STATIVE VERBS: CONCEPTUAL STRUCTURE, HIERARCHY, SYSTEMIC RELATIONS

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Abstract. The study is focused on the semantic and conceptual description of stative verbs. We analyze stative verbs represented in WordNet and the corresponding frames in FrameNet after the alignment between the two resources. After presenting a classification of stative verbs into thematic classes, we outline the components of the conceptual description based on FrameNet frames, the relations between them and the frame elements that describe the frames. We attempt at building a hierarchical structure of frames for each thematic class and a shallow hierarchy of frame elements with a view to their representation and specialization from a more general (parent) frame to more specific (child) frames related to the general one by means of relations such as inheritance, weak inheritance or perspectivization.

Keywords: *conceptual description, conceptual hierarchies, FrameNet, WordNet*

1. Introduction

The study focuses on the semantic description of stative verbs based on the conceptual frames in FrameNet, which offer a largely language-independent model of the semantic representation of lexical items.

The presented results are part of a comprehensive study aimed at creating an ontology of stative situations in Bulgarian and Russian and their linguistic modeling. The aim of this work is to outline the principles for analysis and description of the conceptual structure of stative predicates with a view to building a uniform and consistent system of frames with a set of corresponding relations between them that reflect the specific features of the semantics of stative predicates.

As a result, we offer a classification of stative predicates into thematic classes, which is theoretically grounded on previous analyses and is further refined both from a theoretical and from an applied perspective with a view to the FrameNet-based conceptual description of verbs. The backbone of the classification is formed by the verb classes defined in Paducheva (1996) and further refined in a following work

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(Paducheva 2004), with clarifications and additions from Spencer and Zaretskaya (2003) and Van Valin and LaPolla (1997).

The analysis focuses on three main aspects. First of all, we look at frames and the configurations of the essential participants within the frames (frame elements, FEs), which uniquely characterize individual classes and subclasses of stative situations, as well as the main semantic restrictions imposed on FEs. Based on preliminary observations on verbs, conclusions are drawn about the validity of the frames defined in FrameNet and, where necessary, existing frames are adapted or new ones are created so as to cover the semantic properties of stative verbs.

Secondly, we analyze the relationships between frames within the thematic classes and subclasses of the classification of states. Verbs of the same class have a common invariant semantics that is further elaborated in individual members of the (sub)class, thus these verbs are described by a set of frames with similar semantics exhibiting certain semantic relations between them. For example, there are close relations between the verbs expressing desire and intention and emotion verbs, and this is reflected by an inheritance relation between the more general and the more specific frames (*Experiencer_focused_emotion* > *Desiring*). Specialization within the class of desire predicates results in assigning several different frames to these predicates, the most general frame is *Desiring*, and the more specific ones are *Intention, Preference*, and *Necessity* related to *Desiring* by a hierarchical inheritance relation. Semantic specialization is expressed through different but frame-invariant configurations of FEs, including the narrowing of the semantics of certain FEs, the realization of different numbers of elements in the more specific frames, some of which have no counterpart in the superordinate frame. This, in turn, is reflected by the semantic and syntactic restrictions on the realization of the elements.

Thirdly, the system of typical core FEs for stative frames within each class is presented in a shallow hierarchy, in which the FEs are described with their realization in different (groups of) frames within each class.

The research and created resource of stative frames and description of typical FEs can find application for the purposes of automatic identification of stative predicates and their corresponding arguments in text (semantic role labeling), semantic disambiguation, etc.

2. Overview of Studies on Stative Predicates

Stative predicates are studied from several theoretical and applied perspectives: (i) in terms of their semantically-grounded syntactic behavior (Levin 1993; Pinker 1989; Goldberg 1994, among many others); (ii) their thematic structure (Chafe 1970; Longacre 1976; Van Valin, LaPolla 1997) or conceptual description (Fillmore 1982), and (iii) their aspectual properties (Vendler 1957; Dowty 1979; Pustejovsky 1991; Van Valin, LaPolla 1997, to mention but a few). An intriguing research problem is the

interaction between the two types of description, especially in view of the specifics of aspectuality in the Bulgarian language.

To the best of our knowledge, the most complete description of states from the point of view of their invariant semantics and similar syntactic behavior was presented for Russian by Paducheva (Paducheva 1996) with subsequent additions in a following work (Paducheva 2004). An overview of this classification with a focus on Bulgarian and in comparison with Russian is offered in Leseva et al. (Leseva et al. 2021a; Leseva et al. 2021b). Another, more generalized classification is proposed by Van Valin and LaPolla (1997). The comparative analysis of these studies demonstrates that a different scope of the description of the states and a different granularity of the individual classes are applied.

Studies of the aspectual properties of predicates consider states as one of the main aspectual classes (Vendler 1957; Dowty 1979; Pustejovsky 1991; Van Valin, LaPolla 1997, among others). In general, states are characterized as non-dynamic and temporally unbounded predicates, which are represented by the following combination of features [+static]; [–telic]; [–punctual] (Van Valin, LaPolla 1997: 92–93). Distinctions are also drawn within the class of stative verbs. Carlson (1980) divided states into two groups: properties of objects (individual-level properties) and properties of intervals (stage-level properties), the former being valid at any moment, and the latter – during a certain time interval. The predicates of the first type express permanent properties or states of an object (*Ivan **believes** in ghosts*), and the predicates of the second type correspond to transitory, temporary states (*Ivan **lives** in a flat*). Within stative situations, Paducheva distinguishes between properties and relations, on the one hand, and states, on the other (Paducheva 1996: 126). The former are permanent, atemporal, while the latter are temporally localized. Moreover, states can be temporary, localized in a given relatively short time interval, or permanent, localized in extremely long time intervals (Paducheva 1996: 136–137). The distinction is motivated by the linguistic behavior of the individual subclasses in terms of their compatibility with different temporal expressions (*now, always,* etc.), the possibility of expressing repetition, of using an inceptive (with *begin*, *start*), etc.; their compatibility with circumstantial expressions for place, etc. In the classification presented by Paducheva (1996: 129–131, 136–138, 149–151) semantic classes are combined with aspectual ones.

Here we adopt the classification of stative predicates presented by Paducheva (1996, 2004) supplemented and revised with classes from other classifications (Spencer, Zaretskaya 2003; Van Valin, LaPolla 1997), following roughly the analysis presented in Leseva et al. (2021a, 2021b).

3. Stative Verbs in Lexical-Semantic Resources

The present study relies on two main resources – WordNet and FrameNet, and in particular, verbs representing stative predicates in both resources.

3.1. WordNet

WordNet[1] (Miller 1997; Fellbaum 1998) is a large lexical database that represents comprehensively conceptual and lexical knowledge in the form of a network whose nodes denote cognitive synonyms (synsets) interconnected through a number of conceptual-semantic and lexical (including derivational) relations such as hypernymy, meronymy, etc. The main relation that determines WordNet's structure is the relation of hypernymy.

The original Princeton WordNet has prompted the construction of similar linked networks, including for Bulgarian and other Balkan and Slavic languages, among others, where the corresponding synsets in individual wordnets are related to each other through unique interlingual identifiers. The lexical and conceptual knowledge is thus aligned cross-linguistically, which makes it possible for inter-lingual studies of semantic and syntactic correspondences to be conducted. In this paper we use the data from the Princeton WordNet and the Bulgarian WordNet (Koeva 2006).

3.2. FrameNet

FrameNet (Baker et al. 1998) is a resource which couches lexical and conceptual knowledge in the apparatus of frame semantics. Frames are conceptual structures describing particular types of objects, situations, or events along with their components, called frame elements, or FEs (Baker et al. 1998; Ruppenhofer et al. 2016). For our purposes, we deal particularly with core FEs, which instantiate conceptually necessary components of a frame, and which in their particular configuration make a frame unique and different from other frames. Frames in FrameNet are exemplified by a set of lexical units (LUs) where a LU is a pairing of a word with a meaning and its conceptual semantics is represented by the frame. FrameNet's theoretical framework has been adopted for Bulgarian and extended into an even richer model which accounts for language-specific features, including verb aspect, semantic and syntactic diatheses and syntactic alternations, among others (Koeva 2010).

FrameNet frames are organized into a hierarchical network by means of a number of hierarchical and non-hierarchical frame-to-frame relations (Ruppenhofer et al. 2016: 81–84). Here we list the hierarchical relations, which bear most relevance to the internal structure of thematic verb classes. These are: Inheritance – a relationship between a parent frame and a more specific (child) frame, such that the child frame elaborates the parent frame; Uses (also called 'weak inheritance') – a relationship between two frames where the first one makes reference in a very general kind of way to the structure of a more abstract, schematic frame; Perspective – a relation indicating that a situation viewed as neutral may be specified by means of perspectivized

[1] https://wordnet.princeton.edu/; Princeton WordNet may be explored online at: http://wordnetweb.princeton.edu/perl/webwn.

frames that represent different possible points-of-view on the neutral state-of-affairs; Subframe – a relation between a complex frame referring to sequences of states and transitions, each of which can itself be separately described as a frame, and the frames denoting these states or transitions.

In this paper, we explore stative frames and their corresponding FEs in order to outline the typical frames providing conceptual description of predicates within each of the semantic classes. Stative frames in FrameNet stem from the top node *State*; it describes a state-of-affairs where a concrete or abstract entity (Entity) persists in a stable situation called a State. The set of frames inheriting *State* includes over 130 members and covers many of the thematic classes of stative predicates. Stative frames are identified outside the *State* frame tree (Section 3.3).

The verbs associated with the studied frames are compiled from FrameNet (the verb language units that evoke the relevant frames) and from WordNet by virtue of the alignment between the two resources. For this purpose, we use a mapping of WordNet verb synsets to FrameNet frames in order to use the frames as the means to describe the conceptual structure of the verb predicates. The mapping approaches and procedures employed previously and the obtained results are summed up in Leseva, Stoyanova (2019, 2020a, 2020b). At present, we use a mapping of around 6,000 synsets with assigned frames that have been manually verified. With respect to stative predicates we have observed that only about 42% have a frame assigned and verified. One of the reasons is that FrameNet still lacks a fully adequate set of frames to describe the properties and semantic and syntactic restrictions of stative predicates. This necessitated the devising of new stative frames (see Section 5.1.4).

3.3. Dataset Compilation

Our dataset consists of WordNet verb synsets with stative meaning, which have been assigned frames from FrameNet. Our analysis uses both information extracted from WordNet (such as synonyms in the dataset, translational equivalents in Bulgarian, Russian and English) and frame description and relations from FrameNet (description and semantic restrictions of FEs, frame-to-frame relations of inheritance, etc.).

A set of procedures has been applied for the selection of stative verbs to be included in the dataset aiming at representativeness across thematic classes of stative predicates (see Section 5).

(1) Synsets from WordNet were selected on the basis of their membership to the semantic class of stative verbs, along with their hyponyms regardless of their semantic class[2]. These include predicates with various semantics belonging to the

[2] The verbs in WordNet are divided into 15 semantic primitives, such as verb.change, verb.social (verbs of social interaction), verb.motion, verb.cognition, etc. (Miller et al. 1991; Miller, Fellbaum 2007). Stative verbs fall within the class verb.stative, a heterogeneous group united by a shared membership to the aspectual class of states. Some stative verbs are found

aspectual class of states. In this way we extracted 752 synsets of the category verb. stative as well as another 155 synsets of other categories such as verb.emotion, verb. cognition, etc.

(2) Using the mapping between WordNet and FrameNet, we extracted synsets which have been assigned particular stative frames from FrameNet that have been selected as representative for the thematic classes although not directly descending from *State* (see Section 5). In this way we complemented the dataset with additional 1306 synsets. Further, we also added synsets where their assigned frames were related to these frames (additional 608 synsets).

(3) We also extracted synsets which have been assigned stative frames from FrameNet. These are frames related by inheritance (Is Inherited by) or weak inheritance relations (Uses) to the frame *State* (Definition: An Entity persists in a stable situation called a State). Another 194 synsets have been added to the dataset.

(4) Additionally, we supplemented the data with verbs from specific semantic classes by manually selecting relevant synsets and WordNet trees. For example, in order to ensure coverage of speech states we extract verbs of the class verb. communication and manually select subtrees such as *disagree*:1; *differ*:1; *dissent*:2; *take issue*:1 'be of different opinions' and its hyponyms, or individual synsets such as *excuse*:2; *explain*:1 'serve as a reason or cause or justification of'. Using this approach we added a total of 61 synsets to the dataset for the classes of *Speech states, Emotions, Perceptive states*, etc.

Using the procedures, we have compiled a dataset of 3076 verb synsets. Each selected synset has been assigned to a thematic class automatically based on the frame they were mapped to. The relevant frames in each thematic class have been selected manually on the basis of the actual verbs suggested as examples in the classification of Paducheva (1996, 2004) and supplemented with their synonyms, with other verbs evoking the same frame and verbs evoking closely related frames. The inventory of frames to select from has been derived from the structure of FrameNet, starting with the most abstract stative frame *State* and its descendants (frames related to it through frame-to-frame relations). The stative frame inventory has been further supplemented with frames assigned to verbs with stative meaning (having the WordNet class verb. stative) or hyponyms of such verbs.

In such a way, both lexical resources have been used to enrich the set of stative verbs and frames, as well as to complement each other. 1817 synsets are assigned to thematic classes with 1259 synsets for which a suitable class could not be determined automatically.

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in other groups to which they belong semantically, for example, in the class of cognitive verbs, verbs for emotions, bodily states, possession, etc. The division of the nouns and verbs into classes reflecting the semantic primitive distinction, along with short definitions of the primitives are available at: https://wordnet.princeton.edu/documentation/lexnames5wn.

Subsequently, FrameNet frames assigned to the selected verbs have been analyzed with a view to the (hierarchical) relations between them, in order to build a uniform conceptual description of each stative verb class and to deduce the generalized invariant frame characterizing each class.

