and functionalist proposals) the semantics of words has been the main focus while little attention has been paid to the lexical semantics of word formation. Though there may have been a plethora of reasons for this—some of which are mentioned in Lieber—, it is important to consider seriously the consequences of such a scarce interest in this aspect of word formation. In our view, the neglect of the semantics of word formation after the structuralist tradition has led to an unsatisfactory set of explanations of the morphological

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processes involved in lexical creation. Contrary to the standard position, we claim that only after the processes of semantic composition underlying the creation of a complex word are accounted for, it will be possible to develop the architecture of a morphological theory.

Although it is undeniable that a word-formation product is the outcome of a number of operations at different levels of grammatical description (the title of Kastovsky's 1977 paper *Word-formation, or: At the crossroads of morphology, syntax, semantics and the lexicon* is specially adequate in this regard), the main leitmotif for lexical derivation and compounding is the creation of a new semantic structure that takes the shape of a lexical unit. Therefore, word formation is in essence a lexicological phenomenon and a proper treatment of word formation must be based on a solid theory of semantic representation.

In the quest for such a theory Lieber (4) establishes certain conditions. First, the framework for lexical semantic representations must be decompositional and the primitives for description must be of the right 'granularity'. Furthermore, they must allow us to concentrate on lexical semantic properties, not only on those manifested in syntactic structures beyond word level. Such a descriptive framework must be cross-categorical and, finally, it must allow us to describe the meanings of complex words in the same terms we describe the meaning of simplex lexemes. Based on these requirements, Lieber assesses different frameworks such as those propounded in the work of Szymanek, Jackendoff, Pustejovsky (*Generative*) and Wierzbicka, each of which lacks some of the conditions mentioned. Thus, Pustejovsky's *Generative Lexicon* is decompositional but no explicit commitment is made as to the nature and number of defining components in the system. Nothing is said about whether these are primitives and whether they form a closed set. On the other hand, Wierzbicka's primitives do not conform to the right 'grain size': her word-sized chunks (Lieber 7) do not seem adequate to account for word-formation semantics. Likewise, Jackendoff's system seems insufficient from a cross-categorical perspective.

This kind of argumentation has led Lieber to develop her own proposal, according to which semantic representations consist of two elements, the Semantic/Grammatical Skeleton and the Semantic/Pragmatic Body, which roughly correspond to the distinction Rappaport and Levin ("Types," "Building") draw between event structure templates and constants (or 'roots' as labelled in Levin and Rappaport). The Skeleton includes those semantic features that are syntactically relevant —typically encoded by means of a formal set of primitives— whereas the Body comprises, much like Pustejovsky's *Qualia Structures*, nondecompositional, encyclopaedic semantic information. The Grammatical Skeleton is described as an extension of Jackendoff's *Lexical Conceptual Structures*. Actually, some new primitives like the binary features [\pm material] and [\pm dynamic] are added to Jackendoff's proposal (Lieber 22-35). These two features enable Lieber to posit a division between two major lexical categories: on the one hand, *substances/things/essences* (roughly equivalent to Nouns, both concrete or [+material] and abstract or [-material]) and on the other hand, *situations* (including Events or [+dynamic] situations, and [-dynamic] situations or States). A third feature is IEPS, i.e. [\pm I(nferable) E(ventual)



P(osition) or S(tate)], which marks the addition of a path component of meaning and allows a threefold distinction within [+dynamic] situations: (a) simple activities (e.g. *eat, kiss, listen*, etc.) which are neutral with regard to [IEPS], (b) unaccusative or inchoative [+dynamic, +IEPS] situations, which have a direct *path* component of meaning (e.g. *descend, grow, forget*, etc.), and (c) [+dynamic, -IEPS] or Manner of Change Situations with a random *path* (e.g. *walk, amble, vary*, etc.).

The most important claim behind this proposal is that this system of features facilitates the semantic representation of derivational affixes. If derivational affixes create lexical units that extend the simplex lexicon, and the elements of this lexicon are grouped into (sub)classes defined by such features as the ones mentioned, they are also to be part of the semantic structure of derivational affixes, and they can be grouped paradigmatically in terms of the semantic subclasses to which the derived formations will belong. Thus, *-er, -ee, -ant/-ent*, and *-ist* form a class of concrete processual nominalizing affixes in English, whose common skeleton is (Lieber 37):

- (1) [+material, dynamic ([], <base>)]

The differences among the affixes within the same paradigm are accounted for by variations in the syntactic subcategorization requirements for their bases and on the semantic specifications on their arguments. Thus, *-ee* is distinguished from the other affixes in requiring its argument to be sentient and weakly volitional (underlined in 2 below) while *-ist* imposes a strong requirement of volitionality on its argument (cf. 5 below). The differences among the above affixes are captured by the following entries (Lieber 62):

