

# Semantic Incorporation in a Portuguese WordNet of Verbs of Movement: on Aktionsart shifting<sup>♦</sup>

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## Abstract

The decompositional analysis of Portuguese verbs of movement provides evidence for the relation between semantic incorporation, event structure and syntactic properties of the verbs. This paper identifies a set of semantic elements whose incorporation explains conceptual differences as well as regular Aktionsart shifting within a relational net of verbs. The semantic representation within the GL framework is drawn assuming lexical inheritance and the recursive use of available lexical semantic structures.

## 1 Introduction

This paper concerns semantic incorporation phenomena in verbs of movement. In particular, we observe Portuguese verbs of movement organized in a WordNet (see Marrafa 2002), in order to capture patterns that allow to describe semantic and syntactic properties for meaning computation purposes.

Specifically, we focus on semantic incorporation, its relevance for the specification of the troponymy<sup>1</sup> relation and its relation to verbal Aktionsarten.

Based on the Portuguese data, we propose some alternative perspectives on the incorporation phenomena, as well as on the definition of the semantic elements that showed relevance.

Section 2 addresses semantic incorporation in Portuguese verbs of movement, the semantic elements considered and the degrees of incorporation observed. Section 3 concerns semantic incorporation and Aktionsart shifting phenomena. Section 4 presents our proposal for the semantic representation of these verbs, accounting

for the incorporation and Aktionsart shifting phenomena. Section 5 presents our final remarks.

## 2 Semantic Incorporation in Portuguese Verbs of Movement

Talmy's (1985) approach concerns motion events that describe a situation in which an object (FIGURE) moves or is located with regard to a reference object (GROUND) following a trajectory (PATH). Typically, the reference objects are part of the trajectory, corresponding for instance to the source, the goal or a given milestone of the PATH. These constituents may be expressed by the verb or by *satellites* (cf. Talmy 1985: 102), i.e. categories related peripherally to the verb and forming with it a 'verb complex'. Also, the motion events can include in their structure other supporting sub-events – external to the motion event – reflecting the MANNER or the CAUSE of the movement.

According to Talmy's typology, Romance languages are classified as PATH-type languages since only PATH+MOTION are characteristically represented in the verb root, and not MANNER+MOTION or FIGURE+MOTION (Talmy (1985:75)). Therefore, Portuguese is a PATH-type language and it is predicted that other incorporation patterns are not of significance. However, the observation of data shows that all the conflation patterns described in Talmy (1985) exist in Portuguese:

- (1) a. MOTION+MANNER: *empurrar* (push) = move **through impulsion**.
- b. MOTION+PATH: *subir* (move up) = move **up**.
- c. MOTION+FIGURE: *galopar* (galop) = run, **equines**.
- d. MOTION+GROUND: *nadar* (swim) = move, **in a liquid environment**, through coordinated body movements.

Moreover, in the total set of verbs analysed (218 hyponyms: 125 of change of location and 93 of change of position, so far) the semantic element

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<sup>1</sup> Troponymy is the hypernymy/hyponymy relation that organizes the verbal lexicon, as defined in Fellbaum (1990, 1998).

which is more frequently incorporated is MANNER, in a total of 105 occurrences.

This shows that Talmy's pattern approach does not suffice to account for the existent meaning specifications and suggests that a redefinition of the set of relevant semantic elements is in order.

## 2.1. Semantic Elements

We propose a new set of semantic elements, defined as the meaning elements that correspond to the part of a verb meaning that allow us to differentiate it from its co-troponyms and, mainly, from its hypernym.

In this way, we use Talmy's notion of incorporation – “representation of meaning in surface forms” (Talmy (1985:60)), to describe the meaning specificities that distance hyponyms from troponyms in a relational net.

