

# Aligning corpus-derived argument structures of verbs and deverbal psych nouns in Italian

Marta Ricchiardi and Francesca Torchio

University of Pavia, Italy

{marta.ricchiardi01, francesca.torchio01}@universitadipavia.it

**Abstract.** We discuss the results of an empirical study on argument structures of deverbal psych nouns in Italian. Our aim is to investigate psych predicates between syntax and semantics through a comparison between argument structures of psych verbs and their respective deverbal nouns. We used two resources of computational lexicography to collect corpus-derived argument structures, and we provided a corpus-based alignment of argument structures of Italian psych verbs and noun couples.

**Keywords:** Psych predicates · Argument structure · Corpora · Annotation · Deverbal nouns

## 1 Introduction

### 1.1 Theoretical Background

**Psych Predicates.** The object of this study are psych predicates, i. e. predicates which denote mental processes of various kinds, such as perception (*notice*, *observe*), attitude (*love*), feeling or sensation (*embarass*, *disgust*).

The syntax of psych nominals has been explored in milestone work of Belletti and Rizzi [4], which identifies three primitive lexical classes based on their syntactic behavior, exemplified by the examples (1-a), (1-b), (1-c).

- (1)    a.   Gianni tem-e                questo.  
             Gianni fearPRS-3PL this.  
             **I class: Subj = experiencer, Obj = theme**
- b.   Questo preoccup-a                Gianni.  
             This    frightenPRS-3PL Gianni.  
             **II class: Subj = theme, Obj = experiencer (direct)**
- c.   A    Gianni piac-e                questo / Questo piac-e a Gianni  
             DAT Gianni likePRS-3PL this  
             **III class: Subj = theme, Obj = experiencer** <sup>1</sup>

<sup>1</sup> Also the freedom in the constituent order is peculiar - and not allowed in the classes II and III.

**Argument-taking Nominals.** As first pointed out in Grimshaw’s work [8], nouns do take arguments as well as verbs, as shown in examples (2-a) and (2-b). Nominal argument structures are more flexible on the possibility to omit arguments -as shown by (2-c), which is acceptable, unlike (2-d). However, obligatoriness constraints do exist for nouns as well, as shown by (2-e).

- (2) a. The army destroyed the city.
- b. The army’s destruction of the city caused thousands of refugees.
- c. The distruction of the city
- d. \*destroyed the city
- e. The felling \*(of the trees)

This can be explained in terms of complex events, which are - according to Grimshaw’s theory - the only nouns that have an event structure [21], and therefore are capable of taking arguments [8],[17].

## 1.2 Our contribution

**Motivation.** The study of argument structures can be considered a core issue in syntax-semantics interface. In the field, psych predicates have attracted some interest in light of their behaviour (see section 1.1). However, the study of argument structures of psych predicates has been primarily carried out from a theoretical perspective. On the other hand, the issue of linking verbal into nominal deverbal argument structures has been approached from a computational perspective, mainly relying on existing linguistics resources for English.

We want to keep these two perspectives together focusing on psych predicates, in order to align argument structures of verbs and those of the derived deverbal nouns. The aim is an annotation that is manual but also corpus-supported, so as to rely on systematic corpus uses instead of our intuitions.

To this aim, Italian looks particularly suitable, since there are resources that allow to approach the issue in a corpus-based way. We will use T-PAS [13] and LexIt [15], two resources providing semantically annotated argument structures and distributional profiles respectively. Moreover, in Italian there is not a resource such as the English NomLex [16] and NomBank [19], i. e. providing argument nominal argument structure and linking verbal into deverbal nominal argument structures. In this frame, our hope is to provide a methodology that might work on broader scale for a resource of this kind for Italian.

**Related works.** Related works can be distinguished between those within a computational and within a formal perspective.

The former make use of corpus linguistics resources to obtain large, sometimes manually-annotated corpus data. The resources used in this work are T-PAS and LexIt, for verbal and nominal subcategorization frames respectively,

but other resources need to be mentioned: FrameNet<sup>2</sup> [2], that identifies valence patterns for its lexical units (i. e. both for verbs and nouns, also deverbal) with their syntactic behaviour; VerbNet [22] [14], an English verb lexicon that provides for each verb their semantic and syntactic patterns. T-PAS information is somehow similar to that of these resources, but structures are acquired from corpora through a systematic procedure (Corpus Pattern Analysis, [11], also used in the sister resource for English PDEV [12]). LexIt, on the other hand, provides subcategorization frames in a completely automatic way: even though less in detail (if compared with T-PAS), the advantage is that any verb, noun or adjective of the language is covered (while T-PAS only covers 1165 verbs).