Thematic class		**#synsets**	**Thematic class**		**#synsets**
A1	Physical parameters and inherent properties	34	B1	Speech states	206
A2	Spatial relations	291	B2	Intent, will and desire	78
A3	Relations between facts and events	63	B3	Modal states	67
A4	Relations between objects and sets: inclusion, similarity, possession	372	B4	Observed (perceived) states	46
A5	Semiotic relations	24	B5	Physical and physiological states	61
A6	Properties of set	5	B6	Emotional states, relations and internal experiences	124
A7	Disposition	7	B7	Mental states	315
C	Behaviors	11	B8	Perceptive states	33
D	Occupations	7	B9	Predicates of existence and presence	73

Table 1. Distribution of thematic classes in the dataset.

4. Classification of Stative Predicates with a view to their Conceptual Description

The proposed classification of stative predicates (Figure 1) unifies information from several sources aligned and enriched so as to form a consistent semantic and syntactic description. The classification is based on the verb classes defined in Paducheva (1996, 2004), with clarifications and additions from Spencer and Zaretskaya (2003) and Van Valin and LaPolla (1997).

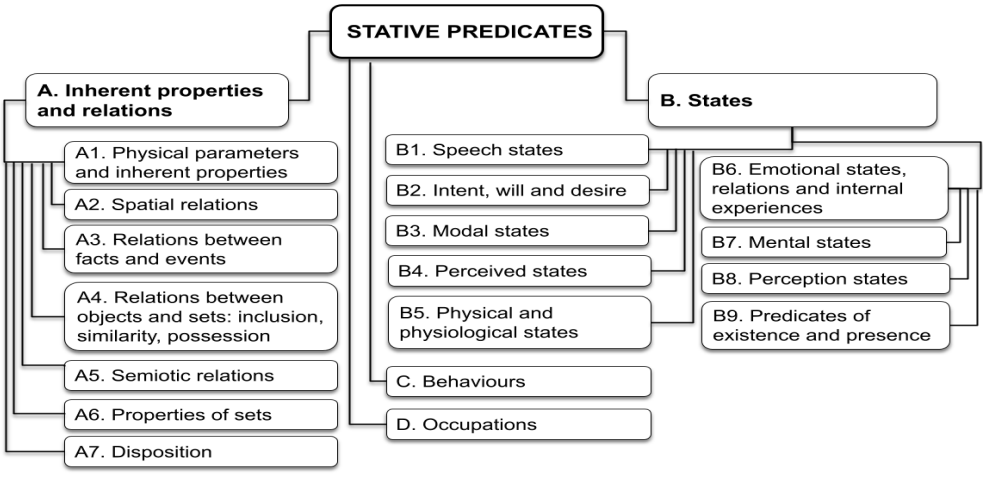


Figure 1. General thematic classes of stative predicates.

The skeleton of the classification is formed by the FrameNet frames that serve as subclasses of each thematic verb class, presenting various levels of specialization or modification within the class. The classification thus represents a shallow conceptual hierarchy, where each general classification category is instantiated by a number of more specific subclasses (frames) and verbs that belong to these classes.

For instance, the thematic class of *Intent, will and desire*, which is closely related to the class of *Emotional states, relations and internal experiences*, is represented by four frames: *Desiring, Preference, Purpose* and *Needing*. The semantic similarity among these frames is reflected in the hierarchical organization of this part of the FrameNet structure (Figure 2). The frame *Desiring* may be considered as the prototypical or invariant frame, which describes the semantics of the class in most general terms. Its semantics is further elaborated, specified or perspectivized in the remaining frames. *Preference* inherits *Desiring* (i.e. the relation Inheritance holds between them), which is evident in the correspondence between the configuration of the FEs of the two frames. The more specific frame has one more FE that models additional aspects of the meaning. The frames *Purpose* and *Needing* use the frame *Desiring*: the weak inheritance between the parent and the children corresponds to the different FE configurations; yet there is strong correspondence between parts of them (see Section 5.3.2 and Figure 11).

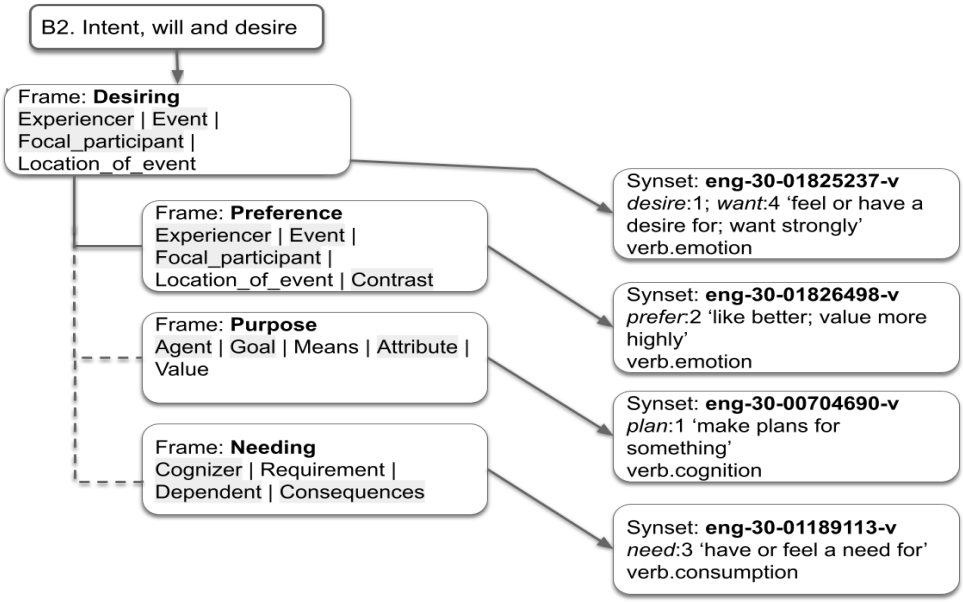


Figure 2. Internal organization of the thematic class of *Intent, will and desire* (dashed lines show weak inheritance based on the Uses frame-to-frame relation in FrameNet).

The classification is further fleshed out by verbs that evoke the different frames in each thematic class, which share the common conceptual description outlined in the frame's definition and represented as a similar configuration of FEs. The specific selectional restrictions of the FEs, along with the typical semantic and syntactic patterns, however, may vary within certain limits for the individual verbs in the frame. Consider the frame *Desiring* whose FrameNet description is partly displayed in Example 1.

Example 1.

(FrameNet) Frame *Desiring*[3]. Definition: An **Experiencer** desires that an **Event** occur. In some cases, the **Experiencer** is an active participant in the **Event**, and in such cases the **Event** itself is often not mentioned, but rather some **Focal_participant** which is subordinately involved in the **Event**.

[3] Each frame (along with the frame-to-frame relations and the lexical units that evoke them) may be accessed through the online FrameNet interface: https://framenet.icsi.berkeley.edu/fndrupal/framenet_search. We use the frame and FE definitions provided there.

Core FEs: **Event** [State_of_affairs]; **Experiencer** [Sentient], **Focal_participant** [Entity]; **Location_of_event** [Location]

FrameNet examples:

[I]$_{\text{EXPERIENCER}}$ only WANTED [one piece of candy]$_{\text{FOCAL\_PARTICIPANT}}$.

[The company]$_{\text{EXPERIENCER}}$ *was* EAGER [for him]$_{\text{FOCAL\_PARTICIPANT}}$ [to leave as soon as possible]$_{\text{EVENT}}$.

[The prince]$_{\text{EXPERIENCER}}$ WISHES [you]$_{\text{FOCAL\_PARTICIPANT}}$ [here]$_{\text{LOCATION\_OF\_EVENT}}$ before matins.

(WordNet) Part of the hypernym tree of *desire*:1; *want*:4 with corresponding lexical units in the FrameNet frame *Desiring*

- *desire*:1; *want*:4 'feel or have a desire for; want strongly'
  -- *wish*:4 'hope for; have a wish'
  -- *fancy*:2; *go for:*4; *take to:*1 'have a fancy or particular liking or desire for'
  -- *feel like*:1 'have an inclination for something or some activity'
  -- *crave*:2; *hunger*:2; *thirst*:1; *starve*:5; *lust*:2 'have a craving, appetite, or great desire for'
  -- *hanker*:1; *long*:8; *yearn*:3 'desire strongly or persistently'
  --- *ache*:1; *yearn*:2; *yen*:1; *pine*:1; *languish*:3 'have a desire for something or someone who is not present'
  -- *ambition*:1 'have as one's ambition'

Verbs such as *desire* and *want* express more general meaning and impose fewer selectional restrictions on their FEs as compared to verbs such as *hanker*, *yearn*, *long*, *pine*, *languish*, *ache*, *ambition*, *feel like*, etc. An obvious difference among the individual verbs in the thematic class would be that the selectional restrictions on the FEs Focal_participant and Event would be partially distinct. For instance, the Focal_participant or Event associated with *feel like* would most likely be something to eat or drink or an associated activity, while the ones typical of *ambition* or *aspire* would tend to be abstract activities, state-of-affairs or entities.

The variations in the semantics of individual verbs have to do not only with the selectional restrictions of the FEs, but with the actual configurations of FEs observed. Semantic patterns involving the Experiencer, the Focal_participant and the Event are found with various verbs from the class, while semantic patterns including the FE Location_of_event are more verb-specific; they are thus more feasible with the prototypical representatives of the class, i.e. *want* and *desire*, more difficult to find with *yearn*, *long*, *pine*, etc. and quite unfeasible with *ambition* or *feel like*.

While the general thematic classes are set out in advance on the basis of existing classifications of stative verbs, the frames (and the associated verbs) relevant to each thematic class are identified empirically on the basis of the extensive verb lexis

provided in WordNet. The analysis results in the further refinement of the classification by redefining, enriching and subdividing the classification categories.

5. Modeling the Thematic Classes of Stative Predicates

5.1. Outline of the Model

Each thematic class is represented by a number of FrameNet frames that capture finer-grained semantic distinctions among the verbs in each class. The interconnectedness established through frame-to-frame relations within the thematic classes attests to the internal organization of the lexis (more explicit in WordNet's hierarchical structure) and translates into the structured conceptual description of semantically related portions of the verb lexicon.

5.1.1. Frames Representing a Thematic Class

For each thematic class we determine an *invariant frame* that represents the verbs in the class in a generalized form by including the most essential, invariant FEs common to the class. The invariant frame can be either an existing FrameNet frame or an abstract construct. A class with a well-defined internal structure typically includes an invariant frame that is situated close to the root or is itself the root of the frame hierarchy. It is generally specified so as to accommodate its more specific descendants. The FEs whose specific configurations determine the frame are also more generally defined than the FEs of the more specific frames in the given thematic class.

The frames within the thematic class elaborate on the invariant frame. In a well-defined class, at least a large part of the more specific frames are direct or indirect descendants of the invariant frame, i.e. they are related to it by means of one of the hierarchical frame-to-frame relations specified above. We pay particular attention to the Inheritance, Uses and Perspective relations as implementations of the taxonomic relation and the inheritance of semantic information. Basically, with the Inheritance relation each semantic fact about the parent must correspond to an equally specific or more specific fact about the child (Ruppenhofer et al. 2016, p. 81–82), which translates as correspondence between entities, FEs, frame relations and semantic characteristics in the parent and the child frame (Petruck 2015). Uses has been specified as a relation in which only some of the FEs in the parent have a corresponding entity in the child, and if such corresponding elements exist, they are more specific (Petruck 2012). Perspective is defined as similar to, but more specific and restrictive than Using (Ruppenhofer et al. 2016: 82) indicating that a situation viewed as neutral may be specified by means of perspectivized frames that represent different possible points-of-view on the neutral state-of-affairs. Thus the more specific frames elaborating on the invariant frame of a thematic class are characterized by more concrete configurations of FEs; this may be implemented in various ways:

by including more FEs that model additional participants and aspects of meaning; by excluding one or more FEs of the parent frame; by defining more specific FEs that correspond to the more specific semantic content of a participant; by profiling a particular FE (different from the one profiled in the parent frame); by incorporating a FE, etc. (see Section 5.1.2).

The frames specifying a given thematic class do not always form a straightforward hierarchy, which may reflect the fact that some classes are inherently more incoherent and the relevant frames pertain to unrelated parts of the frame network. This is the case, for instance, with the class *Relations between facts or events* (see Section 5.2.3 and Figure 5). It is represented by frames that describe temporal and logical relations, contingency, dependence, etc., which belong to different parts of the taxonomic structure of FrameNet (combines frames stemming from *Relation, Contingency, Evidence*). In such cases, we establish a shallow hierarchy derived from the observed data and define a generalized invariant frame to describe the common features of the thematic class.

There are also cases of predicates that combine conceptual features of more than one class, or are borderline states. For example, the frame *Worry* uses *Emotions* and inherits from *Cogitation*, so it combines features from both classes – *Emotional states, relations and internal experiences* and *Mental states*. Although for the sake of consistency we place it only under the frame *Emotions* and the corresponding thematic class, its cognitive aspects and relations to cognitive frames should also be considered.

The possibility for describing the thematic classes by means of FrameNet substructures of closely-related frames attests to both the sound theoretical grounds of the verb classes and the conceptual description in FrameNet, which originate from different linguistic schools and theoretical backgrounds.

5.1.2. Frames Specialization

The observations on hierarchical relations, especially on the more populated ones, such as Inheritance and Using (weak inheritance), shed light on the specialization that takes place from parent to child in the taxonomic (inheritance) hierarchy. We analyze the changes in stative frames within thematic classes where frame specialization deals with including/excluding FEs that correspond to aspects of the state (e.g., attributes that characterize it), reducing the scope of the frame by imposing certain semantic restrictions, profiling of particular FEs, etc. Moreover, some thematic classes are similar and the FrameNet frame-to-frame relations facilitate the distinction between the thematic classes.

