

VerbNet Annotation Guidelines

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Why Verbs?

Computational verb lexicons are key to supporting NLP systems aimed at semantic interpretation. Verbs express the semantics of an event being described as well as the relational information among participants in that event, and project the syntactic structures that encode that information. Verbs are also highly variable, displaying a rich range of semantic and syntactic behavior. Verb classifications help NLP systems to deal with this complexity by organizing verbs into groups that share core semantic and syntactic properties. VerbNet (Kipper et al., 2008) is one such lexicon, which identifies semantic roles and syntactic patterns characteristic of the verbs in each class and makes explicit the connections between the syntactic patterns and the underlying semantic relations that can be inferred for all members of the class. Each syntactic frame in a class has a corresponding semantic representation that details the semantic relations between event participants across the course of the event. In the following sections, each component of VerbNet is identified and explained.

VerbNet: A Verb Class Lexical Resource

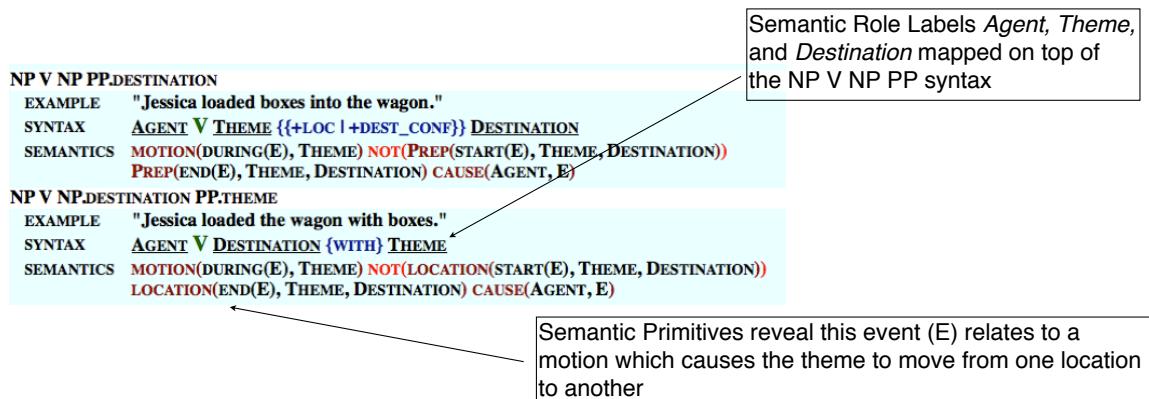
VerbNet is a lexicon of approximately 5800 English verbs, and groups verbs according to shared syntactic behaviors, thereby revealing generalizations of verb behavior. VerbNet is a domain-independent verb lexicon consisting of over 270 such verb classes, and is inspired by Beth Levin's classification of verb classes and their syntactic alternations (Levin, 1993). According to Levin's work, members within a single verb class participate in shared types of alternations, such as the locative alternation (spray verbs,) or the causative alternation (wrinkle verbs,) etc., because of an underlying shared semantic meaning. Thus, although the basis of VerbNet classification is syntactic, the verbs of a given class do share semantic regularities as well because, as Levin hypothesized, the syntactic behavior of a verb is largely determined by its meaning.

One syntactic alternation, called the locative alternation, involves moving something into or onto a location and occurs with verbs of placement and covering. This alternation expresses the "holistic/partitive" effect in which one alternation (*B* below) is interpreted as having filled the container or location completely, whereas the other alternation (*A* below) doesn't have this interpretation:

- A. Jessica loaded boxes into the wagon.*
- B. Jessica loaded the wagon with boxes.*

Verbs that participate in this alternation include *scatter*, *pump*, *hang*, *drizzle*, and *cram*, all of which are verbs that semantically involve a type of placement or covering. Because of their shared syntactic behaviors, these verbs are grouped together in the Spray-9.7 class.

VerbNet expands upon Levin's classification of shared syntactic alternations by making the relationships between syntax and semantics explicit. This is accomplished through the assignment of thematic roles to each syntactic argument in a given verb class, as well as the use of semantic predicates denoting relations between participants and events. Each of these components will be discussed in turn in the following sections. The figure below shows each of these components as they are presented in the Spray-9.7 class.



The locative alternation in VerbNet spray-9.7 class with semantic information mapped to the syntactic alternation

Components of a VerbNet Verb Class

Class Hierarchy – Contains the tree structure of a verb class including all parent classes and subclasses. Each individual class is hierarchical in the sense that classes may include one or more subclasses.

CLASS HIERARCHY
GIVE-13.1
GIVE-13.1-1

Hierarchy of give-13.1 class

Members – Contains the list of verbs belonging to a specific class or subclass. Most verb members are mapped to entries in other lexical resources including FrameNet (Baker et al., 1998), WordNet (Miller, 1990; Fellbaum, 1998), and Xtag (XTAG Research Group, 2001).

MEMBERS	KEY
LEND (WN 2; G 2)	RENDER (WN 2, 6, 7, 8; G 2)
LOAN (WN 1)	
PASS (FN 1; WN 5, 20, 21, 22; G 4)	
PEDDLE (WN 1; G 1)	
REFUND (WN 1; G 1)	

Members of give-13.1 class

Roles – Thematic roles refer to the semantic relationship between a predicate and its arguments. VerbNet makes use of a hierarchical thematic roleset, discussed in Section X. For each class, the roles that are thought to be core to the verb members' behavior are listed.

Selectional Restrictions - Each thematic role listed in a class may optionally be further characterized by certain selectional restrictions, which provide more information about the nature of a given role.

ROLES	REF
• AGENT [+ANIMATE +ORGANIZATION]	
• THEME	
• RECIPIENT [+ANIMATE +ORGANIZATION]	

Semantic Role Labels for give-13.1 class

Frames – The syntactic frames in VerbNet provide a description of the different surface realizations and diathesis alternations allowed for the members of the class. The Frames section consists of syntactic constructions, example sentences, and the semantic roles mapped to syntactic arguments. Semantic predicates are also depicted in this section, indicating how the participants are involved in the event.