- (2) *-ee*
 Syntactic subcategorization: attaches to V, N
 Skeleton: [+material, dynamic ([sentient, nonvolitional], <base>)]
- (3) *-er*
 Syntactic subcategorization: attaches to V, N
 Skeleton: [+material, dynamic ([], <base>)]
- (4) *-ant/-ent*
 Syntactic subcategorization: attaches to V
 Skeleton: [+material, dynamic ([], <base>)]
- (5) *-ist*
 Syntactic subcategorization: attaches to N, A
 Skeleton: [+material, dynamic ([volitional], <base>)]

Both this proposal and the motivations underlying it merit several comments. It has already been mentioned above that we advocate for a lexical semantic treatment of word-formation patterns, and for one that treats affixation and compounding in a parallel with simplex lexemes. In our view, therefore, the lexicon comprises lexical morphemes of two types, free lexical morphemes (i.e. words) and



bound lexical morphemes (i.e. derivational affixes). Both free and bound morphemes will be semantically represented by means of their corresponding lexical template. Both are also grouped into lexical classes defined by their similarity of meaning.

The conception of word-formation morphemes as lexical predicates stems from the proposal put forward originally by Martín Mingorance (Marín Rubiales 62-81), in which the affixal lexicon constitutes the base component for the generation of morphologically complex words. This conception of the lexicon has since then been refined, its latest version being part of the Lexical Constructional Model (LCM) as described in Ruiz de Mendoza and Mairal (“Levels,” “High-level”), Mairal and Ruiz de Mendoza (“Internal,” “Levels,” also this volume), Cortés (English) and Cortés and Mairal (in preparation).

One interesting point of consensus between Lieber’s proposal and Mairal and Ruiz de Mendoza (this volume) is the appeal to a very similar kind of rationale to advocate for a more detailed and robust system of lexical representation. Thus, in overt similarity with Lieber’s Skeleton/Body distinction, the structure of lexical templates, as proposed by Mairal and Ruiz de Mendoza, includes an event structure representation and a fully-fledged description of the semantic parameters that will differentiate one lexical unit from the other members within the same paradigmatic subclass. However, one difference with regard to Lieber’s framework is that lexical templates provide the event structure description in terms of the aspectual distinctions established in Role and Reference Grammar (RRG; Van Valin and LaPolla; Van Valin). Furthermore, a crucial difference comes between the so-called Body in Lieber’s lexical representations and the Semantic Module of the LCM.

One of the main concerns of the LCM has been to devise a system for lexical representation that covers all aspects of meaning construction, which must include not only syntactically relevant information, but also other semantic, pragmatic and discourse features. The development of such a system has gone through several phases, described in Sections 3 and 4 of Mairal and Ruiz de Mendoza’s paper in this volume. The last revised version of this system (Cortés and Mairal, “Constructing”) involves the extension of RRG’s Logical Structures by integrating Pustejovsky’s (*Generative*) Qualia Theory together with the set of Lexical Functions from the Explanatory and Combinatorial Lexicology (Mel’cuk; Mel’cuk, Clas, and Polguère; Mel’cuk and Wanner; Alonso Ramos) and Primitives from Wierzbicka’s Natural Semantic Metalanguage (Goddard and Wierzbicka). We believe that despite their complexity, lexical templates are fully-fledged repositories of the semantic features associated to a lexical unit, either a simplex lexeme or an affix, a view that is still pending in other systems of lexical representation, including Lieber’s. By way of example, we repeat below the representation of the verb *realize* as described in Mairal and Ruiz de Mendoza (this volume):

- (6) **realize:**
 EVENTSTR: **know**' (x, y)
 QUALIASTR: $\left[\begin{array}{l} Q_A: \text{LOCin}(\text{body_part: mind, see}'(x, y)) \\ Q_T: \text{Culm } \mathbf{know}'(x, y \langle \text{ALL} \rangle) \end{array} \right]$



Realize is a verb of cognition that involves reaching knowledge or understanding (as is represented in the Formal quale {Culm **know** (x,y)}). The cognizer gains knowledge by envisaging a mental scenario, something which involves considering its mind as a location (Mairal and Faber). Therefore, the Agentive quale encodes such an event and the mind is conceptualized as an abstract body-part, which means it is in a partitive, metonymic relation to *body*.