The incorporated elements are analysed in each level of a Portuguese WordNet hierarchy:

- (2) a. MANNER: how the event develops.  
Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  how?  
Ex.: *rastejar* (to crawl) is *mover-se* (to move) how? With the body close to the ground.
- b. INTENTION: purpose/ intended goal of the event.  
Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  for what / with what intention?  
Ex.: *passar* (to promenade) is *mover-se* (to move) for what / with what intention? For pleasure or recreation.
- c. FIGURE: object that undergoes the event.  
Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  who/what? /  $V_{\text{troponym}}$  is to who/what  $V_{\text{hypernym}}$ ?  
Ex.: *transportar* (to transport dead bodies to a new burial place) is *transportar* (to transport) what? Dead bodies.
- d. GROUND: object with respect to which the FIGURE undergoes the event.  
Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  with respect to what?  
Ex.: *adiantar-se* (to move ahead of) is *avançar* (to move forward) with respect to what? With respect to something in motion.
- e. CAUSE: what brings about the event.  
Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  because / due to what?  
Ex.: *tremeter* (to tremble because of the cold) is *tremeter* (tremble) because / due to what? Due to the cold.

f. SOURCE: FIGURE initial location.

Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  from where?

Ex.: *remover* (to take from place) is *tirar* (to take) from where? From the usual place.

g. GOAL: FIGURE final location.

Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  to where?

Ex.: *encaixotar* (to box) is *meter* (to put in) where? In a box.

h. PATH: medium location(s) between the SOURCE and the GOAL.

Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  through where?

Ex.: *retroceder* (to backtrack) is *recuar* (to move back) through where? Through the same path.

i. DIRECTION: way in which the motion event occurs.

Test: to  $V_{\text{troponym}}$  is to  $V_{\text{hypernym}}$  in which direction?

Ex.: *subir* (to move up) is *mover-se* (to move) in which direction? Up.

This enlarged set of semantic elements results from the observation of Portuguese verbs of movement. However, the first five elements listed in (2a) – (2e) appear in verbs of other semantic fields (see (3)), thus motivating the reformulation of the original definitions of FIGURE and GROUND elements making no specific reference to motion events.

- (3) a. +MANNER: *gritar* (to shout) is to speak **loudly**.
- b. +INTENTION: *brindar* (to toast) is to drink **in order to salute someone**.
- c. +FIGURE: *beber* (to drink) is to drink **alcoholic drinks**.
- d. +GROUND: *aumentar* (to increase) is to make bigger **with respect to a previous dimension**.
- e. +CAUSE: *bronzear-se* (to tan) is to become tanned **due to ultraviolet rays exposure**.

The introduction of the element INTENTION in this set follows the proposed in Fellbaum (1998) and Barreto (2002), and can be related to the Pustejovsky (1995) *Telic* role concept.

The CAUSE element considered here is not the exact one proposed by Talmy, namely in what concerns the causative meaning types considered by the author (Talmy 1985:79). We consider that there is CAUSE incorporation only in the cases in which the meaning difference of the hyponym refers to what brings about the event. Although not treated in this paper, we also consider the

predicates classification of internal or external causation (Levin & Rappaport Hovav 1995:91) since it provides grounds to account for the relation between transitive and intransitive predicates, as well as for alternation constructions.

The PATH element is originally defined as the element responsible for conveying information about the trajectory described by the element FIGURE. However, several authors<sup>2</sup> adopt more specific concepts included in Talmy's notion of PATH, such as SOURCE, PATH (i.e. set of locations between SOURCE and GOAL), DIRECTION and GOAL. These distinctions are shown to be relevant for the analysis of verbs like *subir* ('move up') and *retroceder* ('move back through the same path') that exemplify the incorporation of the elements DIRECTION and PATH. Our data reveals that, in the subset of verbs of change of location (125 hyponyms), MOTION+DIRECTION incorporation occurs 30 times (*afastar* (move away), *avançar* (move forward), *trazer* (move in our direction), *descer* (move down), *entrar* (move inside), etc.), whereas MOTION+GOAL occurs 11 (*pôr* (move to a given final location), *carregar* (put in a transport vehicle), *encaixotar* (put inside a box), *enterrar* (put under ground), *mergulhar* (put under water)), MOTION+PATH 10 (*enfiar* (put through a narrow opening), *retroceder* (move back through the same path), *circular* (move a given circuit), *circundar* (move through the space around something), *circum-navegar* (sail around a continent), etc.), and MOTION+SOURCE 6 (*tirar* (move from a given location), *remover* (move from the usual location), *desencaixotar* (take from a box), *ir-se embora* (go from a given location), *fugir* (go from an imprisonment place)).

