Situations are "Attractors" of Semantic Interpretations[*]

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

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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 JUST 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.

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 α.

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 σ_i, which can be roughly characterized as a "semantic frame" in the sense of Bekeley FrameNet (BFN) [1],

    b. given two situations, σ and σ', 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

goes unnoticed.

(3) Even when suppressed, some limited aspects of a situation can be made use of (this is called the principle of "greedy interpretation"): this defines sense transfers like metaphor and metonymy. Metaphor is defined as a way of exploiting, or "salvaging" some aspects of a suppressed situation. Metonymy is defined as a way of supplementing information that "bridges" between two incompatible situations or two incompatible aspects of the same situation.

The view of semantics that we advocate is somewhat analogous to, but more radically dynamic than, the "co-compositional semantics" in the sense of Generative Lexicon [3]. In our model, semantic interpretation is noncompositional IN ITS VERY NATURE, and it looks "compositionial" as far as noncompositionality is not evident, or "unnoticeable."

2.2 Remarks

(1a), which we can characterize as a THEORY OF FRAME-EVOCATION, is an idea adopted from BFN, whereas (1b), which we can characterize as a THEORY OF FRAME-SELECTION, is not explicitly specified in BFN, and is supposed to supplement (1a) in essential ways. Compared with BFN, our model puts more stress on (1b) than (1a).

The theory of semantic interpretation predicts that successful interpretation of $s = w_1 \cdots w_n$ does not require that the lexical semantics of $W(s) = \{ w_1, \ldots, w_n \}$ be fully specified. Suppose s contains a nonce word w^*. The interpretation of s gives a "reasonable reading" as long as enough information is specified by $W(s) - w^*$ to evoke reasonable frames, and, more importantly, the (LEXICALLY NULL) semantics of w^* accommodates or "adapts" to the semantics of its environment, which is specified as the situation evoked by $W(s) - w^*$.

What this means is this: THERE IS ALWAYS AT LEAST ONE SITUATION THAT "ATTRACTS" THE READING OF s AND SUPPRESSES OTHER READINGS. We call this the ATTRACTION-TO-SITUATION/FRAME HYPOTHESIS because interpretation of s is "forced" to fall on one of the specific situations/frames available for s.[1]

For example, sentences like "The gang of two attacked w^*" evoke a situation of ⟨ Bank Robbery ⟩ even when w^* is a nonce word. Likewise, sentences like "An earthquake hit w^*" evoke a situation of ⟨ Harm from a Natural Disaster ⟩.

3 Result

We tested and positively confirmed this predication by a psychological experiment,[2] done against the full range of possible interpretations of a Japanese verb "x-ga y-o osou."[3] After a detailed corpus-based analysis modeled on the practice in BFN,[4] we found that the range of possible interpretations was covered by 15 situations[5] 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 instances for (i) semantic type (e.g., animal, human, place); (ii) semantic role (e.g., ⟨ Predator ⟩, ⟨ Prey ⟩, ⟨ Robber ⟩, ⟨Valuables⟩, ⟨Random Killer⟩, ⟨Victim⟩), and (ii) semantic frame (e.g., ⟨ Predation ⟩, ⟨ Bank Robbing ⟩, ⟨ Random Killing ⟩) aiming at providing a sample corpus annotated for semantic roles.

References

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

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[2] But it shoud 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.

[3] *osou* is a rather polysemous verb that means a variety of situations ranging from "x attacks y," to "x hit y"in English.

[4] But we did a much finer-grained analysis that BFN.

[5] 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.