

## On Dynamic Representation of Regular Lexical Ambiguity

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In natural language processing, specifically machine translation, the formal distinction between lexical homonymy and polysemy is often not made. Both are indiscriminately called “ambiguity” and resolved by a similar mechanism of selection between two or more lexicon entries. Thus, e.g., in (Ikehara et al. 1997) there are separate entries for *iru* 居る ‘be’, 射る ‘shoot’, 要る ‘be necessary’ as well as for *au* 合う ‘fit together’, 会う ‘meet’ and 遭う ‘meet with trouble’, and while the first three are clearly homonyms with no elements of meaning in common, the latter (especially the ‘meet’ and the ‘meet with something bad’ senses) can be argued to constitute a single polysemous word. There is no mechanism in that model to make use of any relation between the three senses of *au*.

A somewhat similar tendency can be found in human-oriented dictionaries. As a word is described in more semantic and syntactic detail, it gets split into more and more separate senses with nothing or little to represent the relations of these senses to each other and the unity of the whole.

Looking for ways to reestablish the unity of a polysemous word has been for some time a prominent trend in theoretical semantics, e.g., the Generative Lexicon approach in (Pustejovsky 1995). It can be argued that there are possibilities for it in natural language processing as well.

Prior to bringing out the common elements of the word-senses within a word, it may be well to start by grouping together word-senses across different words based on the similarity of their semantic and syntactic behavior. There is a correlation between semantic roles of a word’s arguments and their formal marking such as prepositions or case particles. A specific set of roles with specific marking can define a word-class. As B. Levin has shown for English verbs in (Levin 1993), there are classes “semantically coherent and syntactically relevant”, the members of which share the basic arguments and the way these arguments are realized, i.e. the diathesis. From the language processing point of view it means that these common properties can be ascribed to such a class (e.g. “verbs of putting”) and inherited by the class members.

One phenomenon of particular interest taking place at the level of these, or maybe also larger, classes is the so called diathetic displacement – a change in the arguments’ marking depending on which argument becomes the focus of attention. For the Japanese language it can be illustrated by examples such as the following:

- (1a) 鉄砲を撃つ ‘fire a cannon’, 長弓を射る ‘shoot a longbow’, 槍を突く ‘stab with a spear’
- (1b) 光弾を撃つ, 矢を射る ‘shoot a flare / an arrow’
- (1c) 的を撃つ / 射る / 突く ‘fire / shoot / stab at a target’

While the semantic differences in the above examples are probably not big enough to postulate distinct “senses” of 撃つ and 射る, different marking of arguments would require separate entries for each diathesis of each word – unless the variation is accounted for at a higher level and inherited.

In a similar manner bigger shifts can occur, involving the change of some of the semantic roles. For example, verbs of transformation often shift into creation and sometimes into destruction:

- (2a) 紙を切る ‘cut paper’, 魚を焼く ‘fry fish’
- (2b) 切り絵を切る ‘make paper-cut art’, ホットケーキを焼く ‘fry pancakes’
- (2c) おさげ髪を切る ‘cut off one’s braid’, 草を焼く ‘burn grass’.

The verbs in these examples do not just mark their arguments differently but take different types of objects – Material in (2a) vs. Product in (2b) vs. Destroyed object in (2c), exhibiting polysemy based on metonymy. A major part of their meaning, however, remains the same, since the process of transformation in (2a) is the manner in which creation in (2b) or destruction in (2c) occurs. If we can ascribe the alternation to a higher class, this invariant is all that needs to be contained in the individual entries of the class members.

The above approach was explored for Russian verbs by E. V. Paducheva in the Lexicographer data base project (<http://www.lexicograph.ru/eng/main.html>). The goal was to determine each verb’s ‘semantic paradigm’, connecting its individual senses by semantic derivation rules and further identifying regular sets of such rules, i.e. regular models or patterns of polysemy (Paducheva 2004).

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It is important to note that, while borrowing the term ‘paradigm’ from inflectional morphology, Paducheva speaks of semantic shifts as derivation rather than inflection. One reason for it is that new entities are formed by both word-formation and meaning shifts, but not by inflection, where the inflected word remains the same. The other is that inflection is massively regular, and both semantic and morphological derivation markedly less so.

It is especially true of metaphoric derivation. The large semantic invariant that is usually shared by two metonymically linked senses does not persist in the case of metaphor. For example, if we look at 蹴る ‘kick’, even the most distinctive of its metonymical senses, ‘make a shot in soccer’, still retains the basic semantic component ‘*X’s foot moved, which caused strong impact of the foot on an object Y*’, even though Y (the ball) is not expressed and the verb instead takes the name of the shot as its direct complement, as in (3a). But neither feet nor impact figure at all in its metaphorical sense ‘to refuse’, illustrated in (3b):

(3a) ペナルティを蹴る ‘kick a penalty shot’

(3b) 誘いを蹴る ‘turn down an offer’

The connection of (3b) to the primary meaning of 蹴る is not difficult to trace – the proposed event is likened to an object in space and is ‘violently sent away’ from the Agent, like a kicked ball. Yet the result is much more idiomatic than (3a), as no other verb of impact undergoes this exact semantic shift (cf. ホームランを打つ ‘hit a homerun’ or ストレートを投げる ‘throw a strait ball’ for (3a)).

However, knowledge of regular metaphors hopefully can be used in the interpretation of contexts which violate selectional restrictions – much as some properties of an unknown wordform can be predicted from its bearing a specific derivational affix. For example, supposing the lexicon description for 背負う ‘carry on one’s back’ did not contain the metaphorical usage illustrated in (4a), on encountering such an example it should still be possible to connect it to the regular polysemy model found in (4b), which some other verbs of firm contact share (“Contact as being in a State”):

(4a) 罪を背負う ‘be guilty’

(4b) 問題を抱える ‘have a problem’, 疑問を抱く ‘harbor a doubt’, 関心を持つ ‘be interested’, 政権を握る ‘be in power’.

It would likely be impossible to predict the meaning of 背負う in (4a) in its entirety, something like ‘*X is in an undesirable state Y and feeling something bad because of it (like what people feel from having something heavy on their shoulders)*’. But the model should at least provide enough information to ascribe semantic roles of Experiencer and State to the verb’s subject and direct object respectively and not to expect an Instrument, Place or any other argument.

The idea of representing a polysemous word as a set of senses dynamically produced by regular meaning shifts is a very attractive one, and it seems viable for the shifts operating on the level of classes rather than individual word-senses. Diathetic and metonymical shifts at class level should present a means for dealing with regular changes of semantic roles and their formal marking. Metaphorical shifts correlate less closely with a word’s syntactic behavior, but patterns of regular metaphorical derivation could be used to make the interpretation of occasionalisms more robust.

## References

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