Also, SOURCE and GOAL elements, in Portuguese as in English, can be expressed by prepositional phrases, presenting evidence that Talmy's notion of PATH is, perhaps, too generic.

<sup>2</sup> Namely, Gutierrez (2001) argues that the GROUND objects may refer to some subpart, as the origin or the endpoint, of the PATH; Clark & Carpenter (1994) examines the notion of *source* in language acquisition, distinguishing *source*, from *direction*, or *goal*; Asher & Sablayrolles (1996) proposes a typology for motion verbs and spatial PPs in French, establishing several types of spatial relations according to the senses of the movement; Teixeira (2001) works on the verbalization of space, or Levin (1993), that proposes verb classes considering the semantic notions of direction (verbs of putting with a specified direction, verbs of inherently directed motion) and spatial configuration (verbs of putting in a spatial configuration, verbs of spatial configuration), among others.

(4) O João subiu do primeiro andar  
 'The John went up from the first floor  
 +DIRECTION SOURCE

para o sótão pelas escadas.  
to the attic through the stairs.  
 GOAL PATH

The GROUND element here considered is not completely coincident with the one presented in Talmy (1985). The author describes the verb *box* as incorporating GROUND, not GOAL, as it is in the present work. Our view is that it is more intuitive to consider that 'the box' is the final location of the FIGURE, than the object with respect to which the FIGURE is moved (cf. (2d) and (2f)).

For purposes of perspicuity, the examples above present the incorporation of only one semantic element, but the incorporation of more than one element is possible and frequent.

- (5) a. +GROUND+MANNER: *voar* (to fly) = move in the air through wings or artificial means of propulsion.  
 b. +MANNER+GOAL: *regressar* (to return) = move again to the start point.  
 c. +FIGURE+MANNER: *bombear* (to pump) = take liquids with a pump.  
 d. +FIGURE+MANNER+PATH: *orbital* (to orbit) = move, celestial bodies, cyclically, around another celestial body.

## 2.2. Degrees of incorporation

The analysis of semantic incorporation is related, first of all, with the specification of the troponymy relation, i.e., the identification of what is specific to the troponym regarding the hypernym meaning. This meaning specification can have more or less visible consequences. The lexicalization of the semantic elements may range from incorporation of event modifying elements, typically paraphrased by adverbial or prepositional phrases, to argument incorporation, affecting in different degrees the predicate syntactic expression.

The fragment of the constructed WordNet in (6) illustrates this phenomenon. Note that the semantic description here proposed presupposes an inheritance device that assures that the elements incorporated by the hypernym, as part of its meaning, are inherited by the troponym and need not to be stated.

- (6)
- |                            |   |   |
|----------------------------|---|---|
| { <i>mover, deslocar</i> } | [change location]                         | V(NP <sub>AG/CAUSE</sub> , NP <sub>THEME</sub> )                          |
|                            | +GOAL                                     |   |
| { <i>pôr, colocar</i> }    | [ <i>mover</i> to a given final location] | V(NP <sub>AG/CAUSE</sub> , NP <sub>THEME</sub> , PP[em] <sub>GOAL</sub> ) |
|                            | +DIRECTION                                |   |
| { <i>meter</i> }           | [ <i>pôr</i> inside of]                   | V(NP <sub>AG/CAUSE</sub> , NP <sub>THEME</sub> , PP[em] <sub>GOAL</sub> ) |
|                            | +GOAL                                     |   |
| { <i>enjaular</i> }        | [ <i>meter</i> in a cage]                 | V(NP <sub>AG/CAUSE</sub> , NP <sub>THEME</sub> )                          |

The incorporation of GOAL in the synset {*pôr, colocar*} is reflected in an increase of the list of arguments required by the predicates in it. The expression of the final location becomes obligatory, through a PP complement, although it is not conceptually specified. This argument structure is, desirably, inherited by the immediate troponym, {*meter*}, that expresses a more specific DIRECTION of the event. The lowest troponym, {*enjaular*}, in turn, denotes the event of “placing inside a specific location” – a cage –, through a process described in Pustejovsky (1995, 2000) as *lexical shadowing*. In (7), on the other hand, only the lowest troponym, *circum-navegar*, shows a different argument structure.