Two works of Gurevich’s group [9], [10] propose an automatic mapping of arguments of deverbal nominals into verb arguments, based on suffix [9] or on argument semantics [10]. More recently, Fučíková and colleagues [7] used both existing lexical resources and parallel corpora to automatically extract deverbal nouns with the future aim to link them to the base verbs with whom they share the valency.

The latter framework has its roots in the tradition of [8] and [4], but also in more recent works in the field of lexical semantics. Fábregas and colleagues [6] focus on the lexical aspect of deverbal psych nominals with respect to verbs, showing that psych deverbal nouns do maintain the aspect of their base verbs in Spanish. Melloni [18] deals with the same problem for Italian psych verbs and nouns focusing on object experiencer psych verbs, claiming that psych nominals are fundamentally stative<sup>3</sup>, with the relevant exception of nouns derived from intransitive verbs used with clitics.

## 2 Methodology

In this section we explain how the annotation procedure and analysis is carried out, discussing the target predicates (2.1), the information available in the two (different) resources (2.2), and the way we managed and annotated this information (2.3, 2.4).

### 2.1 Couples of predicates

Couples consisting of a psych verb and its respective deverbal noun are considered. Table 1 reports the complete list.

<sup>2</sup> Together with FrameNets in other languages ([https://framenet.icsi.berkeley.edu/fndrupal/framenets\\_in\\_other\\_languages](https://framenet.icsi.berkeley.edu/fndrupal/framenets_in_other_languages)).

<sup>3</sup> A stative verb, following the classification proposed by Vendler ([23]), is a verb that does not indicate a process going on in time, thus it lacks dinamicity, and at the same time it has a duration and lacks telicity.

<sup>4</sup> We provide here a translation class by class: **I**: ‘to love’/ ‘love’; ‘to fear’/‘fear’. **II**: ‘to excite’/‘enthusiasm’; ‘to worry’/‘concern’; ‘to move’/‘emotion’; ‘to fascinate’/ ‘fascination’. **III**: ‘to enjoy’/‘pleasure’; ‘to miss’/‘lack’; ‘to interest’/‘interest’.

I	II	III
amare amore	entusiasmare entusiasmo	piacere piacere
temere timore	preoccupare preoccupazione	mancare mancanza
	commuovere commozione	interessare interesse
	affascinare fascino/fascinazione	

Table 1. Couples of verb-noun predicates<sup>4</sup>

The chosen couples are obviously not exhaustive. Three criteria were adopted to identify the pairs: (i) verbs should be present on T-PAS, that provides the patterns for a large but limited set of verbs; (ii) predicates should cover all the three classes of [4]; (iii) predicates should be high-frequency words in common use (according to the online dictionary "Il Nuovo De Mauro"<sup>5</sup>[5])."

## 2.2 Resources

**T-PAS.** T-PAS<sup>6</sup> [13] is a resource that provides argument structures for Italian verbs, annotated with the expected semantic types for each argument (see example (3)). Patterns are corpus derived, and they are obtained through the CPA procedure mentioned above 1.2, based on co-occurrence statistics of syntactic slots in corpus instances<sup>7</sup>. However, the annotation of the semantic types is performed manually: the annotator chooses which semantic type better generalizes over the lexical set which populates each argument slot, observing a random sample of instances from the corpus. Semantic types are organized in a hierarchy in which the relation "kind of" is represented (e. g. [Human] is a kind of [Animate Entity], [Animate Entity] is a kind of [Entity], etc.). The semantic types in T-PAS are corpus-driven categories, and therefore still in expansion as long as new verbs are annotated. About two hundred semantic types have been currently identified.

**LexIt.** LexIt<sup>8</sup> [15] is a resource that provides syntactic and a semantic profile of nouns, verbs and adjectives. The former consists of the syntactic slots (subject, complements, etc.) and the subcategorization frame of the target predicate. The latter consists of a set of the most salient<sup>9</sup> fillers of the syntactic slot and a set of semantic classes characterizing the selectional preferences of the predicate. Although several semantic classes look very similar to the T-PAS semantic types,

<sup>5</sup> <https://dizionario.internazionale.it/>).