The modifications that occur in the conceptual and semantic structure of stative verbs, reflected in the corresponding FrameNet frames, include (but are not limited to) the following:

(1) **Reducing the number of core FEs by incorporating** one of them in the frame and/or verb meaning. Example 2 shows the frame *Worry* which uses the frame *Emotions*, both representing the class of *Emotional states, relations and internal experiences*. In one child frame*, Feeling*, the FE State is conctretized into Emotional_ state, while in the child *Worry* it is incorporated into the meaning of the frame and its corresponding verbs.

Example 2.

(FrameNet) Parent frame *Emotions*: Experiencer | Topic | Stimulus | Expressor | State | Event

Definition: An **Experiencer** has a particular emotional **State**, which may be described in terms of a specific **Stimulus** that provokes it, or a **Topic** which categorizes the kind of **Stimulus**. Rather than expressing the **Experiencer** directly, it may (metonymically) have in its place a particular **Event** (with participants who are **Experiencers** of the emotion) or an **Expressor** (a body-part of gesture which would give an indication of the **Experiencer**'s state to an external observer).

Child frame *Feeling*: Experiencer | Emotion | Emotional_state | Evaluation

Definition: In this frame an **Experiencer** experiences an **Emotion** or is in an **Emotional_state**.

Child frame *Worry*: Experiencer | Topic

Definition: An **Experiencer** continually thinks about some **Topic** whose consequences are important to the **Experiencer** and considered not yet known or resolved.

(2) **Reducing the scope of the frame** through imposing more strict selectional restrictions on the FEs. For example, the FE Theme (Semantic type: Physical_object) in the parent frame *Abounding_with* is represented in the child frame *Lively_place* by the FE Individuals (Semantic type: Sentient) engaged in an Activity (Example 3).

Example 3.

(FrameNet) Parent frame *Abounding_with*: Theme | Location

Definition: A **Location** is filled or covered with the **Theme**.

Child frame *Lively_place*: Location | Activity | Individuals

Definition: A **Location** is characterized by a high amount of (often goal-oriented) **Activity**, or metonymically, with **Individuals** who are engaged in the activity.

(3) **Profiling different FEs** in different children frames or profiling a different FE in the child frame than in the parent frame. Example 4 shows the non-lexical frame *Requirement_scenario* which is used in two frames – *Have_as_requirement* which profiles the Requirement or the Required_entity and describes (dependency) *Relations between facts and events*, and *Being_necessary* which profiles the

Dependent and refers to the class of *Modal states*. Modal verbs are not represented in Princeton WordNet and have been additionally included in the Bulgarian WordNet.

Example 4.

(FrameNet) Frame *Requirement_scenario*: Dependent | Requirement | Required_entity

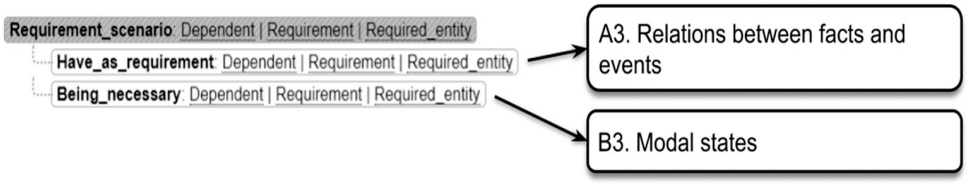
Definition: One state of affairs, the **Dependent**, cannot occur without another state of affairs, the **Requirement**, or an entity, **Required_entity**, also occurring.

Frame *Have_as_requirement*: Dependent | Requirement | Required_entity

Definition: The obtaining of a **Requirement** state of affairs or the presence of a **Required_entity** is profiled as a prerequisite for the obtaining or occurring of a **Dependent** state-of-affairs.

Frame *Being_necessary*: Dependent | Requirement | Required_entity

Definition: A **Dependent** state-of-affairs has a **Requirement** as a prerequisite for obtaining or occurring.



Some of the types of specialization are being studied as a point of departure for defining more narrow-scope frames that would allow for more precise predictions about the selectional restrictions and the syntactic realization of FEs.

5.1.3. Relations between Core FEs

In addition, as part of the conceptual description we construe the relationships between pairs of counterpart FEs in the parent and the child frame, i.e. ones that participate in a situation in the same manner and have similar or identical semantic content. In particular, for each thematic class we are interested in the FEs of the invariant frame and the ways they are concretized in the FEs of the child frames describing the class. Such correspondences are obvious where the relevant FEs are the same across frames (e.g., Experiencer in all frames describing the class *Emotional states, relations and internal experiences*, see Figure 15), but this idea can easily be extended to some pairs of more general and more specific FEs (e.g., the FE Stimulus in the *Emotions_by_stimulus* (parent) frame and the FE Situation in the (child) frame *Other_situation_as_stimulus* within the class *Emotional states, relations and internal experiences*, see Figure 15) as the relationships between them are implicit and derivable from the frame-to-frame relations (Litkowski 2012: 8–9).

As a given FE may be part of the conceptual description of various frames, the definition of such correspondences is not universal across frames (e.g., the correspondence between the FEs Entities in the frame *Relation* and Profiled_event and Landmark_event in the frame *Simultaneity* does not establish a relation between Entity and Event in general, e.g. between the FEs in the frames *Graded_attributes* and *Capability* such correspondence does not exist). Therefore, we consider such correspondences only within pairs or trees of frames. For our purposes we have mapped automatically the candidate FE counterparts using a set of heuristics and have subsequently verified them manually.

The alignment between more general and more specific FEs affords making generalizations over participants with similar semantics and function in the conceptual description of similar frames and referring to FEs of different levels of semantic description while keeping the correspondence between them. Both from a theoretical and an applied perspective using too-fine grained FEs with only a couple of instances may conceal or make it harder to capture existing semantic generalizations, while resorting to too general ones would lead to missing important differences. Providing a strategy for reducing the number of FEs while keeping them apart if necessary has been found to improve the performance of parsing and semantic-role labeling systems (McConville, Dzikovska 2008; Matsubayashi et al. 2009; Litkowski 2012).

5.1.4. Definition of New Stative Frames

New frames are suggested in two cases: (1) where a thematic class of verbs has no suitable frames to match their conceptual description; and (2) where a suitable stative frame is not defined in FrameNet to match its non-stative counterpart(s). The missing frame is defined using the conceptual description of the available frame considering the changes in the FEs, as well as the relations between the new frame and other frames and in particular, its place in the FrameNet hierarchy. In the latter case, i.e. where there is a missing frame presupposed by the FrameNet structure, the definition of new frames is modeled on the example of the triple *Attaching* (causative), *Becoming_attached* (inchoative) and *Being_attached* (stative).

The thematic class of *Spatial_relations* includes predicates for locative relations as well as predicates describing the spatial positioning of immobile objects (often geographical objects and landmarks). While the locative relations are well presented in terms of FrameNet frames (see Figure 4), the spatial positioning was not well covered. This is why we introduced the frame *Spatial_configuration* (Definition: A Figure is located relative to a Ground location in a certain Configuration/Shape) which inherits the frame *Locative_relation* and has FEs Figure, Ground and Configuration/Shape.

The class of *Disposition predicates*, which describes inherent tendencies or propensities of entities to exhibit certain behavior or to react or respond to stimuli or when being operated upon, does not have a set of frames to describe the properties of these verbs. Most verbs of this class are derived from dynamic verbs via diathesis

(e.g., from the original verb *bend* 'to form a curve' we derive *bend* 'to have the property to change shape so that to form a curve'). However, as disposition verbs they change their conceptual structure, most evidently by dropping the FE Agent and by profiling the Theme or the Patient. Further, some of the FEs lose their core status, e.g., compare: *Преведох стихотворението от английски на български* 'I translated this poem from English into Bulgarian' – even if not expressed, the source and target languages are assumed) vs. *Поезията се превежда трудно* 'Poetry does not translate well'[4] (in principle). Further differences between the dynamic and the disposition predicate are restrictions on taking part in nominalization and inceptive use. In this case we formulated a separate frame to cover the class of *Disposition predicates,* the frame *Disposition* which inherits from *Capability* (see Figure 9). Further, the frame can form child frames depending on the frame of the original active verbs but at present we do not employ such distinctions.

5.2. Inherent Properties and Relations

Here we present the structure of frames for each thematic class of stative verbs for inherent properties and relations, while in Section 5.3 we discuss the thematic classes of states and in Section 5.4 we briefly cover the classes of behaviors and occupations. Solid lines connect frames related through Inheritance relation, dashed line shows weak inheritance through Uses relation, and dotted line points to a Perspective relation between frames. Black nodes denote frames that are not included in the class, but are present in the hierarchy to show inheritance relations between the frames. Similarly, shaded nodes in the frame hierarchical structure show frames that are more general and only part of the lexical units that instantiate them belong to the class; often these spread across several classes and even cover entities outside of the class of stative verbs.

5.2.1. Physical parameters and inherent properties

The class of *Physical parameters and inherent properties* encompasses several frames that describe a relation between an entity and a salient attribute of the entity or the attribute's value. As these properties belong to different domains, the frames do not form a coherent hierarchy.

Part of them inherit from *Gradable_attributes* and respectively describe scalar attributes defined on the basis of various inherent features. *Capacity* (*Кутията* ***вмества*** *3 литра* ⇒ The box **takes** 3 liters) refers to the inherent ability of an Entity[5]

[4] The Bulgarian examples are adapted from Internet or FrameNet, usually shortened or simplified to save space.

[5] Co-indexation of frame elements marks the correspondence of pairs of elements in the relevant frames.

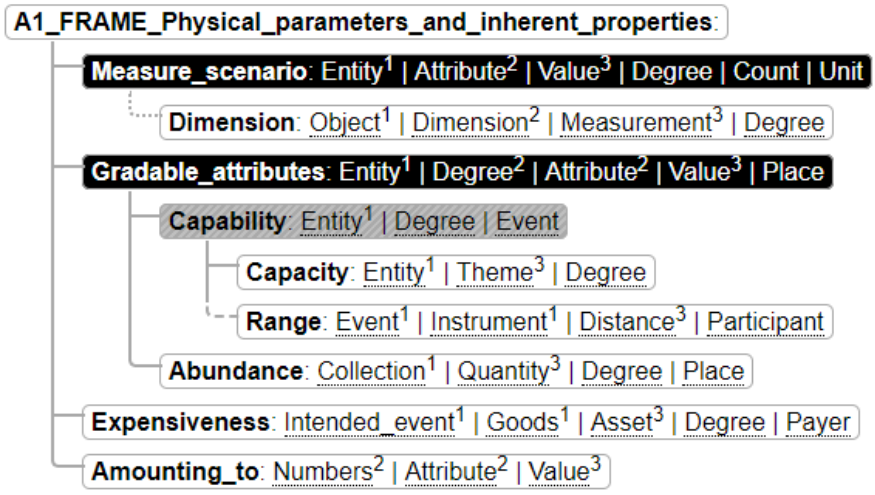


Figure 3. Structure of the thematic class *Physical parameters and inherent properties*.

to contain a Theme, the latter being a numerical expression of the Entity's capacity, and thus corresponding to the frame element Value in the parent frame. *Range* (*Пушката **бие** на 100 метра* ⇒ The rifle **ranges** 100 m) describes the property of an entity, the Instrument (operated or controlled by a deprofiled Participant), to interact with things within a certain spatial extent, whose value is defined by the frame element Distance. The type of occurrence (Event) whose effect extends over the Distance may also be expressed. *Abundance* (*Тревопасните видове, които **изобилстват** по тези места, рядко се сблъскват с естествени врагове* ⇒ The herbivorous species **abounding** in this area rarely encounter any natural predators) deals with the relation where a Collection of entities occurring in a Place has a Quantity defined as a particular Measure. The attribute that serves to define the scale is incorporated by the lexical units in all three frames.

The frame *Dimension* (*Кутията **тежи** 3 кг* ⇒ The box **weighs** 3 kg), which perspectivizes the *Measure_scenario*, concerns lexical units that express a physical entity's (Object's) value (Measurement) with respect to some physical attribute (Dimension).

The remaining frames, *Expensiveness* (*Кутията ми **струваше** 5 лева* ⇒ The box **cost** me 5 leva) and *Amounting_to* (*Тълпата **наброява** поне 1000 души* ⇒ The crowd **amounts to** at least a thousand people), are either orphans or belong to other parts of the FrameNet hierarchy. Nonetheless, they align very well with the conceptual configurations described above. The first one describes a situation in which a Payer gives up the use of an Asset in order to achieve an Intended_event (gaining possession of some Goods or receiving a Service). The Goods or the Intended_event

thus correspond to the parent frame's Entity being affected and the Asset is the value of the non-profiled or incorporated attribute.

With *Amounting_to* the absolute Value of a quantifiable Attribute of an item is determined by adding up the values of the individuals or parts that make up the item, which is not expressed as a separate constituent but is presupposed by the concept of Attribute. Alternatively, a set of Numbers whose sum is the Value associated with the set may be expressed instead of the Attribute.

An appropriate invariant frame describing this class is the non-lexical frame[6] *Attributes*, which encompasses an Entity that has a particular Attribute with some Value. As shown, the invariant frame elements are realized differently in the children frames depending on their specifics.

5.2.2. Spatial relations

Figure 4. Structure of the thematic class *Spatial relations*.

Most verbs denoting location and spatial configuration evoke frames that elaborate on the invariant *Locative_relation* which describes the location of a Figure in relation

[6] Non-lexical frames are high-order abstract frames describing complex events that are not evoked by any language units in a given language (but may be in another language); they serve purely to connect two (or more) more specific frames semantically (Rupenhoffer et al. 2016: 80).

to a Ground (in the sense of Talmy 1972). The abstract frame is a direct descendant of *State*, one of the roots in the FrameNet frame structure. *Locative_relation*'s own descendants denote various elaborations on the locative relation.