- (7)
- |                           |                                       |   |
|---------------------------|---------------------------------------|---|
| { <i>mover-se</i> }       | [move oneself]                        | V(NP <sub>AG/THEME</sub> )                          |
|                           | +GROUND, +MANNER                      |   |
| { <i>navegar</i> }        | [ <i>mover-se</i> on water in a boat] | V(NP <sub>AG/THEME</sub> )                          |
|                           | +PATH                                 |   |
| { <i>circum-navegar</i> } | [ <i>navegar</i> around (something)]  | V(NP <sub>AG/THEME</sub> , NP <sub>OBSTACLE</sub> ) |

As shown, semantic incorporation occurs in several degrees, reflecting or not changes in the argument structure of the event, without necessarily occurring argument incorporation.

We consider, thus, that the analysis of semantic incorporation (and not only of the dominant patterns) can be used for achieving a more complete semantic description of these verbs, identifying more accurately the information in the event structure and its reflection on the verb syntactic behaviour.

### 3 Semantic Incorporation and Aktionsart

Semantic incorporation seems also to have implications on Aktionsart properties of the predicates. However, and as it is commonly acknowledged, Aktionsart values depend greatly on contextual factors (Moens 1987: 44):

- (8) a. John ran in the park (for a while). (*activity*)  
 b. John ran a mile (in less than four minutes). (*accomplishment*)

For this reason, and to determine the basic Aktionsart values of the verbs in study, it is necessary to establish the basic argument structure of these predicates.

#### 3.1. Argument structure and basic Aktionsart value

A first step of this analysis concerned the predicates number of arguments, or adicity. For computational purposes it is desirable that predicates with similar adicity are grouped together, but also that predicates with different adicity, when related, are described in a way that explains the different number of arguments.

Since the obligation of occurrence of the arguments is variable, i.e., there are some arguments that can be optional, we will define as a basic property what we will call *basic adicity*. We define basic adicity as the minimum number of arguments required by a predicate to form well-formed, decontextualized, sentences. In this way, it is possible to determine the basic Aktionsart value of a predicate, accounting, at the same time, for different arguments structures and Aktionsart shifts.

We adopt the four classes typology of Vendler (1967) – states, activities, accomplishments and achievements. In order to determine the basic Aktionsart value we follow Móia’s (2000) set of criteria, taking into account both ontological as well as distributional properties, as schematized in Table 1.

Aktionsart class →		State	Activity	Accomplishment	Achievement
<b>Ontological Properties</b>	Temporal extendedness	non-punctual	non-punctual	non-punctual	punctual
	Homogeneity (subinterval property)	totally homogeneous	relatively homogeneous	heterogeneous	heterogeneous
	Nuclear Structure	no nuclear components	no nuclear components	preparatory process, culmination and consequent state	culmination (and possible consequent state)
<b>Distributional Properties</b>	Time adverbials (telicity)		*in -adverbials for -adverbials	in -adverbials *for -adverbials	*in -adverbials *for -adverbials
	Tense forms	*is V-ing	is V-ing	is V-ing	
	Logical entailments		is (now) V-ing → has V	is (now) V-ing → has not (yet) V	

Table 1: Aktionsart classes properties

### 3.2. Aktionsart shifting

The semantic elements that seem to be responsible for troponym verbs Aktionsart shifts are GOAL, SOURCE and MANNER. The incorporation processes are:

(9) V[activity]  $\xrightarrow{+GOAL}$  V[accomplishment]

a. {*mover-se, deslocar-se*} [move oneself]

{*voltar, regressar*} [*mover-se*, again, to the start point]

b. "O homem moveu-se/deslocou-se durante 10 m."  
'the man moved-CL for 10 m'  
The man moved for 10 minutes.

c. "O homem está (agora) a mover-se/deslocar-se"  
'the man is (now) moving

→ o homem moveu-se/deslocou-se."  
→ the man has moved'

d. "O homem voltou/regressou em 10 minutos."  
'the man returned in 10 minutes'

e. "O homem está (agora) a voltar/ regressar"  
'the man is (now) returning

→ o homem (ainda) não voltou/regressou.  
→ the man has not (yet) returned'

(10) V[activity]  $\xrightarrow{+SOURCE}$  V[accomplishment]

a. {*mover, deslocar*} [change location]