<sup>6</sup> <https://tpas.sketchengine.eu/>

<sup>7</sup> The target corpus of T-PAS is a reduced version of ItWac [3]

<sup>8</sup> <http://lexit.fileli.unipi.it/>

<sup>9</sup> By saliency of a collocation, we mean the probability of one of the two words to appear in collocation with the other, over the total number of possible collocations for that word.

LexIt classes are not corpus-driven, but they consist of a set of 24 mutually exclusive categories that are automatically assigned. LexIt data are extracted from the Italian news corpus La Repubblica <sup>10</sup> [3].

**Why two resources?** The reason why we use two different resources is that, while we have T-PAS for semantically annotated argument structures, we do not have an equivalent resource for nouns, and thus we have to rely only on distributional profiles. Since, together with syntactic frames, LexIt provides the most frequent lexical fillers and semantic classes, it is possible to derive a piece of information that is similar to that in T-PAS, although in a more time-consuming way. In the next section we explain how data from the two resources are integrated.

### 2.3 Deriving argument structures

For verbs, argument structures are already provided in T-PAS in the format of (3) that contains examples of *preoccupare*, ‘to worry’:

- (3) a. [Human] preoccupar-si (di [Anything] | per [Anything])<sup>11</sup>  
       [Human] worry-REFL (for [Anything])  
       b. [Anything] preoccupare [Human]  
       [Anything] worry [Human]

For nouns, as anticipated in 2.2, extracting a semantic profile from LexIt is less straightforward. We first look at the subcategorization frames of the nouns, which appear in LexIt as in the tables in (3). Each frame is provided with a list of the most salient fillers and a list of the main semantic classes of the fillers.

Based on these data, together with our native knowledge of Italian, we can easily derive T-PAS-like argument structures. For the data reported in (3), it would appear as:

- (4) preoccupazione di [Human]||[Institution]

As said in 2.2, LexIt and T-PAS classes are not identical, even though, for our scope, comparable: LexIt classes, together with the information about the most frequent fillers, allow us to align it to the T-PAS structure, which is used as standard.

<sup>10</sup> <https://corpora.dipintra.it/?path=&name=Repubblica>

<sup>11</sup> The square brackets are used for semantic types, the round brackets for constituents that can be omitted. Pipe is used to signal alternation between semantic types and/or syntactic structures.

<sup>12</sup> Notation clarification: *comp-per* means that the verb takes *only* the argument introduced by *per*, with *comp-di#comp-per* it takes the two arguments introduced by *di* and by *per*.

<sup>13</sup> We provide here a translation of the fillers present in the table: ‘operator’, ‘trade union’, ‘government’, ‘pope’, ‘assembly’, ‘authority’, ‘category’, ‘people’, ‘person in charge’, ‘investor’.

Syntactic slot	Saliency	Filler <sup>13</sup>	Saliency	Semantic class	Saliency
comp-per <sup>12</sup>	11017.6687	operatore	53.572	Person	101.9297
comp-su	624.024	sindacato	42.0076	Group	49.1711
comp-di#comp-per	564.7546	governo	41.3055	Body Part	1.1126
comp-in#comp-per	263.145	papa	28.059	Natural Object	0.2485
comp-di#inf-di	82.4807	vertice	21.0871		
comp-tra	79.6156	autorità	17.4678		
comp-di#comp-su	73.633	categoria	16.8354		
comp-a#comp-per	72.0891	gente	16.167		
		responsabile	13.4086		
		investitore	13.3077		

An example of LexIt data. The first table shows the subcategorization frames of the noun *preoccupazione*, while the second and the third contain the lexical fillers and semantic classes of the slot *comp-di* (i.e. complement introduced by the preposition *di*)

## 2.4 Annotating thematic roles

We then annotate argument structures with thematic roles - e. g. argument structures of (3) and (3), that, after our thematic role annotation would appear as in (5):

- (5) a. THEME <sup>14</sup> preoccupare EXP  
b. La preoccupazione di EXP per THEME

## 3 Results

The results of the alignment of verbal and nominal argument structures are provided in our github repository<sup>15</sup>, where we report, respectively, the annotation as it arises from the resources, the annotation on thematic roles and the noun-verb mapping. In table 2, we provide an excerpt, in which only structures already annotated with thematic roles are reported.

## 4 Discussion

In this section we discuss in detail the results of table 2. We first describe the classes of verbs we identified in 4.1; we then move to nouns and nominal argument structures in 4.2. We discuss the relation between thematic roles and semantic types in 4.3.