FRAMES	REF	KEY
NP V PP.DESTINATION		
EXAMPLE "Paint sprayed onto the wall."		
SYNTAX THEME V {{+LOC +DIR +DEST_CONF}} DESTINATION		
SEMANTICS MOTION(DURING(E), THEME) NOT(PREP(START(E), THEME, DESTINATION)) PREP(END(E), THEME, DESTINATION)		
NP V NP PP.DESTINATION-CONATIVE		
EXAMPLE "Jessica squirted water at me."		
SYNTAX AGENT V THEME (AT) DESTINATION		
SEMANTICS MOTION(DURING(E), THEME) NOT(LOCATION(START(E), THEME, DESTINATION)) CAUSE(AGENT, E)		

Frames for spray-9.7-1-1 class

The VerbNet Hierarchy

VerbNet represents a hierarchy of verb behavior, from groups of verb classes that share similar semantics to the tree structure of the verb classes themselves.

Verb Classes are numbered according to shared semantics and syntax, and classes which share a top-level number (9-109) have corresponding semantic relationships. For instance, verb classes related to *putting*, such as put-9.1, put_spatial-9.2, funnel-9.3, etc. are all assigned to the class number 9 and related to moving an entity to a location. Classes that share a top class can also be divided into subclasses, such as *wipe* verbs in wipe_manner (10.4.1) and wipe_inst (10.4.2) which specify the manner and instrument of *wipe* verbs in the “Verbs of Removing” group of classes (class number 10). A complete list of top class numbers and their corresponding types are given below. Class numbers 1-57 are drawn directly from Levin’s (1993) classification. Class numbers 58-109 were developed later in the work of Korhonen & Briscoe (2004). Notably, the verb types of the later classes are less general, as indicated by the fact that most of these classes have a one-to-one relationship between verb type and verb class.

Class Number	Verb Type	Verb Class
9	Verbs of Putting	put-9.1 put_spatial-9.2 funnel-9.3 put_direction-9.4 pour-9.5 coil-9.6 spray-9.7 fill-9.8 butter-9.9 pocket-9.10
10	Verbs of Removing	remove-10.1 banish-10.2 clear-10.3 wipe_manner-10.4.1 wipe_inst-10.4.2 steal-10.5 cheat-10.6 pit-10.7 debone-10.8 mine-10.9 fire-10.10 resign-10.11
11	Verbs of Sending and Carrying	send-11.1 slide-11.2 bring-11.3 carry-11.4

		drive-11.5
12	Verbs of Exerting Force: Push/Pull Verbs	push-12
13	Verbs of Change of Possession	give-13.1 contribute-13.2 future_having-13.3 fulfilling-13.4.1 equip-13.4.2 get-13.5.1 obtain-13.5.2 hire-13.5.3 exchange-13.6 berry-13.7
14	Learn Verbs	learn-14
15	Hold and Keep Verbs	hold-15.1 keep-15.2
16	Verbs of Concealment	concealment-16
17	Verbs of Throwing	throw-17.1 pelt-17.2
18	Verbs of Contact by Impact	hit-18.1 swat-18.2 spank-18.3 bump-18.4
19	Poke Verbs	poke-19
20	Verbs of Contact: Touch Verbs	touch-20
21	Verbs of Cutting	cut-21.1 carve-21.2
22	Verbs of Combining and Attaching	mix-22.1 amalgamate-22.2 shake-22.3 tape-22.4 cling-22.5
23	Verbs of Separating and Disassembling	separate-23.1 split-23.2 disassemble-23.3 differ-23.4
24	Verbs of Coloring	coloring-24
25	Image Creation Verbs	image_impression-25.1 scribble-25.2 illustrate-25.3 transcribe-25.4
26	Verbs of Creation and Transformation	build-26.1 grow-26.2 preparing-26.3 create-26.4 knead-26.5 turn-26.6.1 convert-26.6.2 performance-26.7

		rehearse-26.8 adjust-26.9
27	Engender Verbs	engender-27
28	Calve Verbs	calve-28
29	Verbs with Predicative Complements	appoint-29.1 characterize-29.2 dub-29.3 declare-29.4 conjecture-29.5 masquerade-29.6 orphan-29.7 captain-29.8 consider-29.9 classify-29.10
30	Verbs of Perception	see-30.1 sight-30.2 peer-30.3 stimulus_subject-30.4
31	Psych-Verbs (Verbs of Psychological State)	amuse-31.1 admire-31.2 marvel-31.3 appeal-31.4
32	Verbs of Desire	want-32.1 long-32.2
33	Judgment Verbs	judgment-33
34	Verbs of Assessment	assessment-34.1 estimate-34.2
35	Verbs of Searching	hunt-35.1 search-35.2 stalk-35.3 investigate-35.4 rummage-35.5 ferret-35.6
36	Verbs of Social Interaction	correspond-36.1 marry-36.2 meet-36.3 battle-36.4
37	Verbs of Communication	transfer_mesg-37.1.1 inquire-37.1.2 interrogate-37.1.3 tell-37.2 mannerSpeaking-37.3 instrCommunication-37.4 talk-37.5 chitChat-37.6 say-37.7 complain-37.8 advise-37.9 confess-37.10

		lecture-37.11 overstate-37.12 promise-37.13
38	Verbs of Sounds Made by Animals	animal_sounds-38
39	Verbs of Ingesting	eat-39.1 chew-39.2 gobble-39.3 devour-39.4 dine-39.5 gorge-39.6 feeding-39.7
40	Verbs Involving the Body	hiccup-40.1.1 breathe-40.1.2 exhale-40.1.3 nonverbal_expression-40.2 wink-40.3.1 crane-40.3.2 curtsey-40.3.3 snooze-40.4 flinch-40.5 body_internal_states-40.6 suffocate-40.7 pain-40.8.1 tingle-40.8.2 hurt-40.8.3 change_bodily_state-40.8.4
41	Verbs of Grooming and Bodily Care	dress-41.1.1 groom-41.1.2 floss-41.2.1 braid-41.2.2 simple_dressing-41.3.1 dressing_well-41.3.2 being_dressed-41.3.3
42	Verbs of Killing	murder-42.1 poison-42.2 subjugate-42.3
43	Verbs of Emission	light_emission-43.1 sound_emission-43.2 smell_emission-43.3 substance_emission-43.4
44	Destroy Verbs	destroy-44
45	Verbs of Change of State	break-45.1 bend-45.2 cooking-45.3 other_cos-45.4 entity_specific_cos-45.5 calabrabtable_cos-45.6
46	Lodge Verbs	lodge-46
47	Verbs of Existence	exist-47.1