{*tirar*} [*mover* from a given initial location]

b. "O homem moveu/deslocou a caixa durante 10 m."  
'the man moved the box for 10 m'

c. "O homem está (agora) a mover/deslocar a caixa"  
'the man is (now) moving the box

→ o homem moveu/deslocou a caixa."  
→ the man has moved the box'

d. "O homem tirou a caixa da rua em 10 m."  
'the man took the box from the street in 10 m'

e. "O homem está (agora) a tirar a caixa da rua"  
'the man is (now) taking the box from the street

→ o homem (ainda) não tirou a caixa da rua.  
→ the man has not (yet) taken the box from the street'

(11) V[achievement]  $\xrightarrow{+MANNER}$  V[accomplishment]

a. {*sair*} [move (oneself) out of]

{*esgueirar-se*} [*sair* discreetly, w/ quiet movements]

- b. "O homem saiu \*durante 10 m / \*em 10 m."  
 'the man exited \*for 10 m / \*in 10 m'
- c. "O homem esgueirou-se em 10 m."  
 'the man sneaked out-CL in 10 m'  
 The man sneaked out in 10 m.
- d. "O homem está (agora) a esgueirar-se  
 'the man is (now) sneaking out-CL  
 The man is (now) sneaking out
- o homem (ainda) não se esgueirou.  
 → the man has not (yet) CL sneaked out'  
 → the mans has not yet sneaked out.

The incorporation of the elements SOURCE and GOAL establishes a limit to the event, shifting an activity type to an accomplishment type event; and the incorporation of MANNER may be described as the addition of a process to an achievement type event, both cases predicted in Moens (1987: 45).

Note, however, that the Aktionsart values transitions are also related to the argument structure of the events: an Aktionsart value shift can be induced by the expression of SOURCE, GOAL or Obstacle<sup>3</sup> denoting arguments, as in (12) below:

$$(12) V[\text{activity}] \xrightarrow{\begin{matrix} +\text{MAN.} + \text{GROUND} \\ (+\text{ARG}_{\text{OBSTACLE}}) \end{matrix}} V[\text{accomplishment}]$$

- a. {*subir*} [move (oneself) up]  
 |  
 {*escalar*} [*subir*, on foot, a great steep surface]

- b. "O homem subiu durante 10 m"  
 'the man moved up for 10 m'
- c. "O homem está (agora) a subir  
 'the man is (now) moving up
- o homem subiu."  
 → the man has moved up'
- d. "O homem escalou o Everest em 2 horas."  
 'the man climbed the Everest in 2 hours'

<sup>3</sup> Obstacle arguments are here taken as defined in Fong & Fellbaum (2003): Obstacle arguments (i) are subcategorized by verbs that denote accomplishments; (ii) refer to bounded areas; (iii) can not be partitioned; (iv) can enter (periphrastic) passive constructions; (v) can enter the Middle alternation; and (vi) allow (-ing) nominalization.

- e. "O homem está (agora) a escalar o Everest  
 'the man is (now) climbing the Everest
- o homem (ainda) não escalou o Everest"  
 → the man has not (yet) climbed the Everest'

Although semantic incorporation analysis can help to explain Aktionsart shifting, it may not provide an exhaustive account of these phenomena. For instance, cases such as {*sair*} (exit) and {*entrar*} (enter), achievement type events, that incorporate DIRECTION, and are direct troponyms of the activity type event {*mover-se*} (move oneself), can be seen as difficult cases.

However, according to Moens (1987:45), transitions between processes (activities) and points (achievements) are possible. Intuitively this also seems possible, since the hyponym verb concept denotes motion in a specific direction, concerning also a specific point of the activity denoted by the hypernym that involves a consequence: being in or out of some place. Moreover, the concept denoted by *sair* (exit), accurately expressed by the paraphrase "mover-se para fora de" (*move (oneself) out of*), indicates a complex event structure involving a process (move). Although not unproblematic, this intuition is accounted by Pustejovsky (1995:160) proposal in which achievements bear two events in their event structure – a process and a state –, the head event being the state event.

However, this Aktionsart shift does not occur in all the cases of incorporation of DIRECTION, preventing us from directly relating the semantic incorporation phenomenon with the Aktionsart shifting in these cases.