<sup>14</sup> Thematic roles are written in capitals.

<sup>15</sup> <https://github.com/Rapazebu/Psych-predicates-in-Italian---Annotations>

**Table 2.** Argument structures of verbs and respective deverbal nouns, annotated with thematic roles

Verb	Noun
EXP amare THEME EXP/THEME amarsi (refl) EXP/THEME amarsi (rec)	amore amore per THEME amore verso THEME amore di EXP per THEME amore tra EXP/THEME e EXP/THEME
EXP temere THEME EXP temere di (clause) THEME EXP temere che (clause) THEME EXP temere per THEME	timore per THEME timore di THEME timore su THEME timore di (clause) THEME timore che (clause) THEME
THEME entusiasmare EXP EXP entusiasinarsi	entusiasmo entusiasmo per THEME entusiasmo verso THEME entusiasmo da parte di EXP per THEME entusiasmo di EXP per THEME
THEME preoccupare EXP EXP preoccuparsi di THEME EXP preoccuparsi per THEME	preoccupazione per THEME preoccupazione su THEME
THEME commuovere EXP EXP commuoversi	commozione commozione per THEME commozione da parte di EXP
THEME affascina EXP	fascino di EXP fascino di THEME fascinazione per THEME
THEME piacere a EXP THEME piacere EXP/THEME piacersi (rec)	piacere di (clause) THEME piacere di EXP di (clause) THEME
THEME mancare a EXP	mancanza di THEME
THEME interessare EXP EXP interessarsi a THEME EXP interessarsi a THEME	interesse per THEME interesse a (clause) THEME interesse su THEME interesse di EXP per THEME interesse di EXP verso THEME

#### 4.1 Classes of verbs

We stated in section 1.1 that verbs can be divided into three primitive lexical classes. However, many verbs have more than one argument structure, and thus they fall into more than one class. Moreover, our data show that the three primitive classes are not sufficient to classify all the patterns. Therefore, some further distinctions are worth to be stated.

Many verbs appear in argument structures with clitics (signalled in the table with the third-person clitic *-si*). Three different functions can be assigned to clitics, which are:

- Reflexive constructions where the experiencer and the theme are the same entity, as in (6):

(6) [Human]-EXP/THEME amarsi<sup>16</sup>

which means something like *Human-1 loves Human-1*.

- Reciprocal constructions, where two participants are contemporarily the experiencer and the theme, as in (7):

(7) [Human]s-EXP/THEME amarsi<sup>17</sup>

which means something like *Human1 loves Human-2 AND Human-2 loves Human-1*

- Indirect constructions where the experiencer is realized as the subject and the theme as the indirect object, as in (8-b).

(8) a. [Anything]-THEME preoccupare [Human]-EXP <sup>18</sup>  
 b. [Human]-EXP preoccupar-si (di | per [Anything]-THEME)<sup>19</sup>

Many verbs of classes I and II also appear in this configuration, showing both a direct and an indirect construction which is realized through the clitic. However, there are also verbs in which a similar alternance between direct and indirect constructions is not encoded through the clitics, as for the verb *temere*. As shown in example (9), in (9-a) it behaves like a I class verb, while in (9-b) it shows an indirect construction that is similar to those in (8-b):

(9) a. [Human]||[Human group]-EXP teme [Anything]-THEME <sup>20</sup>  
 b. [Human]||[Human Group]-EXP teme per [Anything]-THEME <sup>21</sup>

<sup>16</sup> Eng: [Human]-EXP/THEME love-3SGPRON

<sup>17</sup> Eng: [Human]s-EXP/THEME love-3PLPRON

<sup>18</sup> Eng: [Anything]-THEME worry [Human]-EXP

<sup>19</sup> Eng: [Human]-EXP worry-3SGPRON (of | for [Anything]-THEME)

<sup>20</sup> Eng: [Human]||[Human Group]-EXP worry [Anything]-THEME

<sup>21</sup> Eng: [Human]||[Human Group]-EXP worry for [Anything]-THEME



This differs from cases like (8), in which the alternation is between II and indirect class. Both this cases are annotated with the label "indirect", which is sufficient for our scopes

To sum up, we provide in table 3 the classes of verbs that we identified.

class verbs	
I	amare, temere
II	entusiasmare, preoccupare, commuovere, affascinare, interessare
III	piacere, interessare
ref	amarsi
rec	amarsi, piacersi
ind	entusiasarsi, preoccuparsi, commuoversi, interessarsi, temere