The above excursus on LCM's lexical representations allows us to demonstrate that this model is not only one of the most solid frameworks in providing a thorough explanation of the semantics of simplex lexemes, but also that it is an even more adequate proposal than Lieber's to account for the meaning of word-formation processes and derivational affixes. Let us consider how the semantic content of the nominalizing affixes *-er*, *-ee*, *-ant/-ent*, and *-ist* is represented in our proposal (Cortés "Derivational"):

$$(7) \quad \phi_{N}^i: [LT (...x^i..., [\phi_{BASE}: \text{Lexical Template}])], x = \text{Macrorole}$$

The structure in (7) represents the 'event structure' of the derivational class of concrete nominalizing affixes, or concrete processual *substances/things/essences* in Lieber's (36) terminology. We propose to label this derivational class as 'Macrorole Nominalizations' since they encompass both Actor and Undergoer Nominalizations. Actor nominalizations include derived instruments, agents, experiencers, locations, etc. and Undergoer formations are prototypically formed by means of *-ee*. The two corresponding templates are:

$$(8) \quad \phi_{N}^i: [LT (x^i..., [\phi_{BASE}: \text{Lexical Template}])], x = \text{Actor}$$

$$(9) \quad \phi_{N}^i: [LT (...x^i, [\phi_{BASE}: \text{Lexical Template}])], x = \text{Undergoer}$$

The label "Actor nominalizations" explains the wide scope of this type of derivational processes. As explained in Cortés and Pérez, the semantics of the template cannot be associated to a specific semantic function such as 'agent'. Even though the most prototypical formations correspond to agent nominals, like *writer*, *runner*, *violinist*, etc, there are many other formations where the notion of 'agenthood' is absent (cf. formations like *believer*, *owner*, *lover*, to mention just a few). The term Actor indicates that all the formations are nominalizations of the macrorole Actor, as defined within RRG¹. This, in turn, justifies the superscript *i* which co-indexes the lexical variable for the derived word (ϕ_N) with the participant that would receive that macrorole function. That is, they mark the nominals as oriented towards one entity (x^i) involved in the state

¹ "Macroroles are generalizations across the argument-types found with particular verbs which have significant grammatical consequences; it is they, rather than specific arguments in logical structure, that grammatical rules refer primarily" (VAN VALIN and LAPOLLA 139). RRG distinguishes two macroroles: the Actor or generalized agent-type role, and the Undergoer or generalized patient-type role. It is important to emphasize that the term Actor is compatible with non-volitional entities such as in *The key opened the door* where *key* is the actor (VAN VALIN and LAPOLLA 141).



of affairs depicted by the base word. Let us recall that the variable ‘LT’ expresses the fact that the event where this entity participates can be of any kind, a state (**pred**), an activity (**do**), or any other logical structure, and, consequently, the semantic function of the nominalized entity is not restricted to Agent. Actually it may take a wide range of values. The following representation is to be understood as a subspecification of the Actor Template, and corresponds to the traditionally labeled Agent nominals, which in RRG terms should be described as effector nominalizations:

$$(10) \phi_{N}^i: [\mathbf{do}'(x^i, [\phi_{\text{BASE}}])] , x = \text{Actor. E.g. } \textit{driver}, \textit{runner}, \textit{smoker}.$$

As mentioned before, this structure expresses the semantic content of the most prototypical nominalizations within the class: the derived words corresponding to this construction describe the Effector involved in the event expressed by the semantics of the base word. Now, there are two co-indexing possibilities expressed in the above representation depending on whether the formation is deverbal (ϕ_V) or not ($\phi_{[V]}$). In the case of deverbal effector nouns co-indexation is usually quite straightforward: the verbal bases typically encode an event that is dynamic, and therefore the meaning of effectorhood derives from the semantic function of its first argument. This is the case of *hunter*²:

$$(11)$$

$$\begin{array}{c} [X\text{-er}]_N: [(x^i, [hunt_V])] , x = \text{Actor} \\ | \\ hunt_V: \text{EVENTSTR}: [\mathbf{do}'(x, e_1)] \\ | \\ \text{OUTPUT} \rightarrow hunter_N^i: \text{ARGSTR}: x: \mathbf{animate} \\ \text{QUALIASTR}: \{\dots Q_A: e_1 [\mathbf{do}'(x^i, [hunt^i(x,y)])]\} \end{array}$$

The semantic structure of the nominal *believer* in (12) illustrates the fact that this type of derived Actor nominals do not exclusively refer to agent arguments. Let us recall that the Actor macrorole is assigned to the rightmost argument in a Logical Structure with two arguments, irrespective of the type of event encoded (Van Valin 60-67). Thus:

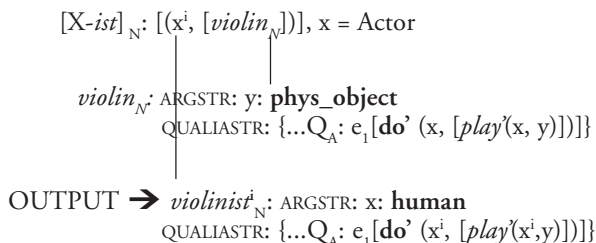
$$(12)$$

$$\begin{array}{c} [X\text{-er}]_N: [(x^i, [(believe_V)])] , x = \text{Actor} \\ | \\ believe_V: \text{EVENTSTR}: e_1 [\mathbf{pred}'(x,y)] \\ | \\ \text{OUTPUT} \rightarrow believer_N^i: \text{ARGSTR}: x: \mathbf{human} \\ \text{QUALIASTR}: \{\dots Q_A: e_1 [believe^i(x^i,y)]\} \end{array}$$

