Situations are “Attractors” of Semantic Interpretations

—A way to make the FrameNet framework more cognitively realistic—

Kow KURODA
National Institute of Information and Communications Technology (NICT), Japan
3-5 Hikaridai, Seikacho, Sorakugun
Kyoto, 619-0289, Japan

Keiko NAKAMOTO
Kyoto University, Japan
Yoshida Nihonmatsu-cho, Sakyoku
Kyoto, 606-8501, Japan

Hajime NOZAWA
National Institute of Information and Communications Technology (NICT), Japan
3-5 Hikaridai, Seikacho, Sorakugun
Kyoto, 619-0289, Japan

Hitoshi ISAHARA
National Institute of Information and Communications Technology (NICT), Japan
3-5 Hikaridai, Seikacho, Sorakugun
Kyoto, 619-0289, Japan

1 Introduction

Despite the pervasiveness of phenomena like metaphor, metonymy, and idioms, many linguists still consider the Fregean principle of compositionality to be a prerequisite to semantic interpretation, partly because it’s still unclear how compositional semantics is related to noncompositional semantics. Many people feel still that if noncompositional semantics is a different kind of animal, then we will need an “exception-handling” mechanism that detects the “signs” or “symptoms” of noncompositionality, and redirect the input to a special component that handles exceptional cases detected. This view of noncompositionality could be called the “noncompositionality-as-exception” view.

While it sounds good theoretically, the problem is that it’s very hard to tell where such signs occur. More importantly, it’s not clear if it is just a practical problem: it is likely that it is rather a theoretical problem, and there is no guarantee that noncompositionality brings its “signs.”

In our work, we present a model of semantic interpretation that challenges this view, trying to dispense with the detection of noncompositionality, which is required in the noncompositionality-as-exception view. In the proposed model, COMPOSITIONAL SEMANTICS IS TREATED AS A SPECIAL CASE OF INTERPRETATIVE PROCESSES THAT NATURALLY LEAD TO NONCOMPOSITIONAL SEMANTICS, showing that so-called noncompositional semantics can be more naturally integrated with compositional one.

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http://www.spectrum.uni-bielefeld.de/DGfS/.

2 Theory

2.1 Basic idea

The essential part of the model is based on the intuition that a sentence $s = w_1 \cdot w_2 \cdots w_n$ is a complex system of words. Under this, we defined the semantic interpretation of $s$ as a multi-body problem of specifying the mapping from $\{m(w_1), m(w_2), \ldots, m(w_n)\}$ to $m(s)$, where $m(\alpha)$ denotes the meaning of a variable $\alpha$.

Obviously, this is a hard problem that you can never solve without a trick. To make it workable, we model it in the way of brain functions, i.e., PARALLEL DISTRIBUTED PROCESSING [4]. More explicitly, we assume:

(1) The meaning of a sentence $s = w_1 \cdots w_n$ is determined out of $W(s) = \{w_1, w_2, \ldots, w_n\}$ as follows:

a. in the context of $s$, each word $w_i$ independently “evokes” a situation $\sigma_i$, which can be roughly characterized as a “semantic frame” in the sense of Berkeley FrameNet (BFN) [1].

b. given two situations, $\sigma$ and $\sigma'$, are either compatible or incompatible: when compatible, two situations “strengthen” each other (“mutual activation/support” effect); when incompatible, they suppress each other (“mutual inhibition/suppression” effect). Thus, cooperative and competitive selection of situations takes place, and semantic interpretation ends when it “settles down.”

(2) No noncompositionality manifests if suppression of (certain aspects of) evoked situations
3 Result

We tested and positively confirmed this predication by a psychological experiment done against the full range of possible interpretations of a Japanese verb “x-ga y-o osou.” After a detailed corpus-based analysis modeled on the practice in BFN, we found that the range of possible interpretations was covered by 15 situations. In this analysis, we collected 400+ examples of sentences in which osou was used as a main verb from a bilingual corpus of 150,000 pairs of Japanese and English sentences [5].

During this process, we annotated each instance for (i) semantic type (e.g., animal, human, place); (ii) semantic role (e.g., (Predator), (Prey), (Robber), (Valuables), (Random Killer), (Victim)), and (iii) semantic frame (e.g., (Predation), (Bank Robbing), (Random Killing)) aiming at providing a sample corpus annotated for semantic roles.

References


Note that this is impossible under the strict interpretation of the Fregean principle of compositionality.

But it should be noted that our corpus-analysis was not originally done for this specific purpose. We rather tried to estimate how promising building a database of semantic frames would be for Japanese.

osou is a rather polysemous verb that means a variety of situations ranging from “x attacks y,” to “x hit y” in English.

We conducted other psychological experiments to evaluate this intuition-based analysis. The positive results were reported in [2]. Overall, linguist’s analysis showed a good fit to a lay person’s semantic intuition.

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