		entity_specific_modes_being-47.2 modes_of_being_with_motion-47.3 sound_existence-47.4 swarm-47.5.1 herd-47.5.2 bulge-47.5.3 spatial_configuration-47.6 meander-47.8 contiguous_location-47.8
48	Verbs of Appearance, Disappearance, and Occurrence	appear-48.1.1 reflexive_appearance-48.1.2 disappearance-48.2 occurrence-48.3
49	Verbs of Body-Internal Motion	body_internal_motion-49
50	Verbs of Assuming a Position	assuming_position-50
51	Verbs of Motion	escape-51.1 leave-51.2 roll-51.3.1 run-51.3.2 vehicle-51.4.1 nonvehicle-51.4.2 waltz-51.5 chase-51.6 accompany-51.7 reach-51.8
52	Avoid Verbs	avoid-52
53	Verbs of Lingering and Rushing	linger-53.1 rush-53.2
54	Measure Verbs	register-54.1 cost-54.2 fit-54.3 price-54.4 bill-54.5
55	Aspectual Verbs	begin-55.1 complete-55.2 continue-55.3 stop-55.4 establish-55.5 sustain-55.6
56	Weekend Verbs	weekend-56
57	Weather Verbs	weather-57
58	Verbs of Urging and Begging	urge-58.1 beg-58.2
59	Force Verbs	force-59
60	Order Verbs	order-60
61	Try Verbs	try-61
62	Wish Verbs	wish-62
63	Enforce Verbs	enforce-63
64	Allow Verbs	allow-64

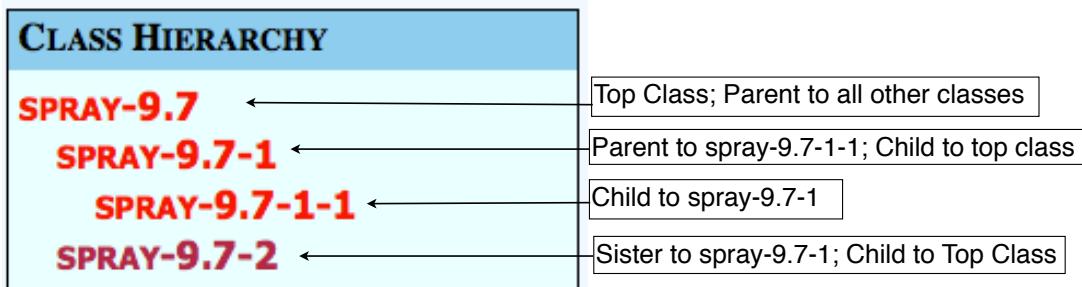
65	Admit Verbs	admit-65
66	Consume Verbs	consume-66
67	Forbid Verbs	forbid-67
68	Pay Verbs	pay-68
69	Refrain Verbs	refrain-69
70	Rely Verbs	rely-70
71	Conspire Verbs	conspire-71
72	Help Verbs	help-72
73	Cooperate Verbs	cooperate-73
74	Succeed Verbs	succeed-74
75	Neglect Verbs	neglect-75
76	Limit Verbs	limit-76
77	Approve Verbs	approve-77
78	Indicate Verbs	indicate-78
79	Dedicate Verbs	dedicate-79
80	Free Verbs	free-80
81	Suspect Verbs	suspect-81
82	Withdraw Verbs	withdraw-82
83	Cope Verbs	cope-83
84	Discover Verbs	discover-84
85	Defend Verbs	defend-85
86	Verbs of Correlating and Relating	correlate-86.1 relate-86.2
87	Verbs of Focusing and Comprehending	focus-87.1 comprehend-87.2
88	Verbs of Caring and Empathizing	care-88.1 empathize-88.2
89	Settle Verbs	settle-89
90	Exceed Verbs	exceed-90
91	Matter Verbs	matter-91
92	Confine Verbs	confine-92
93	Adopt Verbs	adopt-93
94	Risk Verbs	risk-94
95	Acquiesce Verbs	acquiesce-95
96	Addict Verbs	addict-96
97	Verbs of Basing and Deducing	base-97.1 deduce-97.2
98	Confront Verbs	confront-98
99	Ensure Verbs	ensure-99
100	Own Verbs	own-100
101	Patent Verbs	patent-101
102	Promote Verbs	promote-102
103	Require Verbs	require-103
104	Verbs of Spending Time	spend_time-104
105	Use Verbs	use-105
106	Void Verbs	void-106
107	Involve Verbs	involve-107
108	Multiply Verbs	multiply-108

109	Seem Verbs	seem-109
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Hierarchy of Verb Classes; 1-57 are based on Levin's "English Verb Classes and Alternations" (1993)

Verb Class Hierarchy Contents

Each individual class is also hierarchical in the sense that classes may include one or more “subclasses” or “child” classes, as well as “sister” classes. All verb classes consist of a top class, but some further specify behaviors of verb members by having one or more subclasses, which are denoted with a dash and a number after the class information (e.g., top class: spray-9.7, subclass: spray 9.7-1). Within any given VerbNet class, the hierarchy can be found in the top right corner; features of a class or subclass include all content from the Roles and Frames sections.



Class hierarchy for spray-9.7 class

Top Class – The highest class in the hierarchy; all features in the top class are shared by every verb in the class.

The top class of the hierarchy consists of syntactic constructions and semantic role labels that are shared by all verbs in this class. Occasionally the top class will only consist of content under the Frames section and no members will appear in the Member list. This indicates the syntax and semantics in the Frames are shared amongst all the members of the subclass(es). Verbs listed in the top class do not inherit features from subclasses unless they are explicitly listed as members in those subclasses.