² In order to simplify the description, we only provide a partial description of the qualia structure of the bases. As can be seen, the information in the quale is often redundant as

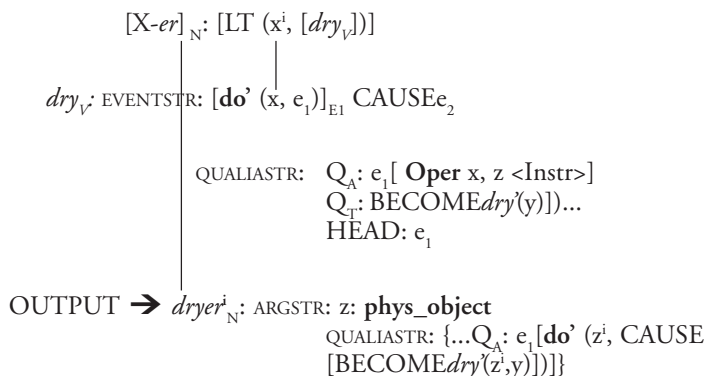
The semantic interpretation of denominal Actor lexemes likewise arises from co-indexation with one argument in one of the events depicted in the qualia structure of the base noun, as is the case of *violinist*, where semantic composition is based on the event encoded as the Agent quale of *violin*:

(13)



One interesting effect of co-indexation within this class concerns the derivation of instrument nominals. Consider the representation given in (14). Semantic composition is sensitive to the Telic quale of the base Q_T : $BECOME_{dry}(y)$ (i.e. drying involves an object (y) becoming dry). But there is one additional restriction: the event in the Agentive quale (**Oper** $x, z <Instr>$) is foregrounded, thus ‘shadowing’ the event associated to the first argument in the semantic structure of the base (i.e. e_1 in $EVENTSTR: [\text{do}'(x, e_1)]_{E1}$: what effector x does). In these cases, foregrounding also motivates that the semantically empty Lexical Function **Oper** inherits the semantic specification from the event structure, whereby ‘ x operates on instrument z ’. **Oper** describes a manipulation event whose exact nature will be determined by the type of object involved.³ This explains the variation in terms of co-indexation between instruments (as happens in the case of *dryer*) and other actor nominals:

(14)

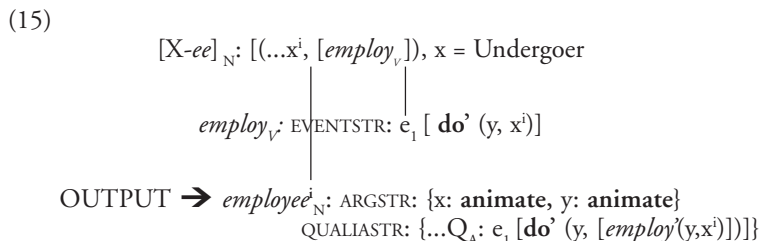


it tends to identify itself with the eventive description of logical structures, unless some specification is added.

³ As described in Alonso RAMOS and MAIRAL and RUIZ DE MENDOZA (this volume), if a stone is used to break a glass, then **Oper** will stand for, say, *throw*. If (z) is to be a hammer, the value of **Oper** is most probably *hit*.



Complex nominals with *-ee* are the most conspicuous examples of Undergoer formations. As mentioned before, Lieber (62) and Booij and Lieber isolate the semantics of this suffix within the general group of concrete processual formations by specifying two subcategorization restrictions on its co-indexed argument: a strong condition of sentience and a weaker condition of nonvolitionality. Stating such conditions is not necessary in our proposal insofar as the lexical template for these formations already restricts co-indexation to the Undergoer macrorole.⁴ Hence, the semantic compositional structure of a noun like *employee* would be as follows:



The only difference between this complex noun and the parallel Actor nominal *employer* lies in the co-indexation. The conventions for macrorole assignment as described in RRG (Van Valin 61) are captured in the following hierarchy:

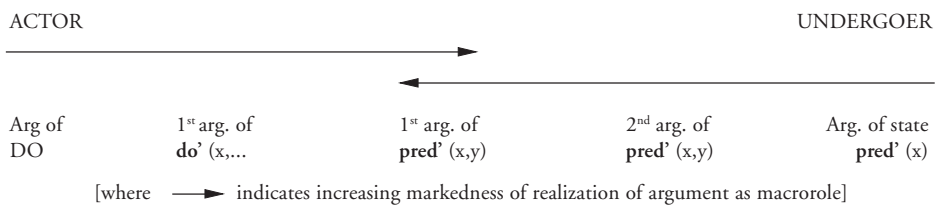


Figure 1: Actor-Undergoer Hierarchy

The Actor-Undergoer Hierarchy states that, given the Logical Structure of a predicate with two arguments, the leftmost one will be the Actor and that the rightmost argument will be the Undergoer. This is reflected by co-indexation with the (x) argument in (11) to (15).