**Table 3.** Syntactic classes of verbs

## 4.2 Nominal arguments

**Psych nouns do take arguments.** Psych deverbals considered in our analysis almost always take arguments. Occurrences of the items without arguments are attested with a sufficient saliency for only three deverbals, *amore*, *entusiasmo* and *preoccupazione*. Moreover, as one can see in table 2, all the target deverbals have significant one-arg constructions, and also two-args constructions are considerably frequent. Some deverbals do not show relevant two-args constructions, like *fascino*, *fascinazione*, *mananza*; and it appears that one-arg constructions are averagely more salient than two-args constructions.

**Prepositions.** Arguments of psych deverbal nouns are mainly introduced by the preposition *di*, *per*, *su*, *verso*. *Per*, *su*, *verso* introduce the theme, while *di* can introduce both the experiencer and the theme. However, the theme can be expressed by *di* only in one-arg constructions when the experiencer is general or already present in the discourse -so as to avoid ambiguities<sup>22</sup>.

**Verbs and nouns compared.** Comparing deverbals with their respective verbs, the distribution of the arguments seems semantically alike.<sup>23</sup> Moreover, there seems to be no strong correlation between the three classes of [4] for the be-

<sup>22</sup> I. e. one can say both *Il timore di EXP* and *Il timore di THEME*, but there are no constructions such as *Il timore di EXP di THEME* attested.

<sup>23</sup> While syntactically nouns are unsurprisingly more flexible as pointed out in (1)

haviour of verbal arguments and the syntactic behaviour of nominal arguments.<sup>24</sup>

### 4.3 Thematic roles and semantic types.

As our argument structures are annotated with the type of the predicate, one can draw generalizations on the relation between semantic types and thematic roles. Table 2 shows the semantic types of the arguments that express the experiencer and the theme of psych predicates<sup>25</sup>.

	EXP	THEME
<b>T-PAS</b>	[Human]	[Anything],[Activity],[Proposition], [Concept],[Human], [Inanimate]
<b>LexIt</b>	Person, Group	State, Event, Act, Process, Knowledge, Attribute, Time

**Table 4.** Semantic Types that express each thematic role in our argument structures based on T-PAS (for verbs) and LexIt (for nouns).

As expected, experiencers are mainly expressed by humans (persons) or groups of humans. Themes are more variable: in the hierarchical system of T-PAS they were often annotated as [Anything], and also in LexIt they are expressed by many different classes. However, LexIt classes show that the most frequent themes are events, states and abstract object of knowledge – what in T-PAS would be referenced as [Eventuality], [State], [Process], [Activity] and [Proposition]. This is not surprising, if one considers that many psych verbs are in fact attitude verbs [20] [1] – i.e. verbs that express attitudes people bear to propositions expressing events or states of things<sup>26</sup>.

## 5 Conclusion

We collected argument structures for a group of Italian psych verbs and deverbal nominals, carrying out an annotation that benefits from both the accuracy of human introspective judgements and the quantitative robustness of corpus linguistics resources. The result is an alignment of verbal and nominal corpus-derived argument structures for Italian, where arguments are annotated with semantic and thematic information.

<sup>24</sup> An exception is the stable correspondence of reciprocal constructions in verbal domain and the PPs introduced by *tra* ('between') in the nominal domain *A e B si amano* / *l'amore tra A e B*.

<sup>25</sup> Keep in mind that T-PAS types for nouns and LexIt classes for verbs are slightly different (see 2), since they are taken from a hierarchical and a mutually-exclusive set of categories

<sup>26</sup> E. g. *I'm afraid she will not come*.

We verified on our data the argument-taking properties of Italian psych deverbals, which behave in semantics terms similarly to their base verbs but they are syntactically more flexible. We overviewed the syntactic configurations of verbal and nominal argument structures. For the former, we provided a more fine-grained syntactic classification to enrich the traditional one [4]. For the latter, we described the distribution of prepositions and their role in introducing nominal arguments. Eventually, we drew some generalization on the relation between thematic roles and semantic types.

Our work was limited to a small sample of predicates, chosen as good representatives of the class of psych verbs. Our hope is to provide a methodology that might be applied to a wider class of predicates -ideally, all the verb-deverbal couples in a language- in the direction of a parallel resource for verbal and deverbal nominal argument structures in Italian.