Nonetheless, the regularity exhibited in the cases of semantic incorporation of SOURCE, GOAL and MANNER and Aktionsart shifting provide evidence for the relation between semantic incorporation and event structure.

#### 4 Semantic representation

As argued so far, semantic incorporation affects the predicates structure in different ways. In this section, we consider the issue of how to represent this phenomenon in the Generative Lexicon framework (Pustejovsky 1995), assuming an inheritance device at the lexical level.

We propose a semantic representation that considers the lexical items within a relational net. The troponymy relation – that mediates between the lexical entries – assures the availability of lexical semantic structures, establishing that troponyms denote the same concept as the superordinate, specifying it:

“[being  $V_1$  troponym of  $V_2$ ] *To  $V_1$  is to  $V_2$  in some particular manner. Manner* is interpreted here more loosely (...) and troponyms can be related to their superordinates along many semantic dimensions” (Fellbaum 1998:79)

In this way, the troponyms inherit the superordinate structure, only adding the specific information that concerns their meaning specification, corresponding to the semantic elements incorporated.

The incorporation of semantic elements is necessarily reflected in the argument structure, since this is the level for the representation of logical arguments. However, the type of arguments introduced depends on how they are realized syntactically.

Take for instance the case of the verb *encaixotar* (box) in (13b) below. The goal argument of the hypernym in (13a), which is a true-argument type syntactically realized, becomes in (13b) a shadow-argument type corresponding to a parameter semantically incorporated into the lexical item that can only be syntactically expressed by subtyping or specification processes (Pustejovsky 1995:63):

$$(13) \text{ a. } \left[ \begin{array}{l} \textit{meter} \\ \text{ARGSTR} = \left[ \begin{array}{l} \text{ARG1} = \boxed{1} \\ \text{ARG2} = \boxed{2} \\ \text{ARG3} = z : \textbf{goal} \end{array} \right] \end{array} \right]$$

$$\text{ b. } \left[ \begin{array}{l} \textit{encaixotar} \\ \text{ARGSTR} = \left[ \begin{array}{l} \text{ARG1} = \boxed{1} \\ \text{ARG2} = \boxed{2} \\ \text{S - ARG1} = w : \textbf{box} \end{array} \right] \end{array} \right]$$

There can be also introduction of new arguments, as in the case of incorporation of MANNER that, typically, are of the shadow-argument type, as in the *mover-se* (move) – *rastejar* (crawl) case:

$$(14) \text{ a. } \left[ \begin{array}{l} \textit{mover - se} \\ \text{ARGSTR} = \left[ \text{ARG1} = \boxed{1} \right] \end{array} \right]$$

$$\text{ b. } \left[ \begin{array}{l} \textit{rastejar} \\ \text{ARGSTR} = \left[ \begin{array}{l} \text{ARG1} = \boxed{1} \\ \text{S - ARG1} = z : \textbf{manner} \end{array} \right] \end{array} \right]$$

Aktionsart shifting cases also require changes on the event structure level. The activity to accomplishment Aktionsart value shift is

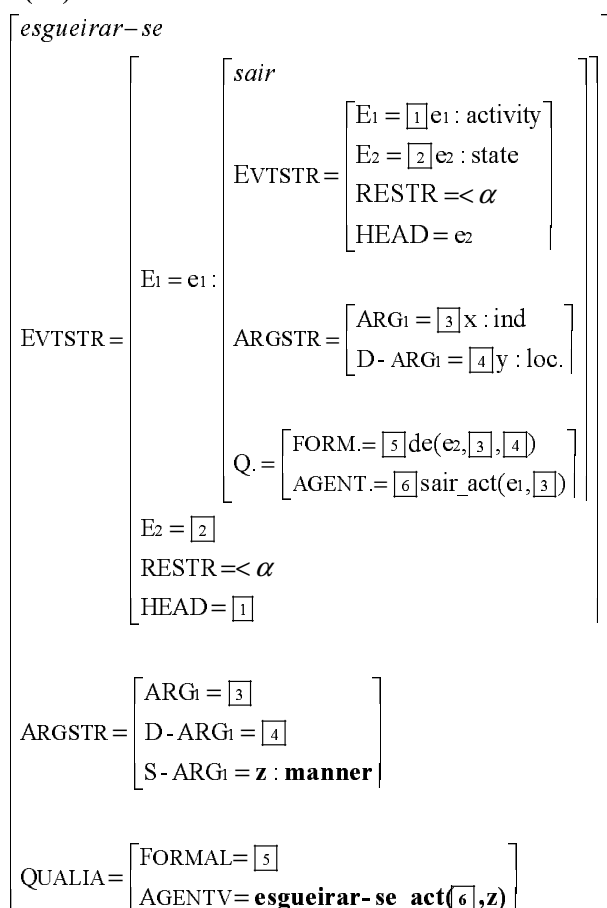
represented by the introduction of a final state on the event structure of the troponym, motivated by GOAL or SOURCE incorporation, as exemplified in (15) for the verb *tirar* (take). The activity event type is identified with that of the hypernym, in  $e_1$ , and a second event of the type state,  $e_2$ , is specified.