No Comments	spray-9.7	Members: 0, Frames: 4	POST COMMENT	CLASS HIERARCHY
				SPRAY-9.7 SPRAY-9.7-1 SPRAY-9.7-1-1 SPRAY-9.7-2
MEMBERS	NO MEMBERS			KEY
ROLES	<ul style="list-style-type: none"> • AGENT [+ANIMATE] • THEME • DESTINATION [+LOCATION & -REGION] 			REF
FRAMES				REF KEY
NP V NP PP:DESTINATION				
EXAMPLE "Jessica loaded boxes into the wagon."				
SYNTAX AGENT V THEME {{+LOC -DEST_CONF}} DESTINATION				
SEMANTICS MOTION(DURING(E), THEME) NOT(PREP(START(E), THEME, DESTINATION)) PREP(END(E), THEME, DESTINATION) CAUSE(AGENT, E)				
NP V NP:DESTINATION PP:THEME				
EXAMPLE "Jessica loaded the wagon with boxes."				
SYNTAX AGENT V DESTINATION {WITH} THEME				
SEMANTICS MOTION(DURING(E), THEME) NOT(LOCATION(START(E), THEME, DESTINATION)) LOCATION(END(E), THEME, DESTINATION) CAUSE(AGENT, E)				
NP V NP:THEME				
EXAMPLE "Jessica squirted water."				
SYNTAX AGENT V THEME				
SEMANTICS MOTION(DURING(E), THEME) NOT(LOCATION(START(E), THEME, ?DESTINATION)) LOCATION(END(E), THEME, ?DESTINATION) CAUSE(AGENT, E)				
NP V NP:DESTINATION				
EXAMPLE "Jessica sprayed the wall."				
SYNTAX AGENT V DESTINATION				
SEMANTICS MOTION(DURING(E), ?THEME) NOT(LOCATION(START(E), ?THEME, DESTINATION)) LOCATION(END(E), ?THEME, DESTINATION) CAUSE(AGENT, E)				

Top class for spray-9.7 class; this class doesn't contain verbs in the Members section, but shows content in the Frames section shared by all the verbs in the subclasses.

Parent Class – Dominates a subclass; all features are shared with subordinate classes.

Subclasses – VerbNet subclasses inherit features from the top class but specify further syntactic and semantic commonalities amongst their verb members. These can include additional syntactic constructions, further selectional restrictions on semantic role labels, or new semantic role labels. Because subclasses inherit content from their parent classes, they can be considered as members of the parent class but with more specific features.

Selectional restrictions are added to the Theme role in this subclass

No Comments
spray-9.7-1
Members: 28, Frames: 2
[POST COMMENT](#) | [TOP](#)

MEMBERS				KEY
WASH (WN 8)	SCATTER (FN 1; WN 3, 4, 6; G 1)	SPATTER (FN 1; WN 1, 3)	SPURT (FN 1; WN 1)	
BRUSH (FN 1, 2; WN 6; G 2)	SEED (FN 1; WN 4)	SPLASH (FN 1; WN 3, 6; G 1)	SQUIRT (FN 1; WN 1, 2; G 1)	
DRIZZLE (FN 1, 2; WN 2)	SEW (FN 1; WN 1; G 1)	SPLATTER (FN 1; WN 1, 2)	STICK (FN 1; WN 1, 12, 13; G 1, 2)	
HANG (FN 1, 2; WN 2, 12, 14; G 1)	SHOWER (FN 1, 2; WN 1, 2, 5; G 1, 2)	SPRAY (FN 1; WN 1, 2, 3; G 1)	STREW (FN 1; WN 1, 2)	
PLASTER (FN 1; WN 2, 3, 4, 1, 5, 6)	SMEAR (FN 1, 2; WN 3, 2; G 1)	SPREAD (FN 1; WN 3, 9, 10; G 2, 3)	STRING (WN 1; G 1)	
PUMP (FN 1; WN 2, 4, 5; G 2)	SMUDGE (WN 1)	SPRINKLE (FN 1; WN 1, 4; G 1)	SWAB (WN 1, 2)	
RUB (FN 1; WN 1; G 1)	SOW (FN 1; WN 1, 3; G 1)	SPRITZ (WN 1, 2)	WRAP (FN 1, 2; WN 1, 2, 3; G 1, 2)	

ROLES		REF
• THEME [+SUBSTANCE [+CONCRETE & +PLURAL]]		REF

FRAMES		REF KEY
NP V PP.DESTINATION EXAMPLE "Paint sprayed onto the wall." SYNTAX THEME V {{+LOC +DIR +DEST_CONF}} DESTINATION SEMANTICS MOTION(DURING(E), THEME) NOT(PREP(START(E), THEME, DESTINATION)) PREP(END(E), THEME, DESTINATION)		REF
NP V NP PP.DESTINATION-CONATIVE EXAMPLE "Jessica squirted water at me." SYNTAX AGENT V THEME (AT) DESTINATION SEMANTICS MOTION(DURING(E), THEME) NOT(LOCATION(START(E), THEME, DESTINATION)) CAUSE(AGENT, E)		KEY

Further syntactic constructions and semantic predicates shared amongst the subclass members are listed, in addition to those featured in the top class

Subclass for spray-9.7 class; these members share content in the Frames section from the top class with additional syntactic and semantic features.

There can be multiple subclasses under a parent class, with the number of dashes denoting the level at which the subclass rests. In the example above, spray-9.7-1 is a subclass under the top class spray-9.7, which is its parent. The subclass spray-9.7-1-1 rests under the subclass spray-9.7-1, which is its parent class. Spray-9.7-2 is a sister to the spray-9.7-1 subclass, and is child to the top class spray-9.7.

Child Class – Is dominated by a parent class; inherits features from this parent class, but also adds information in the form of additional syntactic frames, thematic roles, or restrictions.

Sister Class – A subclass directly dominated by a parent class. This parent class also directly dominates another subclass, so the two subclasses are sisters to one another. Sister classes do not share features.

Semantic Role Labels and Selectional Restrictions

Semantic roles depict conceptual relations among participants in a sentence and illustrate the fundamental, “who, what, how, when, and where?” information contained in a sentence. These semantic role labels reveal the underlying semantics of the participants in a sentence so that alternations in syntax don’t influence their assigned roles. For instance, consider the following sentences:

- a. *Sandy shattered the glass.*
- b. *The glass shattered.*

The first sentence shows *Sandy* as the subject and *the glass* as the direct object, while in the second sentence *the glass* is the subject. By applying the semantic role labels Agent and Patient to these arguments, with *Sandy* as the Agent and *the glass* as the Patient, semantic roles are consistent despite the alternations in the syntax:

- a. *[Sandy] shattered [the glass.]*
[AGENT] [PATIENT]
- b. *[The glass] shattered.*
[PATIENT]

Selectional restrictions further specify semantic roles, and can be combined with operators such as | (OR) and & (AND). These restrictions denote the existence (+) or absence (-) of properties such as [CONCRETE], [ANIMATE], [ORGANIZATION], etc. that are a part of the semantic role label of a specific class. These restrictions are currently being revised. For further details on current semantic predicates and selectional restrictions, see Kipper 2005.