Some of the frames model the spatial position or placement of an object, Theme (a specialization of the Figure) with respect to a particular grounded Location: the weakly inheriting *Being_located* (*Градчето **лежи** в равнината* ⇒ The town **lies** in the valley) describes a stable unchanging position of the Theme, while *Distributed_position* (*Цвете **краси** косата ѝ* ⇒ A flower **decorates** her hair) denotes the spread or dispersal of the Theme over many or all subregions of the Location. The position of the Figure may be further specified as being in close proximity to or in contact with the Ground, as in *Adjacency* (*Неговата нива **граничи** с гората* ⇒ His field **borders** with the wood) and *Spatial_contact* (*Шкафът **се допира до** рамката на вратата* ⇒ The cupboard **touches** the door frame).

The relation between the Ground and the Figure may be construed as one modeling the spatial features in combination with additional aspects of meaning. Thus *Containing* (*Кашонът **съдържа** 100 тетрадки* ⇒ The box **contains** 100 notebooks) reconceptualizes the invariant FEs as a Container and the Contents held within its physical boundaries. In *Abounding_with* (*Езерото **гъмжи** от риба* ⇒ The lake **teems** with fish) the Location is filled or covered by the Theme(s), while its descendant *Lively_place* (*Фестивалната зала **кипи** от събития това лято* ⇒ The Festival Hall **buzzes** with events this summer) further specifies the Location as a place abounding with moving Theme(s) or busy Activity. *Surrounding* (*Гори **обграждат** селцето* ⇒ The woods **surround** the village) describes a locative relation where the Figure is placed around, on all or some sides of the Ground.

Path_shape, which inherits directly from *State* and uses *Locative_relation*, describes lexical units (*Реката **лъкатуши** през низината* ⇒ The river **winds** across the valley) that denote the fictive motion of a land or artificial form (Road) with respect to what may be construed as the different aspects of a Location, including the Source (initial point), the Goal (end point), the Path (trajectory), etc. More precisely, these verbs are usually stative meanings of motion verbs and denote the perceptions of a real or imaginary observer of the way the Road extends in space as he or she perceives it (Paducheva 2004: 384).

A newly defined frame, *Spatial_configuration* (*На стената **висеше** голяма картина в старинна рамка* ⇒ A large painting in an antique frame **hung** on the wall), deals with lexical units that combine the semantics of a locative relation and static configuration or spatial arrangement of an object. The frame inherits *Locative_relation* and is characterized by the following FEs: an object whose location or spatial properties are described (Figure), Ground (which serves as a basis for describing the location of the Figure) and Configuration (which describes the configuration formed by the entire Figure).

In addition to these related frames, we have identified a couple of others that belong to a different place in the FrameNet frame hierarchy but may be considered as

construing a kind of locative relation. *Supporting* (*Четири дървени греди* ***крепят*** *покрива* ⇒ Four wooden beams **hold** the roof) may be viewed as a relation between a specific kind of Location (a structure or object that provides physical strength and support), the Supporter, and another structure or object, a specific kind of Theme, the Supported. Another frame that models a locative relationship is *Eclipse* (*Дървото* ***препречва*** *изгледа към планината* ⇒ The tree **blocks** the view to the mountain). It defines a relation between a foregrounded entity, the Obstruction (a kind of Figure), and another, grounded entity (the Eclipsed entity) that is blocked from perception by the Obstruction.

5.2.3. Relations between facts and events

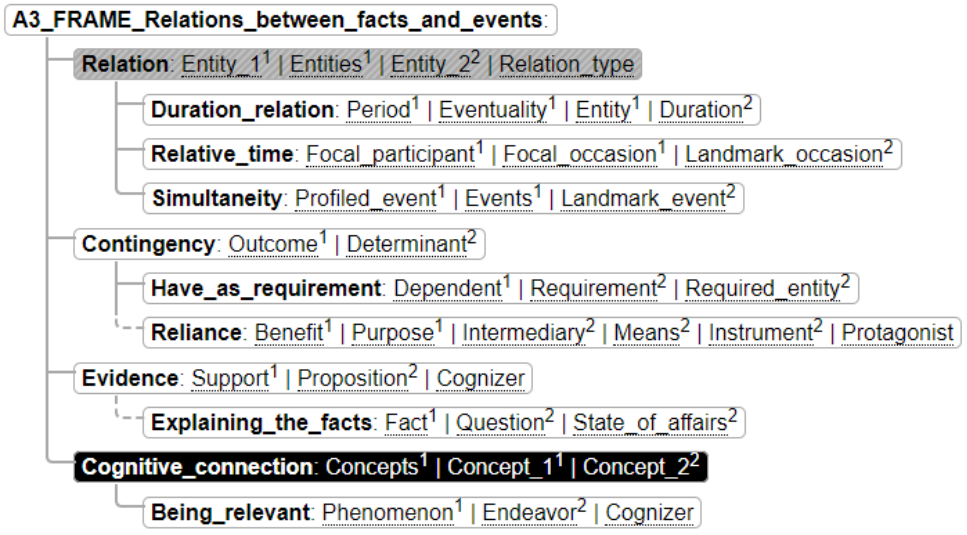


Figure 5. Structure of the thematic class *Relations between facts and events*.

The class of predicates that describe relations between facts and events covers a diverse range of frames pertaining to different parts of the FrameNet structure. The invariant frame specifies a relation between a Focal_eventuality (an Eventuality, a fact or event) and another one, Landmark_eventuality, that serves as an explanation, requirement, or characteristic of the first one.

The class includes several purely relational frames describing temporal relations between events and inheriting from the root frame *Relation*. The descendant frames narrow down the semantic content of the FEs in *Relation*, Entity_1 and Entity_2. *Duration_relation* (*Пиесата* ***трае*** *90 минути* ⇒ The play **lasts** for 90 minutes) specifies a relation between a Period, an Eventuality or an Entity standing metonymically for the Eventuality, on the one hand, and its Duration, on the other;

the former three thus represent concretizations of Entity_1 and Duration elaborates on Entity_2. The frame *Relative_time* (*Учените смятат, че тракийското селище* ***предшества*** *елинското* ⇒ Scientists believe that the Thracian settlement **predates** the Hellenic one) deals with the relative ordering of two events or times corresponding to the invariant Entity_1 and Entity_2: the Focal_occasion or metonymically, a participant in it (the Focal_participant), which is profiled as being in a relation of relative time to a Landmark_occasion. By the same token, *Simultaneity* (*Упражненията ни* ***съвпадат с*** *лекциите на професора* ⇒ Our seminars **coincide with** the professor's lectures) describes a relation defined symmetrically between two Events or asymmetrically between a Profiled_event and a Landmark_event that happen at the same time.

On the other hand, there are logical dependency relations between facts and events which are handled by frames belonging to other parts of the FrameNet structure, in the trees of *Contingency* and *Evidence*.

Contingency (*Почивката му* ***зависи от*** *отпуската на жена му* ⇒ His holiday **depends on** his wife's time off) defines a relation such that the answer to one open question (the Outcome) is dictated, partially or completely, by the answer to another open question (the Determinant). *Contingency*'s descendant *Have_as_requirement* (*Добрият брак* ***изисква*** *жертви* ⇒ Good marriage **demands** sacrifices) models a more specific situation where the obtaining of a Requirement state of affairs or the presence of a Required_entity (i.e. a kind of Determinant that needs to be present) is profiled as a prerequisite for the obtaining or occurring of some Dependent state-of-affairs (i.e. a kind of Outcome). *Reliance* (*Мъжът ми* ***разчита на*** *колата, за да може да си върши работата* ⇒ My husband **relies on** the car to be able to do his job) reconceptualizes the relation holding between an Outcome and its Determinant into one of dependence between a sentient entity, the Protagonist, and some action, the Means, the Protagonist needs to be performed for their Benefit or to the end of achieving a Purpose, usually by an Intermediary. Alternatively, the Protagonist may themselves perform the Means using an object (Instrument). In this scenario, the mutually exclusive Intermediary, Means and Instrument – the doer of the mediating action, the action itself and the instrument involved in it – may be considered as counterparts of the Determinant, while Purpose and Benefit align with the predetermined Outcome.

Another tree of logical relations is represented by *Evidence* (*Добрите отзиви* ***свидетелстват за*** *високото качество на работата им* ⇒ The good reviews **attest for** the high quality of their work). It defines a relation between a phenomenon or fact (the Support) and a claim or proposed course of action (the Proposition) to which it lends support or proof. This frame is used by *Explaining_the_facts* (*Стресът* ***обяснява*** *рязкото влошаване на здравето му* ⇒ Stress **explains** his rapidly declining health), which describes a situation where a particular Fact is presented as the answer to a proposition (formulated as a Question) regarding the reason or cause for a State_of_affairs. The mutually exclusive Question and State_of_affairs represent instantiations of the invariant Landmark_eventuality.

In the frame *Being_relevant* (*Тази книга **засяга** въпроса за войната* ⇒ This book **touches on** the question of war) a Phenomenon is related to some cognitive action, the Endeavor (performed by a Cognizer) to which the Phenomenon is connected in some way; the Cognizer is often null-instantiated and may be inferred from the Endeavor. Thus, while *Contingency* and *Evidence* describe objective states of affairs, *Being_relevant* requires a Cognizer FE, introducing subjectivity in establishing the relation between the facts and events. The frame inherits from *Cognitive_connection* where the Cognizer is not present at all and the cognitive relation holds between Concepts (possibly expressed asymmetrically as Concept_1 and Concept_2).

5.2.4. Relations between objects – inclusion, similarity, possession

Relations between objects or between object and a set also are diverse and can be grouped in the following way: verbs describing comparison between objects bases on gradable attributes (*Similarity, Suitability, Sufficiency*, etc.), inclusion or membership in a physical or abstract sense (*Being_in_category, Inclusion*, *Being_included* and

Figure 6. Structure of the thematic class *Relations between objects and sets*.

its descendants), association (*Have_associated, Reciprocality*), origin (*Origin*) or possession (*Possession*). These frames do not form a consistent hierarchy and belong to different places in the FrameNet structure.

The first group juxtaposes the invariant Entities according to a certain Attribute. *Compatibility* (*Новата операционна система* ***съответства на*** *спецификациите на този компютър* ⇒ The new operating system **meets** the specifications of this computer) models a relation of existing or functioning together, in a non-conflicting manner, of items (Item_1, Item_2 or jointly Items) that share a certain attribute (Parameter). By the same token, *Similarity* (*Картината* ***наподобява*** *по стил ранните творби на Пикасо* ⇒ The paining **resembles** in style the early works of Picasso) characterizes the compared entities as being assessed as (dis)similar according to a particular property (Dimension) or a Differentiating_fact. Unlike the former frames, *Suitability* (*Тази гривна* ***подхожда*** *на млада дама* ⇒ This bracelet would **suit** a young lady) defines a relation between an entity being evaluated (Evaluee) in terms of its suitability and the Purpose or User with respect to which its usefulness is assessed, while the attribute itself is deprofiled. The frame is used by *Imitating*, where a sentient Entity (Agent) is described as modeling their behavior on a certain Standard, that is, the bearer of the Attribute, in this case a certain property or behavior (Characteristic). Two other frames in this group, *Surpassing* and *Sufficiency* inherit their properties from a direct descendant of *Gradable_attributes – Position_on_a_scale*, itself not represented among verbs but describing a relation between an Item, a scalar property possessed by it (Variable) and its Value, a configuration inherited by its children frames. In the case of *Surpassing* (*Неговите способности* ***надминават*** *очакванията ни* ⇒ His skills **surpass** our expectations), this relation is further specified as a relation of superiority between a Profiled_item and a reference Standard_item with respect to some scalar Attribute shared by both, or between their particular values on that scale, Profiled_attribute and Standard_attribute respectively. *Sufficiency* (*Парите му* ***стигат*** *да издържа семейството си* ⇒ His money **suffice** to support his family) specifies the position of an Item on a Scale (an attribute of the Item) relative to a critical value, determined by some state-of-affairs (Enabled_situation) that becomes possible as a result of reaching this value.

The frames denoting inclusion or membership specify a relation between an Entity, (Item, Part) and the set or whole or abstract position or place it belongs to. The prototypical frames stem from the non-lexicalised *Inclusion_scenario* between a Part and a Whole, further perspectivized in *Inclusion* and *Being_included* and the latter's descendants. *Inclusion* (*Материалът за 8. клас* ***включва*** *квадратни уравнение* ⇒ 8th grade material **includes** quadratic equations) defines a relation between an aggregate or a unit (Total) and a component or constituent that forms a part of it (Part). The alternative perspective is represented by *Being_included*, where the Part is profiled as being a subset or constituent subpart of a Whole. Its child *Be_subset_of* (*Името му* ***фигурира*** *сред десетте най-продавани автори* ⇒ His name **numbers** among the ten best-selling authors) models a subset-superset relation between a Part

and a Total, while its descendant *Membership* (*Той **членува** в спортния клуб* ⇒ He **is a member** of the sport club) defines a relationship between a semi-permanently part of a socially constructed Group (Member) and the relevant Group of people.

A case of abstract belonging is represented by *Being_in_category* (*Това действие **се брои за** нарушение* ⇒ This action **counts as a** fault), which defines a relation between an Item and a certain Category it belongs to according to a set of Criteria.

Although an outlier in the FrameNet structure, *Occupy_rank* (*Успехът му го **подрежда** втори в класа* ⇒ His grades **rank** him second in the class) also denotes an abstract relation of membership, where an Item occupies a certain Rank (i.e. a particular value) in a hierarchy defined according to a certain attribute (Dimension).

The frames for association specify relations between two entities: an existing Entity and a Topical_entity, whose states and properties are impacted by its association with the Entity – *Having_associated* (*Училището **има** разнообразна програма* ⇒ The school **has** a varied curriculum). *Commonality* (*Те **делят** общ дом* ⇒ They **share** a home) elaborates on the Items' association as being based on the possession of a common object or attribute (Commonality).