$$(15) \left[ \begin{array}{l} \textit{tirar} \\ \text{EV.S.} = \left[ \begin{array}{l} \textit{mover} \\ \text{EV.S.} = \left[ \text{E}_1 = \boxed{1} e_1 : \textit{activity} \right] \\ \text{ARG.S.} = \left[ \begin{array}{l} \text{ARG}_1 = \boxed{2} x : \textit{ind} \\ \text{ARG}_2 = \boxed{3} y : \textit{ind} \end{array} \right] \\ \text{Q.} = \left[ \text{FORMAL} = \right. \\ \left. \boxed{4} \textit{mover\_act}(e_1, x, y) \right] \end{array} \right] \\ \text{E}_2 = e_2 : \textit{state} \\ \text{RESTR} = < \alpha \\ \text{HEAD} = \boxed{1} \\ \text{ARG-STR} = \left[ \begin{array}{l} \text{ARG}_1 = \boxed{2} \\ \text{ARG}_2 = \boxed{3} \\ \text{ARG}_3 = z : \textit{source} \end{array} \right] \\ \text{QUALIA} = \left[ \begin{array}{l} \text{FORMAL} = \textit{de}(e_2, \boxed{3}, z) \\ \text{CONST.} = \textit{tirar\_act}(\boxed{4}, z) \end{array} \right] \end{array} \right]$$

The achievement to accomplishment Aktionsart value shift requires the redefinition of the event structure head, since achievements are lexically specified right-headed events. The representation of the verb *esgueirar-se*, in (16), presents such a case.

In (16), the verb *esgueirar-se* inherits the lexical semantic structure from its hypernym, *sair*, recovers the events in the event-structure, but assumes a new head event,  $\boxed{2}$ . The incorporation of MANNER results in the introduction of a shadow argument,  $z$ , in the argument structure inherited from the hypernym. Also, the meaning specification relation between the hypernym and troponym is reflected in the Qualia structure through the inheritance of the FORMAL value (the final state,  $\boxed{5}$ ), and through the definition of the AGENTIVE value, *esgueirar-se\_act*, as the modification of the activity event of *sair\_act* by the MANNER argument introduced by the troponym.

(16)



With these lexical structures we show how we intend to explore lexical inheritance within the GL framework, using structure unification, through indexes, and the troponymy relation, through the recursive use of the available lexical semantic structures.

## 5 Final remarks

The decompositional analysis of the verbs of movement within a WordNet provides a semantic description that identifies more accurately the information in the event structure and its reflection on the verb syntactic behaviour. For that purpose, we propose a set of semantic elements that account for the meaning specifications within the domain of verbs of movement.

The observation of semantic incorporation can be used to organize the verbal lexicon, contemplating the conceptual differences and accounting for the properties that are not directly inherited by the verbs in troponym synsets, namely Aktionsart values. The semantic representation here proposed, within a feature structure model such as GL, aims at the formalization of these properties.

The future work will focus further on formalization issues, as well as on the observation

of other properties that will reveal pertinent to account for differentiated syntactic behaviour. These, together with the hierarchical nature of ontological lexica such as WordNet, enable us to draw useful generalizations which can help to develop parsimonious and efficient models for the computation of verbs of movement.

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