Within a VerbNet class, the list of semantic role labels for that subclass is given below the verb member list:

ROLES	REF
<ul style="list-style-type: none">• AGENT [+ANIMATE +ORGANIZATION]• THEME• RECIPIENT [+ANIMATE +ORGANIZATION]	

Semantic Role Labels for give-13.1 class with the OR operator

ROLES	REF
<ul style="list-style-type: none">• AGENT [+INT_CONTROL]• THEME [+CONCRETE]• LOCATION [+LOCATION & -REGION]	

Semantic Role Labels for modes_of_being_with_motion-47.3 class with the AND

operator

VerbNet semantic role labels are domain-general, meaning they aren't specific to one verb or class but can be found in several different verb classes within the database. The semantic role label Stimulus, for example, can be found in both the peer-30.3 and addict-96 classes:

NP V PP.STIMULUS

EXAMPLE "We peered at **the baby**."

SYNTAX **EXPERIENCER** V {{+SPATIAL}} **STIMULUS**

SEMANTICS **PERCEIVE(DURING(E), EXPERIENCER, STIMULUS)** INREACTION_TO(E, STIMULUS)

Peer-30.3 class: "*the baby*" is the *Stimulus* in this construction

NP V NP PP.STIMULUS

EXAMPLE "**I** addicted him to **Douglas Adams**."

SYNTAX **AGENT** V **PATIENT {TO} STIMULUS**

SEMANTICS **CAUSE(AGENT, E) DESIRE(RESULT(E), PATIENT, STIMULUS)**

Addict-96 class: "*Douglas Adams*" is the *Stimulus* in this construction

Semantic Role Hierarchy

VerbNet's thematic roleset has recently undergone revision, stemming in part from a systematic comparison of the previous roleset to that of another semantic resource, LIRICS (Linguistic Infrastructure for Interoperable Resources and Systems. This comparison demonstrated that the two resources differed in the level of granularity of thematic roles. Specifically, VerbNet often makes use of roles that help to distinguish different classes (for example, a *Topic* is a type of *Theme* that is specific to verbs of communication); whereas LIRICS only makes use of roles that are generalizable across all event types. Given that different applications benefit from rolesets of different granularities, we found that it is useful to have a hierarchy of thematic roles that can facilitate mapping across resources of differing granularity, as well as different types of NLP applications. This hierarchy is shown in Figure 1. For a full description of this process, see Bonial et al. (2011a and 2011b). For a mapping of previous roles to new roles, and a complete listing of all changes made in this process, see the Revision Mapping page on the UVI.

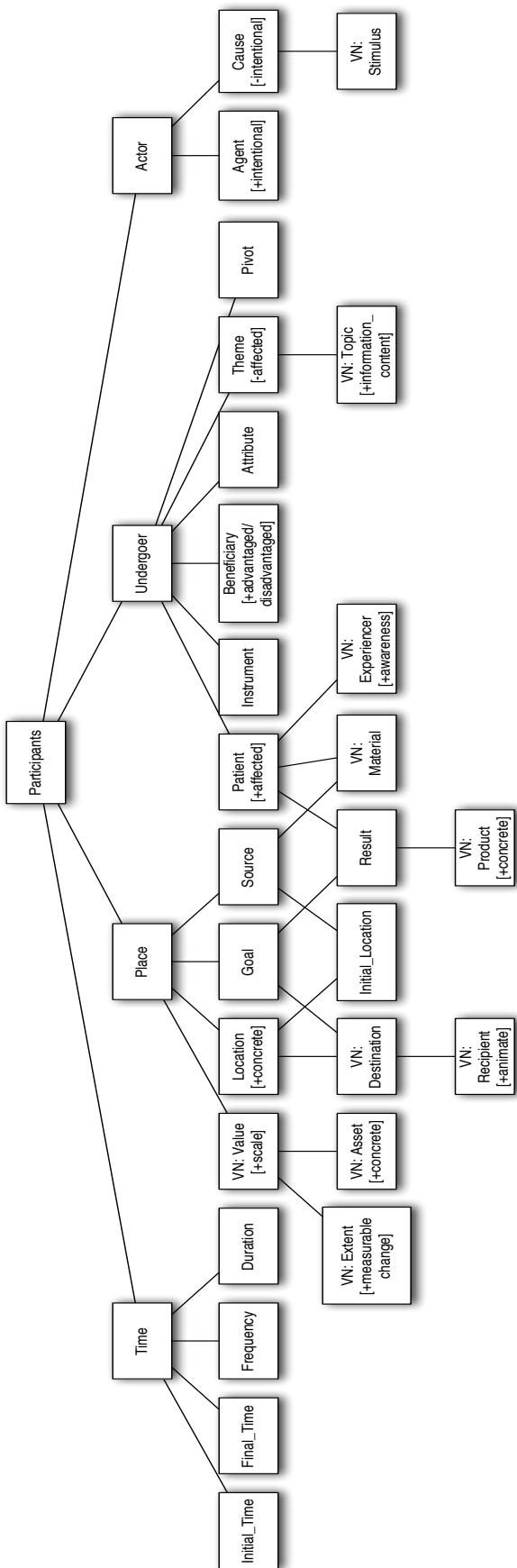


Figure 1. VerbNet Semantic Role Hierarchy

The hierarchy begins with a root node of Participant (Following James Allen, personal communication, Nov. 2009), which dominates the proto-roles Actor and Undergoer (VanValin & LaPolla, 1997). Roles that are not in a parent-child relationship can co-occur. For instance, Agent and Patient co-occur frequently, but Patient and Experiencer never co-occur. Parent-child relationships are governed by additional restrictions placed on the lower node, and in principle nodes that include restrictions may be thought of as either named semantic roles, such as Recipient, or as higher nodes plus feature sets (for Recipient, Goal [+concrete][+animate]).

The highest levels of this hierarchy, or the superordinate roles, are applicable to all verbs. As previously mentioned, the addition of restrictions on these roles will form the basis of subordinate roles. For example, in the hierarchy, Experiencer is subordinate to Patient, thus it inherits all features of Patient, but is characterized by the additional restriction *+awareness*; therefore, an Experiencer is a Patient who is aware of the process denoted by the verb that the participant is undergoing. The role Patient is underspecified for awareness. In some cases, the subordinate roles will be specific to certain event classes; for example, Topic is a Theme with the additional restriction *+information_content*; therefore, a Topic is a Theme in events of information transfer or communication verbs.

