

Computational Representation of Image Schemas in FrameNet

Tiago Timponi Torrent¹, Maria Margarida Martins Salomão¹, Thais Fernandes Samapio¹, Natália Sathler Sigiliano^{2,3}, Ely Edison da Silva Matos¹, Tatiane da Silva Tavares^{1,3}

¹Federal University of Juiz de Fora, ²Federal University of Rio de Janeiro, ³CAPES

An image schema is a recurring dynamic pattern of human perceptual interactions and motor programs, which gives coherence and structure to our experience in the world (Johnson, 1987). Some characteristics of image schemas (Hampe, 2005) parallel to those of frames: they are directly meaningful, highly schematic and internally structured. Due to their relation to abstract reasoning and conceptualization (Lakoff, 1987) image schemas, as well as frames, are good candidates for the computational representation of knowledge. Moreover, image schemas play a central role in the study of grammatical constructions in the sense that content words that develop grammatical functions in constructions tend to preserve them (Sweetser, 1988, 1990).

FrameNet projects around the globe are building lexical-semantic resources for several languages, as well as construction repositories – Constructicons. As computational resources, they have been used in tasks involving reasoning, query answering and information extraction. Such database already includes some image schemas and the idea of using them in combination with FrameNet has already been explored (cf. Bicknell & Dodge, 2004).

This paper proposes a single representation, using OWL, for the structures of frames and schemas. We claim that a computational approach that represents image schemas and frames equally can improve the FrameNet database in regards to reasoning tasks.

As a demonstration of such claim, we discuss the combinatorial restrictions that apply to some constructions in Brazilian Portuguese, among which the Mass Quantification Construction. Such construction is formed by an indefinite article followed by a noun used as quantifier, the preposition *de* and the quantified noun – [um N1 *de* N2]. Semantic combinatorial restrictions apply to the words occupying the noun slots.

(1)	Um	mar	de	cartas
	a	sea	of	letters
	A lot of letters.			
(2)	Um	mar	de	buildings
	a	sea	of	prédios
	A lot of buildings.			
(3)	Uma	chuva	de	cartas
	a	rain	of	letters
	A lot of letters.			
(4)	*Uma	chuva	de	prédios
	a	rain	of	buildings

In examples (1) – (4) the nouns *mar* and *chuva*, used as quantifiers, preserve their underlying image schemas: Region and Motion, respectively. Thus, while *mar* can be combined with both *cartas* and *prédios*, the same does not hold for *chuva*, since buildings are not likely to combine with Motion.

While humans can easily learn such combinatorial restrictions, the same does not hold for computers. Hence, if those constructions are stored in a Constructicon, the machine using such resource will need some criteria upon which to decide: (a) whether (4) is a good example of the quantification construction, and (b) whether a sequence of words like *uma chuva de verão* ('a summer rain') is a construct licensed by this construction.

In order to provide such criteria, we developed a reasoning algorithm that searches the FrameNet database for the words found in the piece of text upon which the decision has to be made. It analyzes the frames evoked by each of these words and the set of schemas associated to the frames. Each set of schemas is represented as a Feature Model. The algorithm then verifies how well such Feature Models can be combined, using best fit processing techniques. The evaluation is represented by a final value that indirectly indicates the probability of combination for the schemas and, hence, whether the construct is licensed by the construction or not.

Keywords: Frame Semantics; Image Schemas; FrameNet; Constructicon; Combinatorial Restrictions