Even an apparently much more debated case like *escapee* is accounted for in the model without having to appeal to special semantic conditions or interpretations of the kind proposed by Barker (719), which involve a violation of some of

⁴ It is worth mentioning that Undergoers are described as the 'logical objects' in semantic structures and, therefore, it is not uncommon that they refer to nonvolitional and sentient entities. In fact, these are some of the contributing properties motivating many of Dowty's Proto-patients, which are also generalized semantic roles like RRG's macrofunctions.



the subcategorization conditions imposed by the affix as described by Lieber: the base verb *escape* involves two arguments, one volitional and the other nonsentient, neither of them being consistent with *-ee*'s requirements. This leads Lieber to necessarily accept a violation of the Principle of Co-indexation as well as Barker's particular explanation of the formation: *escapee* will be referred to the first argument of the base verb (i.e. the effector of *escape*) because, even though it is in control of initiating the action, the consequences of the event are beyond its control.

A more plausible explanation stems from a proper understanding of the semantics of the base verb, which provides far richer information than its argument structure. *Escape* involves a complex scenario composed of two subevents linked causally. Its (skeletal) logical structure representation is the following:

- (16) [**do'** (x, Ø)] CAUSE [BECOME NOT **be-in'** (y, x)]
 e.g. *A scam artist escaped from jail*

This structure involves one entity (e.g. *a scam artist*) carrying out some unspecified activity which is the cause of its not being anymore in a certain location (e.g. *jail*). Note that the same argument (*a scam artist*) appears twice, first as effector argument and, second, as a theme participant in the caused locational relation, which makes it indistinctively a good candidate for Actor or Undergoer status. However, a more detailed description of the semantic structure of the base verb (in line with Mairal and Ruiz de Mendoza's proposal in this volume) leads us to specify the qualia structure characterization and the relation between the subevents in the event structure of *escape*, which provides a detailed explanation of how such an argument is to be considered an Undergoer rather than an Actor and, consequently, a good candidate for co-indexation with the suffix *-ee*.

- (17) *escape*_v
- | | |
|------------|--|
| EVENTSTR = | $\begin{array}{l} E_1 = e_1: \text{activity} \\ E_2 = e_2: \text{state} \\ \text{RESTR} = < \alpha \\ \text{HEAD} = e_2 \end{array}$ |
| ARGSTR = | $\left[\begin{array}{l} \text{[ARG1 =} \\ \text{[ARG2 =} \end{array} \right. \begin{array}{l} \mathbf{x: animate_ind} \\ \text{FORMAL = phys_obj]} \\ \mathbf{y: artifact : building} \\ \text{CONST = z} \\ \text{FORMAL =phys_obj]} \end{array} \right]$ |
| QUALIASTR: | $\left[\begin{array}{l} \dots Q_A: e_1 [\mathbf{do'} (x, \emptyset)] \\ Q_T: e_2: [\mathbf{BECOME NOT be-in'} (y, x)] \dots \end{array} \right]$ |

Two interesting features emerge from this representation: the causing and the caused subevents in the logical structure representation of the verb correspond with the agentive and the Telic qualia characterization respectively. As Pustejovsky (*Generative*, 101-104) points out, when event structures are complex, individual qualia compete



for projection by virtue of mechanisms such as ‘foregrounding’ or ‘focalising’ of a single quale of the verbal semantic representation. These mechanisms account for diathesis phenomena such as the causative/inchoative alternation in different types of verbs, as is the case of pure change of state verbs like *break* (Cortés “Inchoative”).

We have already seen in some previous cases how co-indexation is also sensitive to qualia structure. With regard to *escapee*, co-indexation is applied once the caused subevent has been ‘headed’ or ‘foregrounded’. In other words, qualia also compete for projection in morphologically complex structures and, in this case, the telic quale [Q_T : e_2 : [BECOME NOT be-*in*’ (y, x)]] is the one affected by this mechanism. Thus, Macrorole assignment (i.e. co-indexation in a morphological process) is unambiguous: locational structures of the kind depicted in the Telic quale for *escape* are macrorole intransitive by definition, and since this kind of structures do not include an activity operator *do*’ the only macrorole that can be assigned to the structure is that of Undergoer, which by default will be the theme argument (Van Valin 63).