The roles that are instantiated in VN are the most specific roles possible for the given verb class. Thus, if a verb class contains all communication verbs, the class will be characterized by the role Topic. If the class contains both communication verbs involving information transfer, and other types of verbs involving a more general type of transfer, then Theme would be used. Some higher-level roles, such as Participant, Actor and Undergoer, are not instantiated in the classes at all. Rather, these roles are available only in the hierarchy to allow for flexibility in how VerbNet is used. With this hierarchy, users can select the level of granularity that is ideal for their task. The coarse-grained superordinate role can be used in place of a finer-grained subordinate role for tasks that require a roleset that has the broadest coverage across all verbs; conversely, fine-grained and class-specific roles can be used for tasks that benefit from information that helps to distinguish classes of verbs.

Current Semantic Role Labels in VerbNet

Role	Definition	Example Class(es)
<i>Actor</i>	Participant that is the instigator of an event.	Not currently instantiated, superordinate role in hierarchy only
<i>Agent</i>	Actor in an event who initiates and carries out the event intentionally or consciously, and who exists independently of the event.	admit-65, beg-58.2, cooking-45.3, force-59

<i>Asset</i>	Value that is a concrete object.	bill-54.5, pay-68
<i>Attribute</i>	Undergoer that is a property of an entity or entities, as opposed to the entity itself.	assessment-34.1, calabrabtable_cos-45.6
<i>Beneficiary</i>	Undergoer in a state or an event that is (potentially) advantaged or disadvantaged by the event or state.	cost-54.2, get-13.5.1
<i>Cause</i>	Actor in an event (that may be animate or inanimate) that initiates the event, but that does not act with any intentionality or consciousness; it exists independently of the event.	indicate-78, free-80
<i>Co-Agent</i>	Agent who is acting in coordination or reciprocally with another agent while participating in the same event (specific to events with symmetrical participants).	cooperate-73, meet-36.3
<i>Co-Patient</i>	Patient that participates in an event with another patient, both participate equally in the event (specific to events with symmetrical participants).	mix-22.1
<i>Co-Theme</i>	Theme that participates in an event or state with another Theme; both participate equally (thereby distinguishing this role from Pivot; specific to events with symmetrical participants).	cling-22.5, multiply-108
<i>Destination</i>	Goal that is a concrete, physical location.	bring-11.3, carry-11.4
<i>Duration</i>	Length or extent of time.	
<i>Experiencer</i>	Patient that is aware of the event undergone (specific to events of perception).	flinch-40.5, see-30.1
<i>Extent</i>	Value indicating the amount of measurable change to a participant over the course of the event.	calabrabtable_cos-45.6
<i>Final_Time</i>	Time that indicates when an event ends or a state becomes false.	Not currently instantited, hierarchy only
<i>Frequency</i>	Number of occurrences of an event within a given time span.	Not currently instantited, hierarchy only
<i>Goal</i>	Place that is the end point of an action and exists independently of the event	adjust-26.9, convert-26.6.2

<i>Initial_Location</i>	Source that indicates the concrete, physical location where an event begins or a state becomes true.	bring-11.3, carry-11.4
<i>Initial_Time</i>	Time that indicates when an event begins or a state becomes true.	Not currently instantited, hierarchy only
<i>Instrument</i>	Undergoer in an event that is manipulated by an agent, and with which an intentional act is performed; it exists independently of the event.	destroy-44, tape-22.4
<i>Location</i>	Place that is concrete.	appear-48.1.1, coil-9.6
<i>Material</i>	Patient that exists at the starting point of action (inheritance from Source), which is transformed through the event into a new entity; concrete or abstract.	deduce-97.2, knead-26.5
<i>Participant</i>	Entity involved in a state or event.	root node to the hierarchy
<i>Patient</i>	Undergoer in an event that experiences a change of state, location or condition, that is causally involved or directly affected by other participants, and exists independently of the event.	break-45.1, poison-42.2
<i>Pivot</i>	Theme that participates in an event with another theme unequally. Pivot is much more central to the event (thereby distinguishing it from Co-Theme).	own-100, require-103
<i>Place</i>	Participant that represents the state in which an entity exists.	*not instantiated in the classes
<i>Product</i>	Result that is a concrete object.	create-26.4, preparing-26.3
<i>Recipient</i>	Destination that is animate.	bill-54.5
<i>Result</i>	Goal that comes into existence through the event.	bend-45.2, break-45.1
<i>Source</i>	Place that is the starting point of action; exists independently of the event.	substance_emission-43.4
<i>Stimulus</i>	Cause in an event that elicits an emotional or psychological response (specific to events of perception)	sight-302., stimulus_subject-30.4
<i>Time</i>	Participant that indicates an instant or an interval of time during which a state exists or an event took place.	continue-55.3
<i>Theme</i>	Undergoer that is central to an event or state that does not have control over the way the event occurs, is not structurally changed by the event,	butter-9.9, hold-15.1

	and/or is characterized as being in a certain position or condition throughout the state.	
<i>Trajectory</i>		escape-51.1, push-12
<i>Topic</i>	The me characterized by information content transferred to another participant (specific to events of communication).	chit_chat-37.6, talk-37.5
<i>Undergoer</i>	Participant in a state or event that is not an instigator of the event or state	Not currently instantited, hierarchy only
<i>Value</i>	Place along a formal scale	cost-54.2

Syntactic Frames

VerbNet classes include syntactic constructions with information about other structures (such as prepositions that certain arguments require or sentential complements) explicitly labeled in the syntax. Prepositions required by the construction are denoted by curly brackets {}, with the possibility of one or more prepositions defined inside.

NP V NP PP.DESTINATION

EXAMPLE "Amanda carried the package **to** New York."

SYNTAX **AGENT** V **THEME** {**TO TOWARDS**} **DESTINATION**

Syntactic Frame for carry-11.4 class; this class allows for either Agent V Theme TO Destination or Agent V Theme TOWARDS Destination

NP V NP PP.THEME

EXAMPLE "It freed him **of** guilt."

SYNTAX **CAUSE** V **SOURCE** {**OF**} **THEME** <-SENTENTIAL>

Syntactic Frame for free-80 class; the Theme in this construction is specified as non-sentential.

Alternations included in the syntactic frames can range from transitive, intransitive, prepositional phrases, and a large set of diathesis alternations.