## References

1. Asher, N.: A typology for attitude verbs and their anaphoric properties. *Linguistics and Philosophy* pp. 125–197 (1987)
2. Baker, C.F., Fillmore, C.J., Lowe, J.B.: The berkeley framenet project. In: *COLING 1998 Volume 1: The 17th International Conference on Computational Linguistics* (1998)
3. Baroni, M., Kilgariff, A.: Large linguistically-processed web corpora for multiple languages. In: *EACL’06: Proceedings of the Eleventh Conference of the European Chapter of the Association for Computational Linguistics: Posters & Demonstrations; 2006 Apr 5-6; Trento, Italy*. Stroudsburg (PA): Association for Computational Linguistics; 2006. p. 87-90. *ACL (Association for Computational Linguistics)* (2006)
4. Belletti, A., Rizzi, L.: Psych-verbs and  $\theta$ -theory. *Natural Language & Linguistic Theory* pp. 291–352 (1988)
5. De Mauro, T., Chiari, I.: Il nuovo vocabolario di base della lingua italiana. *Internazionale*. [28/11/2020]. <https://www.internazionale.it/opinione/tullio-de-mauro/2016/12/23/il-nuovo-vocabolario-di-base-della-lingua-italiana> (2016)
6. Fábregas, A., Marín, R., McNally, L.: From psych verbs to nouns. Telicity, change, and state: A cross-categorical view of event structure pp. 162–184 (2012)
7. Fucíková, E., Hajic, J., Uresova, Z.: Enriching a valency lexicon by deverbative nouns. In: *Proceedings of the Workshop on Grammar and Lexicon: interactions and interfaces (GramLex)*. pp. 71–80 (2016)
8. Grimshaw, J.: *Argument structure*. the MIT Press (1990)
9. Gurevich, O., Crouch, R., King, T.H., De Paiva, V.: Deverbal nouns in knowledge representation. *Journal of Logic and Computation* **18**(3), 385–404 (2008)
10. Gurevich, O., Waterman, S.A.: Mapping verbal argument preferences to deverbals. In: *2009 IEEE International Conference on Semantic Computing*. pp. 17–24. *IEEE* (2009)
11. Hanks, P.: Corpus pattern analysis. In: *Euralex Proceedings*. vol. 1, pp. 87–98. *Université de Bretagne-Sud Lorient* (2004)

12. Hanks, P., Pustejovsky, J.: A pattern dictionary for natural language processing. *Revue Française de linguistique appliquée* **10**(2005/2), 63–82 (2005)
13. Ježek, E., Magnini, B., Feltracco, A., Bianchini, A., Popescu, O.: T-pas; a resource of typed predicate argument structures for linguistic analysis and semantic processing. In: *Proceedings of the Ninth International Conference on Language Resources and Evaluation (LREC'14)*. pp. 890–895 (2014)
14. Kipper, K., Korhonen, A., Ryant, N., Palmer, M.: Extending verbnet with novel verb classes. In: *Proceedings of the Fifth International Conference on Language Resources and Evaluation (LREC'06)* (2006)
15. Lenci, A., Lapesa, G., Bonansinga, G.: Lexit: A computational resource on italian argument structure. In: *LREC*. pp. 3712–3718 (2012)
16. Macleod, C., Grishman, R., Meyers, A., Barrett, L., Reeves, R.: Nomlex: A lexicon of nominalizations. In: *Proceedings of EURALEX*. vol. 98, pp. 187–193. Euralex Liege, Belgium (1998)
17. Melloni, C.: Event and result nominals. Peter Lang AG (2012)
18. Melloni, C.: Aspect-related properties in the nominal domain: The case of italian psych nominals. *Aspect and Valency in Nominals* **134**, 253 (2017)
19. Meyers, A., Reeves, R., Macleod, C., Szekely, R., Zielinska, V., Young, B., Grishman, R.: Annotating noun argument structure for nombank. In: *LREC*. vol. 4, pp. 803–806 (2004)
20. Nelson, M.: Propositional attitude reports. In: Zalta, E.N. (ed.) *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, Spring 2022 edn. (2022)
21. Pustejovsky, J.: The syntax of event structure. *cognition* **41**(1-3), 47–81 (1991)
22. Schuler, K.K.: VerbNet: A broad-coverage, comprehensive verb lexicon. University of Pennsylvania (2005)
23. Vendler, Z.: Verbs and times. *The philosophical review* **66**(2), 143–160 (1957)