This explanation has some important advantages: headedness and co-indexation reflect the prominence of the features referring to ‘affectedness’, associated to the theme semantic function of the (x) argument in the structure of *escape*. Such a prominence leaves in the background the other more ‘agentive’ semantic functions of the same argument which are associated to its being also a causing entity. Another interesting factor revealed by this explanation is the complex interaction that exists between the semantic structures of the primary lexicon and those of the affixal lexicon in the processes of semantic composition that motivate a complex word.

In our proposal, the semantics of the affix *-ee* does not need to establish special restrictions on any argument. Following the format proposed in some previous works (Cortés and Pérez; Sosa, *Análisis*, “Locative”), the lexical entry for this affix is:

$$(18) \phi_N^i: [(\dots x^i, [\phi_{\text{VERBBASE}} [\text{LEXICAL TEMPLATE } (\dots x^i)])]), x = \text{Undergoer}$$

The formula in (18) expresses the fact that all *-ee* formations are nominals whose denotation is an Undergoer argument from one of the events captured in the Lexical Template of the base verb. The superscript *i* explicitly signals that such an argument is co-indexed with the derived word itself. The representation of the semantic composition of the noun *escapee* is therefore expressed as follows:

$$(19) [X-ee]_N: [(\dots x^i \dots, [escape_v]), x = \text{Undergoer}$$

$$\begin{array}{c} | \\ \text{escape}_v \\ \text{EVENTSTR} = \end{array} \left[\begin{array}{l} E_1 = e_1: \text{activity} \\ E_2 = e_2: \text{state} \\ \text{RESTR} = <_{\alpha} \\ \text{HEAD} = e_2 \end{array} \right]$$

$$\left[\begin{array}{l} \text{QUALIASTR} = \dots Q_T: e_2: \\ \text{[BECOME NOT} \\ \text{be-}i\text{in}' (y, x^i)] \dots \end{array} \right]$$

3. MEANING CONSTRUCTION IN WORD FORMATION

The discussion addressed in the previous section presupposes the existence of certain generative mechanisms for meaning construction in word-formation processes. Such semantic mechanisms include at least co-indexation (especially in the case of derivational processes, but also in compounding) and qualia specification and co-composition (in compounding).

Let us consider firstly how qualia specification can account for the different types of semantic relations that hold between the members of a compound. As Johnston and Busa specify, semantic composition in Noun+Noun compounding involves a modification of a head noun by another modifying noun. The different possibilities of semantic interpretation in a compound are determined by the qualia structures of the nouns involved in the process: co-indexation will affect an argument of one of the events encoded in some of the qualia of the head noun. In other words, the semantics of the modifying noun is a specification or ‘subtyping’ of one quale in the head noun. In order to illustrate this we will repeat Johnston and Busa’s description of some specific cases.

One of their examples (Johnston and Busa 80) is the formation *bread knife* in which the modifying noun relates to the purpose entailed by the head noun. This means that co-indexation will take place in the Telic quale of *knife* which encodes the inherent purpose of this kind of instrument, i.e. cutting, by means of a predicate [**do**’ (x, [*cut*’ (x,y))]]. In (20) below we present the (simplified) semantic structure of *bread knife*:

$$(20) \text{ bread}^i \text{ knife}_N$$

$$\text{TYPESTR} = (x: \text{artifact-tool})$$

$$\dots$$

$$\text{QUALIA} = \left[\begin{array}{l} Q_f: (x) \\ Q_c: \text{blade, handle, ...} \\ Q_r: e_2 [[\text{do}' (x, [\text{cut}' (x, y)])]] \\ Q_x: e_1 [\text{Oper} (z, x)] \end{array} \right]$$

Co-indexation expresses the function of the modifier noun *bread*, which is to be the affected argument in the telic event, i.e. in the action of cutting.

Compare this with the structure of another root compound, *lemon juice* (Johnston and Busa 82):

$$(21) \text{ lemon}^i \text{ juice}_N$$

$$\text{TYPESTR} = (x: \text{liquid})$$

$$\dots$$

$$\text{QUALIA} = \left[\begin{array}{l} Q_f: (x) \\ \dots \\ Q_x: e_1 [[\text{do}' (y, [\text{squeeze_act} (y, x^i)])]] \end{array} \right]$$

The semantic interpretation in (21) is based on co-indexation with one argument of the Agentive quale: the modifier noun (*lemon*) has a subtyping func-

tion of the second argument in the predicate [*squeeze_act* (y, x¹)] which describes the origin or bringing about of the entity represented by the head *juice* (Pustejovsky, *Generative* 106-122). In other formations like *cardboard box* or *silver ring* the modifier specifies a subpart of the head or the material of which it is composed. That is, co-indexation will take place between the modifier and one argument of the Constitutive quale.