Semantic Predicates

The underlying components of meaning of an event and its participants are revealed in semantic predicates under the Frames section in a verb class. Semantic predicates such as CAUSE and MOTION are applied to reveal the core meaning of the construction. These predicates are used in conjunction in order to express the basic components of the verb, and the temporal dimension of the event is given by the event variable e with a start and end (START(e) and END(e)). Additional operators can be added to the predicates to further define the semantics of the construction, such as negation (NOT) and implied participants that don't explicitly appear in the construction (?).

SEMANTICS NOT(LOCATION(START(E), THEME, ?DESTINATION)) LOCATION(END(E), THEME, ?DESTINATION)
CONFINED(RESULT(E), THEME) CAUSE(AGENT, E)

Semantic Predicate for confine-92 class

ANNOTATION GUIDELINES

Does the Instance Fit the Class? Determining Membership in a Verb Class

A verb may be tagged for a VerbNet class if it is consistent with the content in the Roles and Frames sections, meaning the syntax and semantics should both determine whether the verb belongs to a class or not.

Semantics

Semantic role labels and their selectional restrictions provide information about participants in a sentence; to tag a verb instance as belonging to a VerbNet class, the sentence should have arguments that share the semantic roles listed in the class.

Example: *Sprain*

Instance: She [sprained] her ankle this weekend.

Sprain is a member of the hurt-40.8.3 class, which has the roles Experiencer and Patient:

ROLES	REF
• EXPERIENCER [+ANIMATE]	
• PATIENT [+BODY_PART +REFL]	

When determining whether an instance has the correct semantic role(s) for a class, the first step is to find the arguments in the sentence. These are the participants that the verb requires, whether they are present or implied in the usage. The verb *give*, for example, typically requires three arguments – the giver, the recipient, and the object given. The verb *run*, however, only requires one argument – the entity running. Adjuncts add further information to the sentence (usually temporal or locative information,) but aren't required by the verb. In the instance above, there are two arguments (*she* and *her ankle*) and one adjunct (*this weekend*).

If one of the semantic role labels in a class is not present in the instance, it's possible it is still implied.

Semantic predicates reveal the core meaning behind verb classes, and can be useful in determining whether the sense of the verb in an instance matches the underlying semantics of the class. The class hurt-40.8.3 has the semantic predicates HARMED and EXPERIENCE, which indicate that this class involves a participant who is experiencing some kind of physical injury or harm to the patient (specified here as *her ankle*). In the case of the verb *sprain*, the experiencer, *she*, has undergone a physical injury to a body part, a sprained ankle; this verb is therefore fitting with the semantic predicates given in the hurt-40.8.3.

SEMANTICS HARMED(DURING(E), PATIENT) EXPERIENCE(E, EXPERIENCER)

Syntax

Syntactic frames contain constructions in the class as well as prepositions, sentential complements, or additional information about the syntax the verbs generally appear in.

The give-13.1 class features the construction NP V NP PP.RECIPIENT, and the frame specifies the *to* preposition is necessary to introduce the recipient.

NP V NP PP.RECIPIENT

EXAMPLE "**They lent a bicycle to me.**"

SYNTAX **AGENT** **V** **THEME** {**TO**} **RECIPIENT**

Give-13.1 class syntactic frame

The syntax of a class can often help in cases where two classes share similar semantics.

Verbs Represented in Multiple Classes

Many verbs occur in multiple classes in the VerbNet database, and membership in each class indicates a distinct sense of the verb. Semantic role labels, semantic predicates, and the syntax of an instance could all help to distinguish the correct class for any verb instance. In some cases, one feature could be a more useful indicator than others for determining which class it should be tagged in.

It is possible there are other senses of a verb that aren't represented by the class membership in VerbNet. If an instance of a verb has a sense that is not represented in its classes, this instance should be tagged N/A.

Example 1. Stir

Instance: The earliest finding of archaeopteryx in the state of Bavaria, Germany, [stirred] the whole world. (Xinhua corpus)

The verb *stir* belongs to three classes, each depicting a different sense of the verb:

VerbNet class	Example	Semantic Role Labels	Semantic Predicates
amuse-31.1	The story stirred the audience.	Experiencer, Stimulus	CAUSE, EMOTIONAL_STATE
modes_of_Being_with_Motion-47.3	The leaves stirred over the grass	Agent, Theme, Location	EXIST, MOTION
shake-22.3-1-1	Herman stirred the cream	Agent, Patient	CAUSE, DEGRADATION_MATE RIAL INTEGRITY

The semantic role labels in an instance can help to distinguish membership in one class over another; in the example above, *stir* has distinct semantic role labels (Experiencer, Cause, Theme, Location, Patient) depending on the class. Assessing the semantic roles of this verb instance can help determine its suitability in one class over another.

This sense of the verb *stir* relates to a stimulus causing an emotional reaction in another participant. The participant [the earliest finding of archaeopteryx] is the stimulus causing the emotional response, whereas [the whole world] is the entity experiencing that emotional state. Semantic role labels Stimulus and Experiencer are present, and the syntax also fits the syntactic frame and semantic predicate information given in the amuse-31.1 class. The most appropriate classification for this instance is the amuse-31.1 class.

Example 2: *Employ*

Instance: Mining will encourage foreign businessmen to [*employ*] new high level technology to participate in the technical transformation of China 's enterprises.

Although it's often the case that semantic role labels will vary given the class sense, it's possible semantic role labels could be similar between two different classes for a given verb. The verb *employ* belongs to two classes that share similar semantic role labels:

VerbNet class	Example	Semantic Role Labels
hire-13.5.3	I employed two secretaries.	Agent, Theme, Attribute
use-105	I employed a hammer to hang the picture	Agent, Theme, Predicate

Despite the similarity in the semantic role labels, the syntactic constructions vary amongst the *hire-13.5.3* and *use-105* classes, and the semantic predicates reveal entirely different meanings inherent to the verb. The *hire-13.5.3* class features predicates CAUSE and LOCATION, and the frame below shows this verb class relating to an agent causing a theme to move into a location:

NP V NP	
EXAMPLE	"I hired two secretaries."
SYNTAX	<u>AGENT</u> V <u>THEME</u>
SEMANTICS	CAUSE(AGENT, E) NOT(LOCATION(START(E), THEME)) LOCATION(END(E), THEME)

Frame for the *hire-13.5.3* class

The semantic predicate USE is given for the *use-105* class, which relates to an agent using a theme for some purpose:

NP V NP S_INF

EXAMPLE "I used the cupboard to store food."