The frame *Origin* (*Той **произхожда от** скромно семейство* ⇒ He **comes from** a humble family) specifies the relationship between an Entity and the abstract entity related to the beginning of its existence (expressed as the FE Origin), which can be a place, culture, time period, text, etc.

Finally, *Possession* (*Той **има** голяма къща* ⇒ He **owns** a big house) describes a more specific association between an entity and the thing it owns (the Possession).

Although incoherent and diverse in semantics, in general the frames in this class describe the inherent relations between objects (where the second one can denote a set in the case of the *Inclusion_scenario*) either in a symmetrical (e.g., *Similarity*) or asymmetrical way (e.g., *Origin, Inclusion*).

5.2.5. Semiotic relations

Predicates expressing semiotic relations model a relation between various signs and their signifiers or, possibly, referents. Based on the analysis, an invariant frame for the class may be defined as a relation of equivalence or association between a Signified and a Signifier that may be further specialized or elaborated.

Most notably, this class is represented by the frames *Sign* and *Linguistic_meaning* and their descendants. The first one (*Последните данни **показват** ръст на инфлацията* ⇒ Recent data **indicate** inflation rise) uses *Evidence* (Section 5.2.3) and describes a relation between two phenomena, the Indicator and the Indicated, where the former exists as an indication of the latter. Its descendant *Omen* (*Смята се, че поведението на пчелите **предсказва** времето* ⇒ It is believed that bees' behavior **foretells** the weather) describes a situation where a Predictive_phenomenon is an indication (Indicator) of the existence of another, Future_phenomenon, or

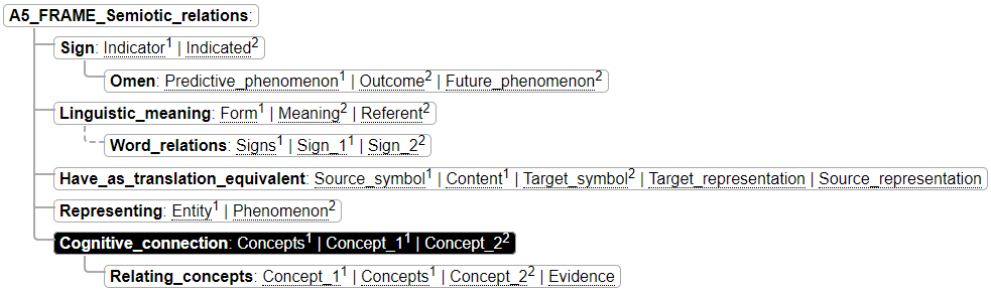


Figure 7. Structure of the thematic class *Semiotic relations*.

provides clues as to the good or bad Outcome of the Future_phenomenon. Another manifestation of semiotic relations is represented by *Linguistic_meaning* (Думата 'власт' ***назовава*** *обобщено политическите органи и тяхното управление* ⇒ The word 'power' is used to **denote** collectively the political organs and their governance), which defines a relation between a linguistic expression (Form) and its Meaning or, possibly its real-world Referent. The frame is used by *Word_relations* where a specific relation (such as synonymy, antonymy, collocation, etc.) between linguistic Signs (or Sign_1 and Sign_2) is defined.

The frame *Have_as_translation_equivalent* (Думата 'власт' се превежда на английски като '*power*' ⇒ The word 'власт' translates into English as 'power') conceptualizes the semiotic relation as one of equivalence between two signifiers – a Source_symbol and a Target_symbol – that share the ability to express a particular signified (Content) in a Source_representation system and a Target_representation system respectively.

The frame *Representing* (*Знамето на ЕС* ***символизира*** *единството* ⇒ The EU flag **symbolizes** unity) is concerned with the relation between an Entity and some Phenomenon it represents, evokes or has some association with through its existence and/or defining characteristics.

Additionally, in the *Relating_concepts* frame (*Намерените на местопрестъплението отпечатъци го* ***свързват*** *с убийството* ⇒ His fingerprints found at the crime scene **connect** him to the murder), which inherits from *Cognitive_connection* describes a situation where two concepts (Concept_1 and Concept_2) are related by means of some Evidence (a conceptualisation of the signifier).

A notable feature of these frames as opposed to *Mental states*, *Perceptive states* and *Observed (perceived) states*, is that the Cognizer (involved in any cognitive process or state) is deprofiled as the semiotic relations are permanent and independent of an individual cognizer.

5.2.6. Properties of sets

The *Properties of sets* is a small class of predicates closely related to the class of *Relations between objects and sets*. In contrast, the properties of sets include predicates expressing domination, trends, diversity and other characteristics of the whole set rather than relations between individual members and the set. This is not a semantically coherent class as the properties typical of sets or classes instead of individual entities denote various types of relations belonging to different frame structures with only isolated lexical items representing each frame.

The invariant frame includes an Entity which is restricted semantically to be a Set, a Group or an abstract Entity (generalized object) and a Feature that characterizes the Entity. The Feature is used to describe a common property of the members of the set or a distinctive property that establishes diversity. In general, the properties covered can describe the group's size (*Групата* ***наброява*** *10 души* ⇒ The group **numbers** 10 people), typical or dominating members (*В групата* ***преобладават*** *младежите* ⇒ The group **is dominated by** youngsters), range of values of the property in question (*Цените* ***варират*** *от 10 до 20 лв.* ⇒ Prices **range** from 10 to 20 leva), etc.

5.2.7. Disposition

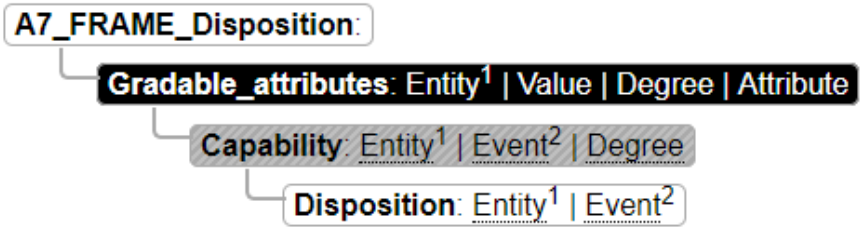


Figure 8. Structure of the thematic class *Disposition*.

The class of *Disposition* covers verbs that express tendency or inclination of entities (in the semantic role of Patient or Theme) to exhibit certain aspect, state, feature, or to take part in an action, e.g. *bend* 'be able to change shape' (*The pipe bends*), *cut* 'allow to be divided with a sharp instrument' (*The cake cuts nicely into slices*), etc.

However, these verbs are not well represented in WordNet as they most frequently are considered as diatheses of dynamic verbs. Since there were no adequate FrameNet frames to describe the conceptual structure of these verbs, we have designed the invariant general frame *Disposition* as a direct descendant of *Capability*. The frame *Disposition* includes two core FEs – Entity (which exhibits inclination to perform in a certain way) and Event (the event, act or behavior that the Entity is inclined to take

part in). It should be noted that these verbs inherit to a certain degree their conceptual properties from the original frame of the dynamic verb (see Section 5.1.4). This is why it is useful for them to keep the link to that frame and consider the additional semantic restrictions when expressing disposition.

5.3. States

5.3.1. Speech states

Figure 9. Structure of the thematic class *Speech states*.

This class includes speech verbs that have come to denote states. These are predominantly (verbal) communication predicates that are used to express a stative mental attitude, opinion or other cognitive content (e.g. predictions) by means of the corresponding speech act: *criticize*, *renounce*, *reject*, *confirm*, *affirm*, *complain*, *protest*, etc. Thus, *criticize* is reconsidered as 'have a critical attitude towards (may be optionally, but not necessarily expressed by means of a speech act)', *complain* – as 'do not approve (may be optionally, but not necessarily expressed by means of a speech act)', etc. There are no dedicated frames that describe speech states; rather, the verbs of this class fall under active communication frames that have developed this additional stative meaning. Below we consider the main communication frames that are evoked by such verbs.

As an invariant of this class we posit the most general communication frame *Communication* restricted to conveying stative meaning. The verbs evoking it (*Той* ***споделя*** *опасенията й* ⇒ He **shares** her concerns) define situations in which a Communicator carries an attitude or opinion on a given Topic which can optionally be expressed via a Message using a particular means or medium of communication (Medium).

This frame's configuration is further elaborated by its descendant *Communication_response* (*С това писмо задочно* ***адресираме*** *всички поставени въпроси* ⇒ With this letter we implicitly **address** all questions raised), where the Message is understood as a response to some earlier state of affairs, the Trigger, and is directed

to a particular Addressee. *Respond_to_proposal* (*С това гласуване на практика ЕС **отхвърля** предложението на Русия* ⇒ With this vote in fact the EU **rejects** Russia's proposal), which uses *Communication_response*, construes the Message in more narrow terms as prior communication to which the response is given (Proposal) or metonymically as an Interlocutor who has made the proposal and who stands for it.

Communication is also elaborated in the weakly inheriting *Statement* (*Правителството принципно **признава** необходимостта от консенсус, но няма да предприеме никакви официални стъпки в тази посока* ⇒ In principle, the government **acknowledges** the need for consensus, but will not take any formal steps in this direction), which shares with its parent the same configuration of FEs, with Communicator further specified as the Speaker. A number of frames that inherit or use *Statement* also include statively construed speech verbs that narrow the invariant semantics in different ways. *Affirm_or_deny* has the same FE configuration, but the Message is semantically specified more narrowly as content whose truth is affirmed or denied to some (non-core) Addressee (*Той мълчаливо **отхвърля** обвиненията* ⇒ He silently **rejects** the allegations). *Complaining* also elaborates on the invariant 4-frame element configuration by narrowing down the semantic scope of: (i) the communicating sentient entity, construed as the one who produces a negative emotional reaction (Complainer), and (ii) the Message, which is specified as Complaint (*Те отдавна **оплакват** съдбата си* ⇒ They have long since **complained** of their fate). *Predicting* also specializes *Statement*'s configuration by delimiting the Message's content to be a future Eventuality made known by the Speaker (*Последните социологически изследвания **прогнозират** загуба на изборите* ⇒ Recent sociological studies **prognosticate** an election landslide).

Other frames bring in an evaluative meaning. *Judgment_communication*, which uses *Judgment* and *Statement*, expands on aspects of both frames. It involves a Communicator who expresses judgment of an Evaluee using a gesture or stance of a body part, the Expressor. The motivation, or Reason, for the judgment is also defined as part of the frame, as are also the Topic to which the judgment relates and the Medium through which the judgment is conveyed. The Message FE of the parent frame, and its positive or negative value in particular, is incorporated in the semantics of the relevant verbs (*Тя **превъзнася** пластичния си хирург* ⇒ She **raves** about her plastic surgeon). *Renunciation* also involves a Speaker (using a Medium) who communicates his or her wish to be no longer associated with the Content, which is implied to be no longer desirable (*В последните години организацията **се отрича** от подобни методи* ⇒ In recent years the organization **renounces** the use of such methods). The Message in the parent frame is incorporated in the verbs' semantics.

More detailed analysis of the class of speech states can lead to the formulation of new frames with stative meaning within the tree of communication frames, so that to address the specifics of stative speech predicates which combine the semantics of both speech acts (with agentive Speaker) and stative mental attitude, opinion or judgment.

5.3.2. Intent, will and desire

The class is represented by several closely-related frames with a clear-cut hierarchical structure; the major FEs in the descendant frames inherit the invariant FEs of a sentient Experiencer and a desired Event or state-of-affairs.

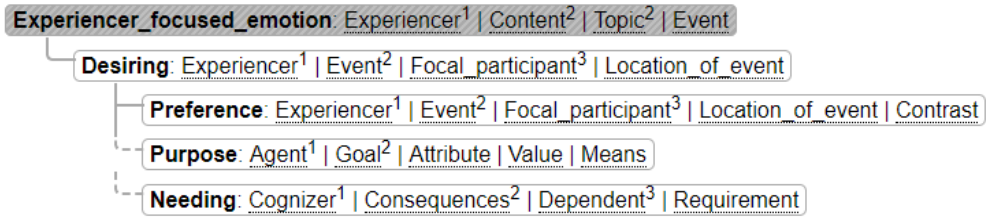


Figure 10. Structure of the thematic class Intent, will and desire.

The invariant frame *Desiring* is inherited by the more specific frame *Preference* and used by *Purpose* and *Needing*. The typological and semantic relatedness between this class and verbs of emotion is attested by the fact that *Desiring* inherits from *Experiencer_focused_emotion*, which is the invariant emotion frame. The frames in the class of *Intent, will and desire* are all characterized by a subject of emotion, construed differently in the particular frames, and an object of emotion defined as a non-realised state-of-affairs that the subject wants to be realized or to which the subject aspires.

The invariant frame *Desiring* models states of affairs in which an Experiencer wants an Event to occur. In such cases the Event itself is not mentioned, but rather some Focal_participant, which is subordinately involved in the Event and which the Experiencer wishes to be affected by the Event (*Много* ***се надяваме*** *и те да дойдат* ⇒ We **hope** so much for them to come too). In addition, the place involved in the desired Event, Location_of_event, is also specified in the frame (***Искаме*** *да си тук в 8 сутринта* ⇒ We **want** you here at 8 o'clock).

As a frame strictly inheriting its parent, *Preference* shares with *Desiring* its FE configuration. Its more elaborated nature is reflected in the fact that it specifies an additional element, Contrast, which describes a state-of-affairs in comparison to which the Experiencer deems the Event more desirable (*На вкус* ***предпочитам*** *вино пред бира* ⇒ In terms of taste, I **prefer** wine to beer).

The correspondence between *Desiring* and the other two frames is less strong as the relation holding between them is weak inheritance. The sentient subject in the frame *Purpose* is not just an Experiencer, but a volitional Agent that undertakes to achieve his or her purpose using an object or action that is used or designed to achieve the Goal (Means). The state-of-affairs desired by the subject is construed in two alternative ways – as an action or situation to which the Agent's efforts are directed (Goal) or as an Attribute for which it is the Agent's goal to reach a certain Value

(*С тези стъпки* ***планираме*** *да увеличим производството* ⇒ With the following steps we **plan** on increasing production).