The analyses of *bread knife* and *lemon juice* also show that the incorporation of qualia theory as part of the lexical templates permits to restrict the interpretation of compounds to a great extent. Lieber (53) remarks that little can be predicted of the final meaning of a compound except its referential properties and the semantic property of headedness of one of its components. The rest is 'free', i.e. in her view, the final determinants for lexicalization are context and encyclopaedic knowledge. We believe that, even though she is partially right, qualia specification in compounding (the potential 'modes of predication' of a lexical unit) restrict heavily the lexicalization possibilities of a newly coined form. It seems that, in Lieber's model, the boundaries for interpretation are limited by the Skeleton (i.e. Pustejovsky's event structure). Qualia structure, however, captures (among other features) the components of Lieber's 'Body' and, therefore, semantic interpretation is more constrained in our proposal.

Bahuvrihi compounds of the type *pickpocket*, *redskin* or *paleface* are semantically composed by the same generative mechanisms as root compounds. In *paleface* the modifying noun is co-indexed with the Constitutive quale of *face*, also realizing a subtyping function. Therefore, the internal semantic configuration of *bahuvrihi* compounds and root compounds is essentially the same. The only difference stems from the final denotational value of the *bahuvrihi* as a whole: it involves a kind of metonymic reconstruction through type coercion (as described in Pustejovsky *Generative*, Ch. 7 and *Syntagmatic*) and this usually affects the Constitutive quale of the head noun, since it expresses the component parts of the referent of the noun⁵.

A bit more complex is the process of semantic composition of cases in which a modifying noun denotes an event, as in *destruction weapons* or *hunting rifle*. Johnston and Busa (83-85) explain that these cases involve a generative mechanism of co-composition of the qualia structures of the head and the modifier nouns (Pustejovsky 122-127). In *hunting rifle*, co-composition produces a complex Telic quale with 'sub-qualia'. The Telic quale of the head noun *rifle* which is [*do'* (x, [*shoot'* (y, z)])] will be integrated as an agent 'subquale' within the Telic quale of the compound. The modifier *hunting* provides a telic 'subquale' (the event denoted by the predicate *hunt*) within the Telic quale. The overall structure of the compound is represented in (22):

⁵ For a very similar description of the internal semantic constituency of exocentric compounds and the metonymic motivation for its semantic interpretation see BOOIJ.



(22) *hunting rifle*_N
 TYPESTR = (x: **weapon**)

$$\left[\begin{array}{l} \text{QUALIA} = Q_f: (x) \\ \dots \\ Q_f: \left[\begin{array}{l} \text{SUBQ}_t e_2 [[\text{do}'(x, [\text{hunt}'(y, z)])]] \\ \text{SUBQ}_A e_1 [[\text{do}'(x, [\text{shoot}'(y, x')]]] \end{array} \right] \\ \dots \end{array} \right]$$

The different types of complex words that have been analyzed show one fundamental feature of all word-formation processes: co-indexation must always occur between the head word and some element in the overall semantic interpretation of the complex lexeme. In the case of the affixal nominals described in Section 2, co-indexation is one of the features of the lexical template corresponding to the affixes. This also holds in the case of derived verbs in, for instance, causative affixal formations. The general lexical template for this derivational class is expressed in (23) (Cortés, “Derivational”):

(23) $\phi_v: \text{do}'(x, \emptyset)$ CAUSE [Lexical Template (... ϕ_{BASE} [Lexical Template]...)]

The formula in (23) encodes a complex semantic structure in which there is causal bond between two subevents, the induced one corresponding to a state of affair in which the base word (ϕ_{BASE}) is involved or affected more or less directly. That is, as a subclass of verbalizations, the function of causative affixes is to build up a predicational structure around the lexical template of a potential argument. A verb like *enthroned* (e.g. *The Virgin enthroned with Child and Saints*) is the output of a causative locative template in which the base noun *throne* is enmeshed in a semantic scenario as a locus for the placement of some other entity (e.g. *The Virgin*). Thus, the derived formation takes the base noun as a pillar around which to build up an event. The locative meaning is determined by the semantic characterization of the noun and it is co-indexation with one argument in the event encoded in one of the base word’s qualia characterization that would impose a definite interpretation of the template. Depending on this factor, the canonical template will yield different causative interpretations, among which are the following:

(24) Causative Locative (‘to cause (N) to be at/in/on...(N)’): [$\phi_v: \text{do}'(x, \emptyset)$ CAUSE [BE-LOC (y, z)]] E.g. *encage*, *enthroned*, *perfume*, *jail*, *land*, *gasify*.⁶