SYNTAX AGENT **V** THEME PREDICATE <+VC_TO_INF>

SEMANTICS USE(DURING(E), AGENT, THEME, PREDICATE)

Frame for the use-105 class

For the instance below, the semantic role labels, semantic predicate (USE) and syntax of the verb *employ* fit the use-105 class:

Mining will encourage [foreign businessmen] to [employ] [new high level technology] to participate in the technical transformation of China's enterprises.

The most appropriate classification for this instance is therefore the use-105 class.

Determining what is a “Verb” to be tagged

Several instances may appear in which the predicate to be tagged is not a verb. These can sometimes be difficult to identify, but non-verbal predicates should not receive a tag in VerbNet annotations.

Nouns

Gerunds:

A gerund looks like the progressive *-ing* form of a verb but is functioning as a noun. Since gerunds have both verbal and nominal properties, it is sometimes difficult to distinguish a gerund from a verb. If it is followed by “be” or if it follows a preposition, then it is a gerund.

- *Running is* an important activity for health
- The U.S. conference *on wiping* out crime has passed the planning stages.

Determiner test:

If a verb is preceded by a determiner, such as *the, a, an, that, those, this, or these*, it is a noun.

- I'm off to the deck to have *a sit*.

Infinitives:

The infinitive occurs with “to” + the bare form of a verb. When it is a noun, it usually appears at the beginning of the sentence and is followed by “be”.

- *To run is* a pleasant activity.

Adjectives

Adjectives:

If a predicate occurs between a determiner (the, a, an, that, those, this, or these,) and a noun, it is an adjective.

- The *trapped* bear growled at the *wailing* cat.

Predicate Adjectives:

A predicate adjective is linked to the noun it modifies with “be”. For example, in “the trees are green,” *green* is a predicate adjective. The past participle form of a verb can appear similar to a predicate adjective. Consider, for example, “the car was *towed*” – is *towed* an adjective or a past participle?

The presence of verbs like “seem”, “feel”, “become”, and “look” before the questionable predicate can indicate that it is an adjective.

- John seems/felt/became trapped. (adjective)
- They seem wiped out. (adjective)
- *The car seems/felt/became towed. (verb)

A degree adverb like “quite”, “rather”, “very”, and “less” is also a potential diagnostic for distinguishing the past participle verb from the adjective. Degree adverbs only work with adjectival uses, so the following examples are all verbal:

- *King Louis XIV saw his palace very destroyed by the mob (verb)
- *The onlookers saw the situation very controlled by the police (verb)

Adjectives in Reduced Clauses:

A relative clause is a subordinate clause that modifies a noun. Relative clauses begin with a complementizer such as “that” or “which” and are followed by a conjugated verb. In the sentence, “I’ve heard a rumor that Dr. Smith is leaving his post,” *that Dr. Smith is leaving his post* is a relative clause.

The complementizer + “be” (such as “that are” or “which are”) isn’t present in a reduced relative clause; for instance, “the man killed was my husband” is a reduced relative clause as opposed to its relative clause counterpart “the man *that was killed* was my husband”. Reduced relative clauses can make the predicate of the clause appear as a past tense verb but could be a predicate adjective:

- The workers *exposed* numbered in the thousands

The passive by-phrase can help to make this determination. If the by-phrase is permissible, the clause is a reduced passive. If the phrase sounds strange, it’s adjectival:

- The workers *exposed by the press* numbered in the thousands. (verb)

Auxiliaries and Semi-Auxiliaries

Auxiliary verbs can carry information about inflection or express information regarding tense, aspect, or mode, but don't contain the semantic content of a sentence. In this sense, auxiliaries are contributing information to the main verb but aren't carrying the crucial information about the event in the way a main verb does. An example of an auxiliary verb is *have* in the sentence "I have heard this song before" where the main verb is *hear*. A sentence could have multiple auxiliary verbs, such as "I have been visiting her often," where *have* and *be* are both auxiliaries. Common auxiliary verbs include *have, do, be, might, may, can, and could*.

Semi-auxiliaries are auxiliary verb-particle combinations such as "have to", "be able to", "be going to", and "be about to". A good diagnostic is that most of these are phonologically reducible when in the semi-auxiliary position, e.g. "have to" -> "hafta".

Auxiliaries and semi-auxiliaries should not be tagged in VerbNet annotations.

Light Verbs

Light verbs carry less semantic content than the typical instance of the verb and are followed by a noun or preposition in a V+(article) + N or V + PP form. The verb *take*, for instance, is a light verb in the following phrases: *take a nap, take a hike, take a bath, or take into consideration*. In these constructions, the bulk of the event's semantic content is expressed by the deverbal noun rather than the verb: *nap, hike, bathe, consider*.

Verbs such as *take* and *have* appear in VerbNet under several classes and therefore might appear in several annotation instances. Occasionally they might surface as light verbs; if they appear in an instance as a light verb, they should not be tagged.

Figurative Uses of Verbs

A verb used in a figurative sense could still manifest the syntactic and semantic behaviors that correspond to a VerbNet verb class. Many classes have selectional restrictions that specify animacy or concreteness in a participant, and therefore might be less suitable for metaphorical use. However, if the semantic role labels and their selectional restrictions, as well as syntax, and semantic predicates are consistent with the figurative instance, the verb should still be tagged in that class.

Example: *Smell*

Instance: He [*smelled*] trouble in the air

Some possible senses of the verb *smell* include:

1. Perceive through olfactory sense (literal)
2. Perceive or discover (metaphorical)

For the instance above, the verb *smell* belongs to four classes. Two classes share the semantic role labels Experiencer and Stimulus but the syntactic constructions differ:

VerbNet class	Example	Semantic Role Labels	Syntax
see-30.1	I saw him laughing	Experiencer, Stimulus	Experiencer V Stimulus
smell_emission-43.3	The onions reeked	Theme, Location	Theme V
stalk-35.3	I stalked the woods for game	Agent, Theme, Location	Agent V Location {for} Theme
stimulus_subject-30.4	That pea soup tasted delicious	Experiencer, Stimulus	Stimulus V ADJ

Since the sentence “he smelled trouble in the air” contains the Experiencer *he* reacting to a Stimulus *trouble*, the candidates for this instance are the see-30.1 and stimulus_subject-30.4 classes. The see-30.1 class fits the syntax of this example and is therefore the best fit for this verb instance.