The sentient subject in *Needing* is interpreted as a Cogniser that believes that some state of affairs or entity must be present so as to cause some other state of affairs to occur (Dependent). The Dependent corresponds to the desired state of affairs in the other frames in this class (and thus – to *Desiring*'s and *Preference*'s Event or *Purpose*'s Goal), but it cannot hold in the absence of the Requirement (***Нуждаят се*** *от още време, за да довършат работата* ⇒ They **need** more time to finish the job). The configuration is further expanded with the FE Consequences, i.e. the undesirable state-of-affairs that results if the Requirement is not met.

5.3.3. Modal states

The class of *Modal states* represent a class of verbs modeling the two main types of modality, i.e. possibility and necessity. In general, the invariant frame would describe an Eventuality, a state-of-affairs or event, whose existence depends on a necessary Requirement.

The modality of possibility is modeled by a small number of interrelated frames: *Possibility*, *Capability* and *Likelihood. Capability* and *Likelihood* are direct descendants of *Gradable attributes*, and *Capability* also inherits *Possibility* and uses *Likelihood*.

Figure 11. Structure of the class Modal states.

The prototypical frame *Possibility* defines a relation in which a Possible_event has a probability of occurrence if some further Condition pertains (*Ако станеш*

*рано, **може**[7] и да стигнеш навреме* ⇒ If you get up early enough, you **might** get there on time). Its child frame *Capability* describes a situation where an assessment of an Entity's meeting or falling short of certain preconditions to participate in an Event is made, e.g. the Entity is inherited from the other parent *Gradable_attributes* (*Децата им **могат** да четат от тригодишни* ⇒ Their children **can** read since they were three). The third frame, *Likelihood*, is concerned with evaluating a Hypothetical_event's likelihood of occurrence (***Може** да успеят да се върнат навреме* ⇒ They **may** be able to come back on time). The way the Event is modeled, i.e. as possible, real or hypothetical, bears relevance to the distinct modality couched by the three frames.

The other major branch of modal states that deals with necessity and obligation stems from the non-lexical *Requirement_scenario*, a situation where a state of affairs (Dependent) cannot occur without another state of affairs (the Requirement) also occurring, or depends on the presence of a Required_entity. The scenario is perspectivized in *Being_necessary* (evoked by predicative adjectives such as *необходим*, *нужен, изискван* ⇒ necessary, needed, required, etc., which inherits the same FE configuration but, unlike the *Requirement_scenario* – where the degree to which the Dependent depends on the presence of the Requirement may vary – specifies the Requirement as a prerequisite for the Dependent's obtaining or occurring.

Being_necessary is used by *Required_event*, whose single core element Required_situation denotes a state of affairs that prevents some Negative_consequences or serves to achieve a Purpose (*Книгата **трябва** да е по-кратка* ⇒ The book **needs** to be shorter). *Required_event* is inherited by the non-lexical *Obligation_scenario*; the latter is defined as a relation between a Responsible_party and a Duty (a conceptualisation of the Required_situation) the party needs to perform. This frame itself is respectively used and perspectivized by *Being_obligatory* and *Compliance*. The former inherits *Obligation_scenario*'s FE configuration. *Compliance* represents a more complex elaboration of the parent frame; it is concerned with Acts or State_of_affairs for which a Protagonist is responsible and which meet or violate some Norm. Thus, the Protagonist and by extension – his or her actions – correspond to the Responsible_party. The parent's FE Duty is construed as the child's element Norm, i.e. the rules or standards that ought to guide a person's behavior (*Всички ние **спазваме** закона* ⇒ We all **comply with** the law).

Required_event is also used by two other frames *Deserving* and *Desirable_event*, which may also be viewed as couching aspects of modality. The first reconceptualizes the parent's semantic content as a situation in which an existing State_of_affairs represents a sufficient reason for taking some Action (*Работата*

[7] Here we analyze the semantic and, to some extent, the syntactic selective properties of modal verbs and other verbs with modal meaning; we do not consider their role as part of the sentence.

им ***заслужава*** *похвала* ⇒ Their work **deserves** praise). *Desirable_event* defines a situation in which a State_of_affairs is evaluated as desirable or required for some purpose (*Разстоянието между двете препятствия* ***трябва*** *да е точно 2м* ⇒ The distance between the two obstacles **should** be exactly 2m).

5.3.4. Observed (perceived) states

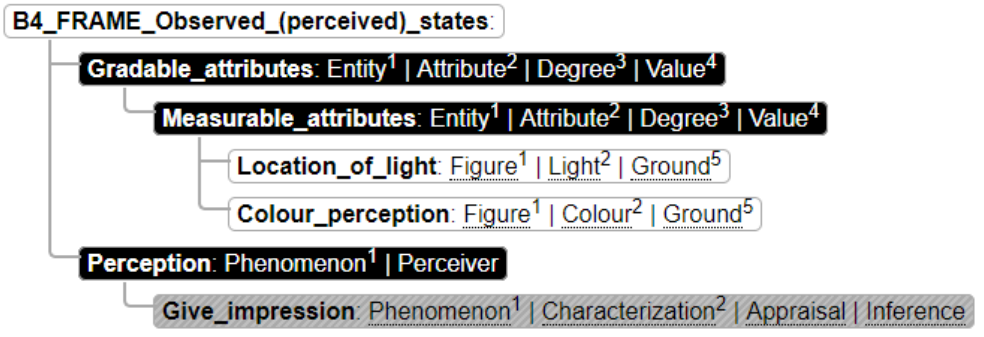


Figure 12. Structure of the thematic class *Observed (perceived) states*.

As the verbs in this class originate from different thematic classes of active verbs, there cannot be a single invariant frame that would encompass all or the majority of them. A suitable candidate for the description of part of these predicates, such as *мирише* ⇒ smell, *воня* ⇒ reek, *звуча* ⇒ sound, *изглеждам* ⇒ look is *Give_impression* (*Идеята* ***звучи*** *чудесно* ⇒ The idea **sounds** great). The frame conceptualizes a state of affairs where some Phenomenon and its perceptual characteristics are described; the description itself may be a Characterization of the Phenomenon's perceptual properties, a positive or negative judgment (Appraisal) or an Inference about a non-perceptual property based on perception. While this frame inherits *Perception*, it profiles the perceived Phenomenon, whereas the Perceiver is backgrounded as a non-core element denoting the sentient being which makes the Characterization, Appraisal or Inference.

The frame *Location_of_light* inherits its properties from *Measurable_attributes* and uses *Perception*. It describes situations where a perceptible Figure (a specialization of the parent frame's Entity) shows up against a Ground due to Light shining on or from it. The *Measurable_attributes*' FE Attribute is incorporated in the respective verbs' semantics (*Мокрият път* ***лъщеше*** *на лунната светлина* ⇒ The wet road **glistened** in the moonlight).

A productive portion of verbs denoting perceived states related to color and possibly to other sensory modalities are not found in English and hence are not described in FrameNet. To account for them, we posit a frame *Colour_perception* defined along similar lines as *Location_of_light*: inheriting from *Measurable_*

attributes and using *Perception*, with two major core elements: a Figure (the entity whose state is perceived) and a Ground against which the Figure stands out, with the FE Color incorporated in the verb semantics (*Къщата* ***се белееше*** *в далечината* ⇒ The house was **standing out white** in the distance).

5.3.5. Physical and physiological states

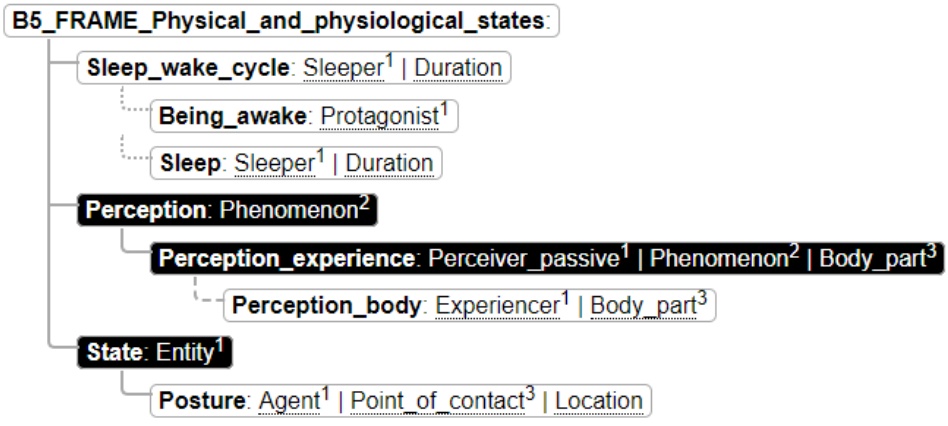


Figure 13. Structure of the class *Physical and physiological states*.

The thematic class of *Physical and physiological states* is similar to the class of *Observed (perceived) states*, but their existence does not depend on the presence of a Perceiver (Spencer, Zaretskaya 2003:17). The invariant frame includes an Experiencer (a sentient entity who is in the physical or physiological state), a State (describing the conditions that cause the Experiencer's experience, sometimes incorporated in the frame or verb semantics) and often a Body_part (the location or body organ where the physiological state occurs or is experienced by the Experiencer).

The class includes several groups of predicates denoting physiological states (such as sleep or being awake), physical / bodily perceptions and physiological effects of external or internal states or processes, respectively.

The first group includes the frames *Sleep* and *Being_awake*, subframes of the *Sleep_wake_cycle*. Their FE configurations are characterized by a single core FE, the Protagonist (or Sleeper in the *Sleep* frame), while the state the Protagonist is in, is incorporated in the verbs (*Децата* ***бодърстваха*** *цяла нощ* ⇒ The children **stayed awake** the whole night).

The most prototypical part of this class are predicates for expressing physical perceptions. These verbs represent a small coherent group described by the frame *Perception_body*. Beside the Experiencer who has a passive (non-volitional) role inherited by the Perceiver_passive in its parent *Perception_experience*, the frame

also specifies a Body_part, in which the bodily process or sensation is localized (*Краката **ме болят** от ходене* ⇒ My feet **ache** from all the walking)[8].

As pointed out by Spencer and Zaretskaya (2003), the stative meaning of some physical or physiological predicates is derived from dynamic verbs (e.g. *Ръцете му **треперят** от старост* ⇒ His hands **tremble** from the old age). Many such verbs represent a stative interpretation of the frame *Body_movement*, which describes motions or actions an Agent performs using some part of his or her body. The stative construal is associated with a sustained, repetitive or continuous involuntary performance of the motion or action as in the example above.

Verbs denoting body postures are not included in Paducheva's classification of states on the assumption that such predicates require a constant input of energy and must therefore be classified as dynamic verbs (Bulygina 1982; Paducheva 1996). Even so, as they denote sustained, unchangeable postures or bodily configurations, we consider them as stative verbs, following Van Valin and LaPolla (1997), among many others. The relevant frame, *Posture*, a direct descendant of State, defines a state of affairs in which an Agent supports their body in a particular Location, usually relying on a part of the body, Point_of_contact, to provide support to the body (*Тя **седеше** на колене до прозореца* ⇒ She **was sitting** on her knees beside the window).

5.3.6. Emotional states, relations and internal experiences

The class of *Emotional states, relations and internal experiences* is largely covered by frames stemming from the non-lexical frame *Emotions*, a direct descendant of *State*. It defines a state of affairs such that an Experiencer has a particular emotional State, which may be described in terms of a specific Stimulus that provokes it, or a Topic which categorizes the kind of Stimulus. A particular Event (with participants who are Experiencers of the emotion) or an Expressor (a body-part of gesture indicating the Experiencer's state) may metonymically stand for the Experiencer. The frame is perspectivized, used or inherited by a number of other frames that form the tree of the class and that, for the most part, inherit its FEs. Additionally, Paducheva (1996) divides the class into two major subclasses – temporary emotional states (e.g., *worry, fear, enjoy*) and emotional relations or permanent states (e.g., *love, hate, envy, admire*), a distinction that is not strictly represented in FrameNet.

The most prototypical stative emotion frame is *Experiencer_focused_emotion*, which perspectivizes *Emotions*. While it inherits from *Emotions* most of its FEs, the frame particularly models the reaction of the Experiencer (his or her emotional state) with respect to some Content. The predicates evoking it are the so-called Experiencer-subject emotion predicates that form the core of the class (*Тя **обича***

[8] We leave aside the question of the argument structure asymmetries between these verbs in English and Bulgarian.

децата си повече от всичко ⇒ She **loves** her children more than anything). *Emotion_directed*, which uses *Emotions*, describes the feeling or experience of an Experiencer of a particular emotional response to a Stimulus or about a Topic, which may have a particular Reason. The English lexical units that evoke this frame are primarily adjectives and nouns, Bulgarian has a host of stative (and inchoative) Experiencer-subject verbs that are best described by it (*Той* ***се ядосва*** *на децата си* ⇒ He **is angry** with his children). *Emotion_heat* deals with an Experiencer experiencing an intensive Emotion associated with a specified Seat_of_emotion within the Experiencer (*Дълбоко в себе си момичето* ***кипеше*** *от гняв* ⇒ Deep inside the girl **was boiling** with anger).

A couple of frames blend emotions with other psychological or cognitive aspects. *Worry* conceptualizes a situation in which an Experiencer continually thinks about some Topic whose consequences are important to him or her (*Учениците* ***се притесняват*** *за предстоящите изпити* ⇒ The students **are worried** about the forthcoming exams). The frame differs from the mental state frame *Cogitation* in that it emphasizes the emotional consequence. *Contrition* describes an Experiencer's regret about an Action, or a failure to act, which he or she judges as wrong (*Още* ***съжаляваме*** *за думите си* ⇒ We still **regret** our words).