⁶ KASTOVSKY (“Derivation,” 99-100) proposes a similar explanation for the derivation of the different types of causative derived verbs in English. The main difference in his proposal lies in the structure of the second subevent which he describes in all cases as a location ([[AGENT]] CAUSE THEME (T) BECOME [NOT] BE IN LOCATION (L)) and in the fact that he considers all other possible meanings (State and Status, as he labels them) as metaphorical extensions of the original since, in his view, it does not seem unlikely that the causative locative semantic structure has “a



- (25) Causative mutative ('to cause to become ADJ'): $\phi_V: \mathbf{do}'(x, \emptyset)$ CAUSE [BECOME **pred'**(y)] E.g. *solidify, purify, narrow, smooth, legalize*.
- (26) Causative adscriptive ('to cause to become/be (like) N') $\phi_V: \mathbf{do}'(x, \emptyset)$ CAUSE [BECOME/BE (**like'**)(y, z)] E.g. *arch, heap*.⁷

In relation to (24), a vast group of denominal formations share a causative-locative interpretation motivated by the semantic characterization of the bases. Their qualia characterization provides the contextual feature that triggers this reading: these nouns typically have the function of containers, involving a locative relation with respect to another entity, as expressed in the Formal quale for *encage*. On some occasions, the base noun is the locandum/theme argument as indicated, for instance, by the Telic quale in the case of *varnish*.⁸ The corresponding semantic structures to both types are given in (27) and (28) respectively⁹.

- (27) *encage*_V
 $[\mathbf{en-}\phi_N^i]_V: \mathbf{do}'(z, \emptyset)$ CAUSE [$e_2 =$ [BECOMEbe-in'(cageⁱ_N, y)]]
 |
 TYPESTR = (x: **artifact-lcp**)
 QUALIASTR= ... $\left[\begin{array}{l} Q_e: \mathbf{container}'(x^i, y) \\ Q_A: e_1[\mathbf{do}'(z, \emptyset)] \\ Q_T: e_2: [\mathbf{BECOMEbe-in}'(x^i, y)] \\ \dots \end{array} \right]$
- (28) *varnish*_V
 $[\phi_N^i]_V: \mathbf{do}'(z, \emptyset)$ CAUSE [$e_2 =$ [BECOME be-on'(x, varnishⁱ_N)]]
 |
 TYPESTR = (x: **liquid**)
 QUALIASTR= $\left[\begin{array}{l} \dots Q_A: e_1[\mathbf{do}'(z, \emptyset)] \\ Q_T: e_2: [\mathbf{BECOME be-on}'(x, y^i)] \end{array} \right]$

universal cognitive foundation [...] reflecting the basic human activity of moving objects around in space" KASTOVSKY ("Derivation" 99-100). Given that no proof is provided of the centrality of the locative interpretation, we prefer to maintain an open variable 'Lexical Template' in the basic lexical template and to treat locative structures, as well as any other specific values of the complex lexemes, as the effect of co-indexation.

⁷ See Wunderlich for a very similar semantic representation of denominal causatives with the notational conventions of Lexical Decompositional Grammar.

⁸ Note that this is also effective in the class of locative prefixations, and marks the difference between locative formations like 'forefather' or 'forerunner' where the base noun encodes a theme entity that is located with regard to some unexpressed location (in time or space), whereas in formations like 'forenoon' the base encodes the location around which a locandum is constructed morphologically. For a detailed analysis of locative prefixation see SOSA (*Análisis*, "Locative").

⁹ For a detailed description of the semantics of (25) and (26) see CORTÉS ("Derivational").

4. CONCLUSION

The motivation for this paper has stemmed from two different proposals: on the one hand, the insights by Lieber with regard to the centrality of a solid theory of lexical representation for a proper understanding of the semantic composition processes that underlie all word-formation phenomena; on the other hand, the interest in extending the proposal by Mairal and Ruiz de Mendoza ("Internal," "Levels," and also this volume) on the macro- and microstructure of the lexicon, i.e. lexical organization and representation. With regard to this second aspect, Mairal and Ruiz de Mendoza provide a comprehensive system of lexical decomposition by drawing on contributions from different sources, which yields a very rich lexical structure, namely their lexical templates.

Our purpose has also been twofold: (i) to show that lexical templates are an even more solid methodological proposal of lexical representation than Lieber's, especially because it integrates Pustejovsky's (*Generative*) qualia theory. Qualia structure and the generative mechanisms associated to them have paved the way to find explanations for several of the more vexing problems of lexical morphology; (ii) to extend the proposal of lexical organization by Mairal and Ruiz de Mendoza to the word-internal domain, which is also an essential part of core grammar. These aims have led us to offer the analysis of the semantic make-up of different types of word-formation processes, but still there is dire need for more detailed and intensive studies on several derivational and compounding patterns.

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