Unlike the verbs evoking the remaining frames, the ones described by *Feeling* do not incorporate in their meaning the emotion of the Experiencer, but rather specify that he or she experiences an Emotion or an Emotional_state (which may be subject to some Evaluation). Thus the Emotion is often expressed by an adjective or noun of the same root as the verbs evoking the *Experiencer_focused_emotion* (*Тя* ***изпитваше, изживяваше*** *непозната за нея обич* ⇒ She **felt**, she **experienced** a love unknown to her).

Several frames inherit from *Emotions* through *Emotions_by_stimulus*. The latter frame inherits its parent's FE configuration, but profiles particularly the *Stimulus* or *Topic* that bring about the emotion (*Детето* ***се радваше****, че родителите му ще го водят на кино* ⇒ The child **was glad** that his parents were taking him to the cinema). This conceptualisation is further narrowed down to the Stimulus in other frames such as *Emotion_of_mental_activity* (*Тя* ***се наслаждаваше*** *на топлото слънце* ⇒ She **delighted** in the sun's warmth).

Stimulate_emotion, which also uses *Emotions*, represents a different perspective on emotion states, i.e. the influence of the Stimulus on the Experiencer (*Вулканът* ***удиви*** *децата* ⇒ The volcano **astonished** the children) As the invariant situation of this frame involves the provoking of an Emotion, it has not a stative, but rather a causative meaning and is therefore not considered in the class of stative emotions.

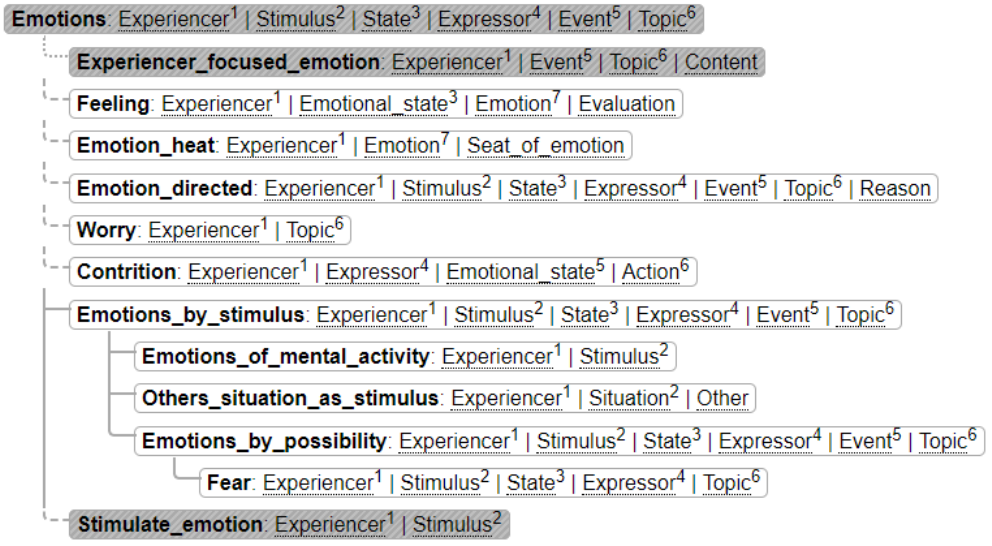


Figure 14. Structure of the thematic class *Emotional states, relations and internal experiences*.

5.3.7. Mental states

Part of the class of *Mental states* forms an altogether coherent hierarchy, while the second part is represented by a number of outliers, whose meaning nonetheless aligns well with the semantics of the class. The invariant frame is the non-lexical *Mental_activity*. It describes a situation where a Sentient_entity's mind is focussed on a particular situation or state of affairs (Content) or a particular Topic. A body part (Expressor) may reveal the Sentient_entity's mental state to the observer.

Awareness conceptualizes the general idea of a mental state by describing a situation where a Cognizer has a piece of Content in their model of the world (***Вярвам**, че всичко ще бъде наред* ⇒ I **believe** that everything will be alright). The frame inherits *Mental_activity* and basically shares the FE configuration of its parent (to the exception that the Sentient_entity is construed more specifically as a Cognizer). The frame is further elaborated in a number of frames.

Grasp models a situation where the Cognizer is viewed as able to predict the behavior or occurrence of an idea or object, the Phenomenon (a specialization of Content), based on his or her knowledge about the Phenomenon's nature. The Cognizer may be alternatively expressed by a Faculty, i.e. a metonymic cognitive-emotional seat of ability, such as the heart or the mind, conceived of as having understanding (*Той отлично **проумяваше** сложните отношения в семейството си* ⇒ He fully **grasped** the complex relationships in his family). *Expectation* deals with a Gognizer who believes that a Phenomenon will take place in the future. The configuration also

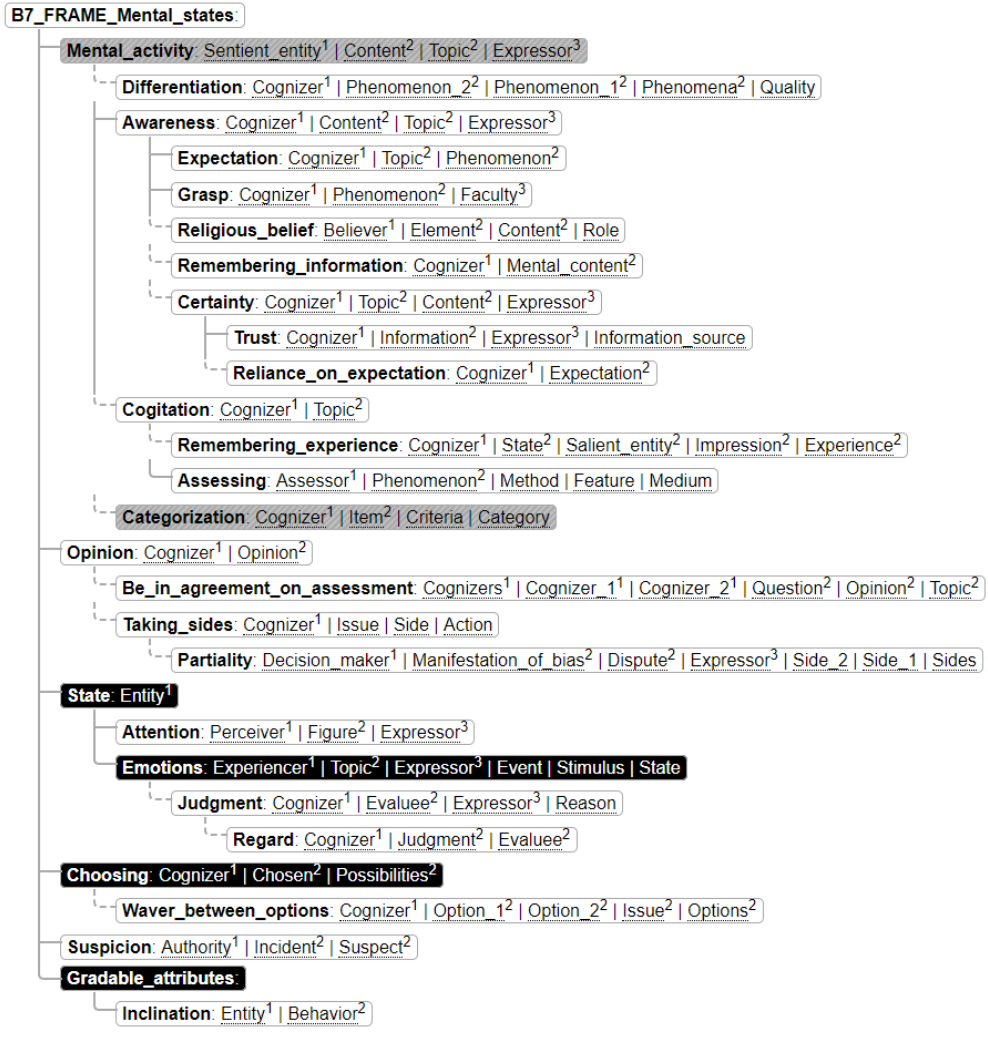


Figure 15. Structure of the thematic class *Mental states*.

includes a Topic that serves as the focus of the predicted Phenomenon (***Очакваме*** *покачване на цените* ⇒ We **expect** a price increase).

Several other frames use *Awareness*. All of them realize the two central FEs, the Cognizer (specialized as a Believer in *Religious_belief*) and the Content, which may be further narrowed down to Mental_content, as in *Remembering_information* (*Той* ***си спомняше*** *разказа й* ⇒ He **remembered** the story she told him) or reconsidered as either Content or Element (*Тя* ***вярва*** *във висша сила* ⇒ She **believes** in a higher power), where the latter may have a certain Role (*Тя* ***вярва*** *в Христос нашия спасител* ⇒ She believes in Jesus **as our savior**; frame *Religious_belief*).

While it shares *Awareness*' FE configuration, *Certainty* describes a more specific situation referring to the Cognizer's confidence about the correctness of beliefs or expectations (*Той **се съмняваше** в собствените си чувства* ⇒ He **doubted** his own feelings). Its descendant *Trust* specifies a Cognizer's opinion that a piece of Information provided by an Information_source is correct. The salient participant is the Information, while its Content and Topic are backgrounded to non-core status (*Те вече **не вярваха** на информатора си* ⇒ They **didn't trust** their source anymore). *Reliance_on_expectation*, which weakly inherits *Certainty*, features a Cognizer and Expectation, the latter being a reliable fact, such that the Cognizer can base his or her plans on it (***Разчитах** да ме повишат* ⇒ I **relied on** being promoted).

Another small branch of frames that weakly inherits *Mental_activity* is represented by *Cogitation* and its descendants. *Cogitation*'s configuration narrows down that of its parent so that it specifies a Cognizer and a Topic the Cognizer thinks about (*Той **обмисля** да замине за чужбина* ⇒ He **contemplates** about going abroad). Its descendant *Assessing* deals with a specific kind of Cognizer (Assessor) that evaluates a Phenomenon (a concrete Content) so as to establish its Value according to some Feature (*Той **претегли** всички доводи* ⇒ He **weighed** all pros and cons).

Cogitation is used by *Remembering_experience* (*Той **помни** всичко* ⇒ He **remembers** everything). The frame describes a situation in which a Cognizer recalls an episodic memory of past Experience or an Impression of a Salient_entity (a property attributed to this entity) based on past experience or a particular State of the Salient_entity (a property or role of this entity that frames the Cognizer's memories of it). The cognitive Content of the parent frames is construed as either a piece of Experience, or an Impression, or a State associated with the Salient_entity.

Another frame that uses *Mental_activity*, *Differentiation* (*Смята се, че котките **различават** 6 цвята* ⇒ Supposedly, cats **distinguish** 6 colors), denotes a situation in which a Cognizer is or is not aware of the difference between two Phenomena, Phenomenon_1 and Phenomenon_2 (an elaboration of Content), that may be expressed collectively.

Categorization (*Той **смята** постъпката си за грешка* ⇒ He **regards** his action as a mistake), which uses the frame *Mental_activity*, models a situation where a Cognizer construes an Item as belonging to a certain Category according to certain set of attributes (Criteria). In this class we include categorization predicates describing the mental state of the Cognizer as opposed to categorization predicates in the thematic class of *Relations between objects* which deprofile the Cognizer and describe objective inclusion of an object in a certain category (see Section 5.2.4).

Several frames do not form part of this hierarchy. *Attention* and *Judgment*, and the latter's descendant *Regard*, respectively, inherit from their parent, *State*. *Attention* (*По време на работа тя **игнорира** всичко странично* ⇒ While working, she **ignores** anything else) describes a Perceiver's readiness to process mentally a state of affairs represented as the presence/absence of a Figure within a Ground. The Perceiver thus corresponds to the parent's Entity and the perception of the Figure

corresponds to the parent's element State. *Judgment* (*Тя* ***цени*** *усилията на мъжа си* ⇒ She **values** her husband's efforts) describes a situation where a Cognizer makes a positive or a negative judgment about an Evaluee which may be conveyed by (an action by) a body part. A specific Reason for the judgment may also be specified. The frame only loosely inherits its parent frames (*Emotions* > *State*) and elaborates on the emotional-cognitive state defined by *Emotions* by profiling the entity that is the subject of assessment (the Evaluee). *Regard* (*Моят шеф* ***цени*** *работниците си* ⇒ My boss **appreciates** his workers) describes a situation where a Cognizer assesses an Evaluee by making a Judgment, expressing how high or low his or her regard for the Evaluee is. It thus elaborates on *Judgment*'s configuration by stating the Evaluee's position on a scale of approval.

Opinion (***Смятам****, че той е отличен шофьор* ⇒ I **think** he is an excellent driver) describes a Cognizer who has a particular mental stance or way of thinking (Opinion), which is not necessarily generally accepted, and which is generally dependent on the Cognizer's point of view. The frame thus aligns very well with the hierarchy of *Mental_activity* and may be related to its frame family[9]. Its descendant *Be_in_agreement_on_assessment* deals with a situation where Cognizers (possibly expressed separately as Cognizer_1 and Cognizer_2) hold (dis)similar Opinion(s). The Opinion may alternate with two other FEs: (i) a phenomenon about which a similar or differing Opinion is held (the Topic) or (ii) a Question to which the Opinion is the answer (or is understood as such) may be *s*pecified instead.

Waver_between_options (*Той често* ***се колебаеше*** *по кой път да тръгне* ⇒ He **was** often **doubting** which way to go) describes a situation of a Cognizer's having to make a choice or considering the available choices (Options) on some Issue, keeping changing their mind between Option_1 and Option_2. Therefore, although weakly inheriting from the active frame *Choosing*, its configuration shows its membership in the domain of mental states: the Options considered by the Cognizer represent some cognitive Content, while the Issue corresponds to the Topic of this mental content.

5.3.8. Perceptive states

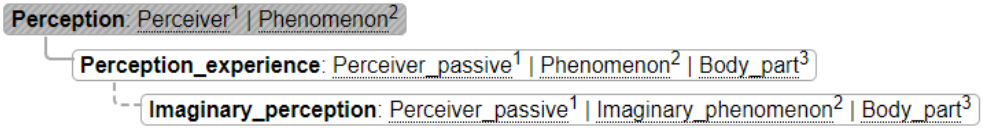


Figure 16. Structure of the thematic class *Perceptive states*.

[9] It is in fact related to *Awareness* by means of the unspecified relation See_also, but the definition of a more clear-cut relationship may be considered.

While not a big group, the class of *Perceptive states* (or inert states as in Paducheva (2004: 204), following G. Leech) represents one of the most prototypical in the domain of stative predicates. It encompasses verbs whose Perceivers have perceptual experiences that they do not necessarily intend to as they do not actively direct their senses towards the stimulus to acquire the perceptions: *detect*, *experience*, *feel*, *hear*, *overhear*, *perceive*, *see*, *sense*, *smell*, *taste*, *witness*. The corresponding verbs of the same sensory modality whose Perceivers make a conscious, active effort to direct their attention to the object or phenomenon perceived are categorized as active perception verbs (e.g. Leech 2004: 23) across various classifications. Such verbs evoke the frame *Perception_active* in FrameNet. *Perceptive states* represent a very coherent class whose invariant is the frame *Perception_experience.* Its configuration of FEs includes the sentient entity that has the perceptual experience (Perceiver_passive), the entity or phenomenon that the Perceiver experiences with his or her senses (Phenomenon) and the location on the Perceiver_passive's body where the perceptual experience takes place (Body_part). The latter is usually left unexpressed with many of the verbs as it is implied by the sensory modality encoded in the verb.

In addition, Paducheva (2004) refers to this class another distinct group of verbs typical for Russian and Bulgarian, the so-called predicates of *Imaginary perception*. These verbs share with verbs denoting perceptive states the presence of a passive perceiver and a perceived phenomenon. The main difference between the two subclasses is the presence and respectively, the absence, of an actual phenomenon (or perceptual stimulus) to be spontaneously perceived, as "the image forms independently of an external stimulus" (Paducheva 2004: 200). These verbs (*причува ми се* ⇒ I seem to hear, *привижда ми се* ⇒ I seem to see, etc.) have been studied in Bulgarian as well. Drawing on earlier work by Nitsolova (1992/1993), Dzhonova (2008) defines a subclass of predicates that express some unreal sensory perception. To the exception of *въобразявам си* ⇒ imagine, *предвкусвам* ⇒ anticipate, the Perceiver is typically expressed as a dative pronoun.

This shift in focus constitutes an important difference from the verbs evoking the *Perception_experience* frame. A new, *Imaginary_perception* frame has been defined in which an Imaginary_phenomenon comes into the awareness of a Perceiver_passive. As the frame changes the focus of the described situation but is closely related to *Perception_experience*, it is related to it by means of the relation Uses.

5.3.9. Predicates of existence and presence

The *Predicates of existence and presence* encompass verbs that denote the physical existence, location or presence of an Entity. The similarity between the two subclasses is pointed out by Paducheva (Paducheva 2004: 425–440), who acknowledges that presence or location presupposes existence.

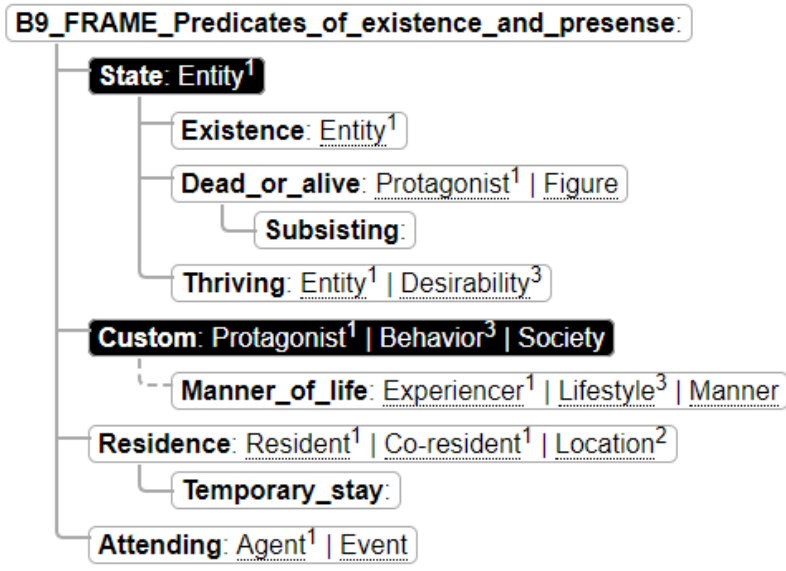


Figure 17. Structure of the thematic class *Predicates of existence and presence*.

Part of the frames form a coherent subtree descending directly from *State.* The invariant frame *Existence* describes an Entity that is declared to exist, generally irrespective of its position being specified (*Законите* ***съществуват****, за да се спазват* ⇒ Laws **exist** to be obeyed). The frame is used in *Being_located*, that is, in one of the main representatives of the class of *Spatial_relations*. *Dead_or_alive*, which also inherits directly *State*, describes a sentient entity, the Protagonist, who is in the state of being alive or has exited this state (***Живеем*** *в странни времена* ⇒ We **live** in strange times). Its inheriting frame *Subsisting* deals with a sentient Entity that survives some situation. It expands the configuration of the parent's frame by specifying a resource (Support) that the Entity relies on to survive (*Двамата от години* ***преживяваха*** *с оскъдни средства* ⇒ For years, the two of them **have subsisted** on meager funds). The frame *Thriving* presents a temporary state of an Entity associated with its participation in a preponderance of states and events which are desirable for it (*Подобни практики* ***процъфтяваха*** *при предишното правителство* ⇒ Such practices **thrived** under the previous government).

Although an outlier in the frame hierarchy, *Manner_of_life* (*Те* ***живеят*** *охолно* ⇒ They **live** in abundance) represents a given state of existence, in particular, a situation involving an Experiencer who actualises a pattern of behavior (Lifestyle), possibly characterized by a Manner.

Another aspect of this class is represented by predicates denoting someone's presence at a location, thus evoking the frame *Attending* (*Децата* ***посещават***

училище от 7-годишна възраст ⇒Children **attend** school from the age of 7 years). The frame inherits from a dynamic state of affairs (*Intentionally_act*), which reflects the fact that it involves a sentient entity (Agent) who goes to an Event (in order to be present there), but as the example show, may also be construed as a custom or habit-like state or behavior relating to the sentient entity's presence at the Event. Such cases are treated as stative construals of the existing frame.

Yet another dimension of the class is represented by the frame *Residence* (*Те* ***живеят*** *извън града* ⇒ They **live** outside the city) and its descendant *Temporary_stay* (*Учениците* ***квартируват*** *в хотел извън града* ⇒ The students **are lodging** in a hotel outside the city). *Residence* has to do with people (Residents) who reside in a Location, possibly with a Co-resident. *Temporary_stay* describes a more specific situation where a Guest stays for a Duration at a Location, which is not his or her permanent residence and is often the permanent residence of a Host. The frame elaborates on its parent's FE configuration by specifying the Resident as a Guest and the Co-resident as a Host, as well as by introducing the duration of the stay.

5.4. Behaviors and Occupations

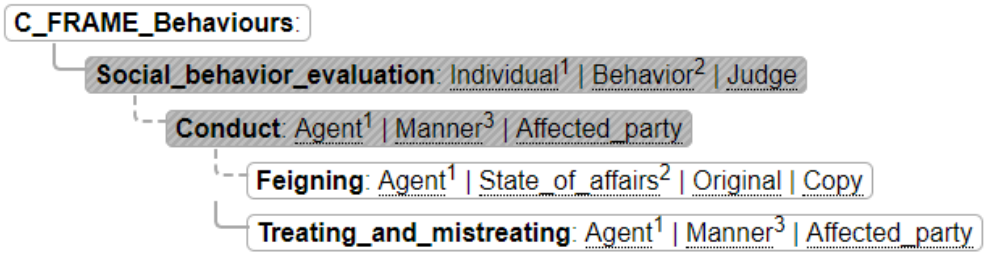


Figure 18. Structure of a fragment of the verbs entering the class of *Behaviors*.

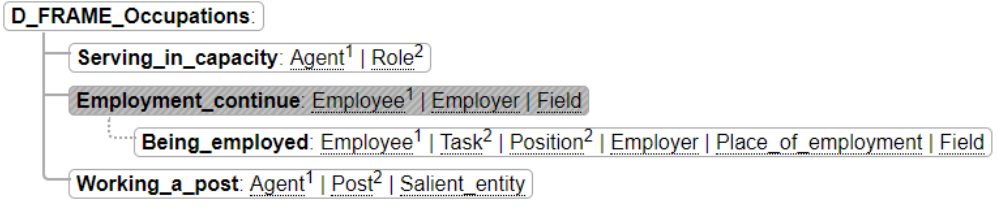


Figure 19. Structure of the thematic class *Occupations*.

The classes of *Occupations* and *Behaviors* are stative verbs that fall outside the scope of the two main classes of properties and relations and states. They have been defined as generalized states by Vendler (1957, 1967), who primarily discusses activity verbs that either by virtue of their semantics or by virtue of a kind of

reconceptualization denote or come to denote activities characteristic of a particular subject over a very long period of time. The former is exemplified by cases like the following one: *She is smoking outside* (activity) vs. *She smokes 3 packs of cigarettes a day* (generalized state). On the other hand, there are some verbs that describe activities that inherently take place over a prolonged period of time, e.g. *rule*, *govern, predominate*, among others. An important property of such verbs pointed out by both Vendler (1957, 1967) and Paducheva (1996) is the fact that they hold over a very long interval of time, without being true at each moment of this interval, e.g. smoking 3 packs a day does not involve smoking at every second of the day, nor ruling implies taking managerial decisions all the time.

The differentiation between the two classes described by Paducheva (1996) is based on the presence of a sentient entity distinct from the subject of the activity who expresses a (negative) judgment (*Behaviors*) and the lack of such assessor (*Occupations*).

The *Occupations* encompass various activities that a person pursues as a vocation, for sports, fun or as a pastime: *воювам* ⇒ *war*, *преподавам* ⇒ teach, *пътешествам* ⇒ voyage, among others. A distinct candidate frame that describes the semantics of professional occupations is *Being_employed*. By virtue of its definition it presupposes a prolonged period over which an Employee is employed in a Position, doing work in a particular Field or on a particular Task, for which the Employer gives him or her Compensation. The frame is evoked by verbs such as *работя* ⇒ work, *сервитьорствам* ⇒ wait (tables), *чиновничествам* ⇒ clerk, *дърводелствам* ⇒ carpenter, *кметувам* ⇒ work as a mayor, *учителствам* ⇒ teach, work as a teacher. The frame itself is a perspectivization on the non-lexical frame *Employment_continue*, which describes a stable employment relationship between an Employer and an Employee. Two other frames also cover occupations, *Serving_ in_capacity* where the focus is on the Agent fulfilling a Role and *Working_a_post* which involves a Post that the Agent fills. Verbs remaining outside these frames, such as *воювам*, *пътешествам* represent counterparts of dynamic verbs belonging to different frames and are associated with the conceptual descriptions characteristic of the relevant frames; the best treatment of such verbs at this stage of the analysis is to be viewed as aspectual construals of the respective active verbs.

Many of the verbs that fall in the class of *Behaviors* are verbs whose habitual interpretation is their inherent meaning. They would thus be evoking various frames based on their particular semantics: *клюкарствам* ⇒ gossip evokes the frame *Chatting* (*Нищо не ѝ казвай, много* ***клюкарства*** ⇒ Don't tell her anything, she**'s** quite **the gossip girl**), *преструвам се* ⇒ pretend, *симулирам* ⇒ simulate evoke *Feigning*, *имитирам* ⇒ imitate, *копирам* ⇒ copy evoke *Imitating*, and so forth.

6. Conclusions and Future Work

The analysis of frames and relations between them outlines the internal organization of the semantic classes and subclasses of stative predicates as well as the significant components of the semantic description relevant to the definition of the classes and the frames describing them. In addition to the concrete objectives of this work to present a summary of the conceptual, syntactic and semantic properties of previously formulated thematic classes, a further goal is to improve WordNet-to-FrameNet mappings and coverage of stative verbs by introducing the newly defined frames into FrameNet's structure and designing automatic and semi-automatic procedures for mapping and validation.

Special attention needs to be paid to verbs and WordNet subtrees which have no frames assigned. A venue of ongoing research that we are concerned with is the definition of precise selectional restrictions imposed on the core FEs of particular frames and their implementation as semantic relations between a verb synset and a set of noun synonyms that satisfy these restrictions. In such a way we will enrich WordNet with relations between verbs and nouns corresponding to participants in their conceptual structure, particularly ones realized as arguments and adjuncts.

The work proposed in this paper, as well as the system of conceptual frames covering thematic classes, is to a great extent language independent. Although we have presented examples for English and Bulgarian, our analysis of the data can be extended to other languages especially through the alignment between the resources.

Acknowledgements

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Стативните глаголи: концептуална структура, йерархия, системни релации

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Резюме. Изследването се фокусира върху семантичното и концептуалното описание на стативните глаголи. Анализираме стативните глаголи, представени в Уърднет, заедно със съответстващите им фреймове от Фреймнет след съотнасянето на двата ресурса. Представяме класификация на стативните глаголи в тематични класове, след което очертаваме компонентите на концептуалното описание въз основа на концептуалните фреймове от Фреймнет, отношенията между тях, както и ядрените фреймови елементи. Изследването е опит за извеждане на йерархичната структура от фреймове за всеки тематичен клас, както и на плитка йерархия на фреймовите елементи с оглед на тяхната специализация от по-общата рамка в по-специфичните рамки, свързани чрез релации на наследяване (Inheritance), слабо наследяване (Uses) и перспективизация (Perspective).

Ключови думи*: концептуално описание, концептуална йерархия, Фреймнет, Уърднет*

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